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THE DEVELOPMENT OF E-LKPD BASED ON HIGH-ORDER THINKING SKILLS (HOTS) WITH 4D MODEL

Jessica Kristanti Hartono[1], Rita Juliani[2]
[1,2] Universitas Negeri Medan, Medan 20113, Indonesia
Email: jessicakhartono@gmail.com

Abstract

This research aims to know the level of validation and level of practicality of the development of e-LKPD based on HOTS with a 4D model of Doppler effect material from a material expert, media expert, teacher, and student. The research type is a 4D model but this research is limited to 3D steps that are defined, designed, and develop. The research population was students in SMA Negeri 3 Pematangsiantar Class XI Science. The sample research is taken by cluster sampling. In this research, the validators have an instrument with a questionnaire of development e-LKPD to know the level of validation. The instrument of this study was a questionnaire from a material expert, media expert, and teacher. The analysis results that development gets level validation and practicality are very worthy with 92,5% from the material expert, very worthy with 97,5% from the media expert, and very worthy with 95,2% from a teacher. Based on the data, the conclusion is that the development of e-LKPD based on HOTS with a 4D model on the Doppler effect is very worthy of validation and practicality.

Keywords: Development, E-LKPD, HOTS, 4-D MODEL

The innovation from the 2013 curriculum aims to improve the good quality of education and can be needed by students. The 2013 curriculum is designed to increase the ability of students to think creatively and critically. Indirectly, the ability of students to think critically and creatively is part of high-order thinking skills (HOTS). HOTS can be improved and trained by instructional design where teachers can use appropriate raters to assess students in HOTS learning (Chandra & Hayati, 2021). The HOTS of question is an instrument for measuring the HOTS ability of students in seeking to solve a problem by applying learning concepts or principles that do not only use memory but also restate or refer without processing. Students must be able to solve a problem in scientific learning. Physics learning is one of the processes that require high-order thinking skills (HOTS). Physics as a science that is closely related to various events and nature events in makes it very important for students to have critical-level thinking skills because learning physics requires students to be able to recognize, solve problems, interfere, analyze, summarize, and evaluate in physics (Astutik, 2017). Knowledge of physics will overcome and solve problems from problems that arise and teachers have a role in efforts to build knowledge and students' thinking skills (Chandra & Hayati, 2021).

The physics learning process in high school requires learning that can build high-order thinking skills so that a solution is found in the form of a student worksheet equipped with

technology as a student media based on HOTS with a 4D model. Innovation 4D model in the developing research is a solution for teachers and students as interactive that can improve critical thinking skills (Bakri et al., 2020). The development used 4D but steps are limited to 3D steps as defined, designed, developed, and validated by experts. The validation in this research contains aspects according to the implementation of the National Professional Certification Agency (BNSP). The results of validation with the development of e-LKPD based on HOTS with a 4D model, that converges these requirements have gone through a feasibility test of media expert and material expert with very effective and good categories (Daryanto & Suryanto, 2022).

The research conducted to solve problems in SMA Negeri 3 Pematangsiantar is important to design strategies and techniques according to the times in education. The implication of the research is an alternative to overcoming the problems of 21st-century education in the era of the industrial revolution 4.0 which refers to problem physics learning of low critical thinking skills, creative skills, and scientific creativity skills. By conducting e-LKPD based on HOTS, students can understand that builds students' HOTS and able students to the interesting physics learning process. Therefore, it is very important to develop an appropriate physics learning design in overcoming low critical thinking and able to improve students' thinking skills (Astutik, 2020). Students are expected to have easier access to the e-LKPD anytime and anywhere. Researchers feel important with the development of e-LKPD berbasis HOTS with the existence of validation and practicality in accordance National Professional Certification Agency (BNSP). Researchers are making it easier for students to learn with the help of technology and making teaching material an e-LKPD.

METHODS

The type of research carried out is qualitative and quantitative research with questionnaires. Meanwhile, research is also carried out based on aspects analysis learning needs of physics and referring to the 2013 curriculum so that the research design of e-LKPD based on HOTS with a 4D model on effect doppler was designed with the implementation of 4-D is 3D model, in Figure 1.

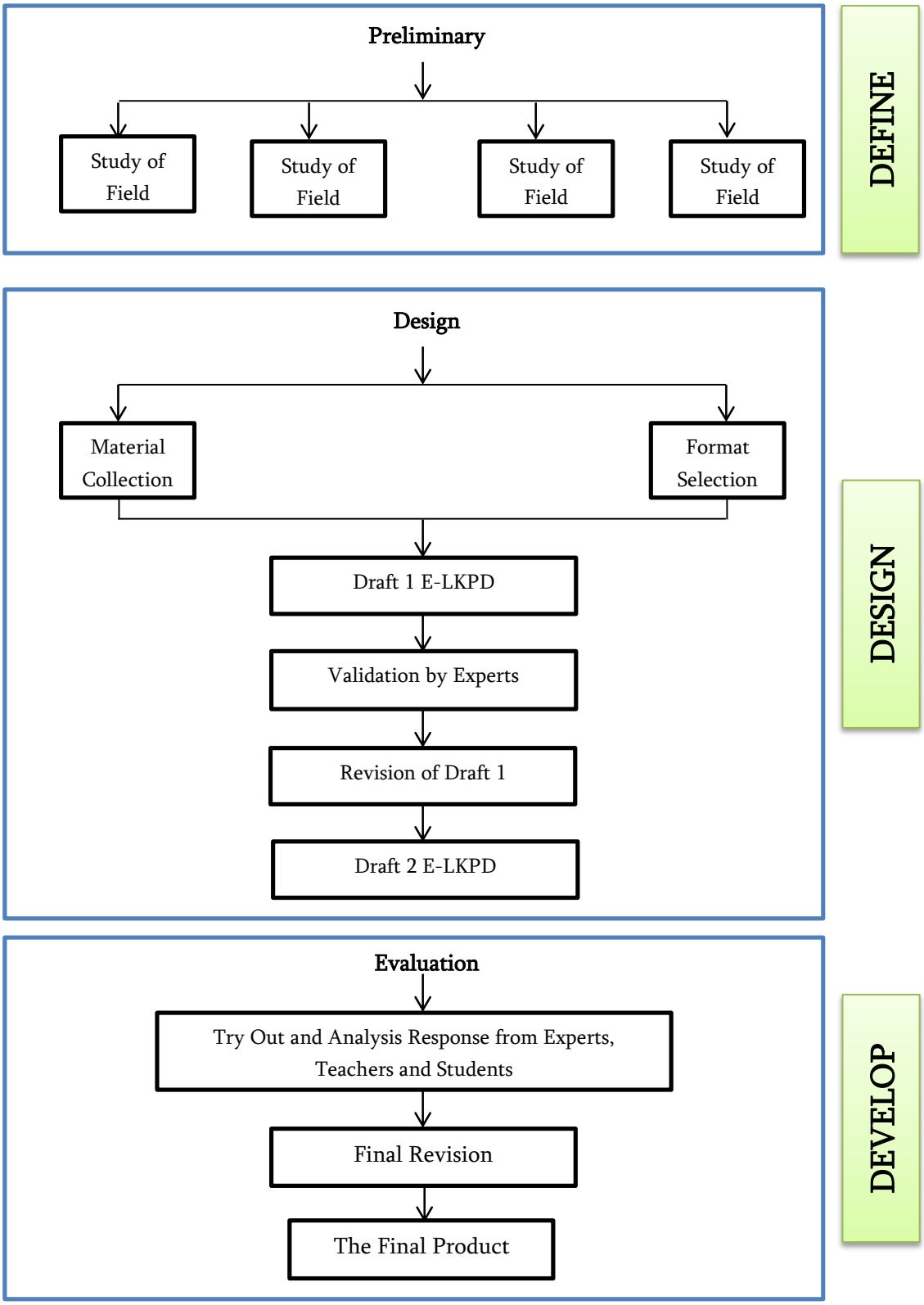

Figure 1. Procedure of Research & Development e-LKPD-based HOTS Modified

In Figure 1. there are three steps: (1) Define for the researcher conducts a needs analysis before developing teaching materials based on the background problems found in learning as a

supporter of the researcher in developing e-LKPD based on HOTS. The define stage aims to determine learning requirements; (2) The design aims to make products based on the response rate method of scientific material (components of the e-LKPD), which includes the presentation of the contents of the chapters to train students' High Order Thinking Skills (HOTS). The design stage should have student discussion questions to enable them to discover important concepts related to response rates; (3) Develop aims to produce an e-LKPD that is suitable for use. This development stage is a continuation of the design product from development. This research was conducted only 3D model due to the limited time in the research.

After the development stage, e-LKPD is validated by a material expert, media expert, and teacher to get a level of validation. The validation has been collecting data with a questionnaire. The Feasibility of teaching materials that the researcher will develop refers to the National Professional Certification Agency (BNSP) eligibility criteria. The questionnaire aims to assess the validation with category level Linkert scale (Sugiyono, 2019).

RESULT AND DISCUSSION

The results of the validation questionnaire can be seen in Figure 2. that the average validation by media experts, material experts, and teachers. Validation is carried out to see exactly what is in development and then obtain the results of the validation developed by the researcher (Tanti et al., 2020). The questionnaire validation of the media expert, material expert, and teacher referred to the scoring description adapted by National Professional Certification Agency (BNSP). Figure 2. shows the average validation by experts. There is average material expert got 92,5% in the very worthy category, the media expert got 97,5% in the very worthy category, and the teacher got 95,2% in the very worthy category.

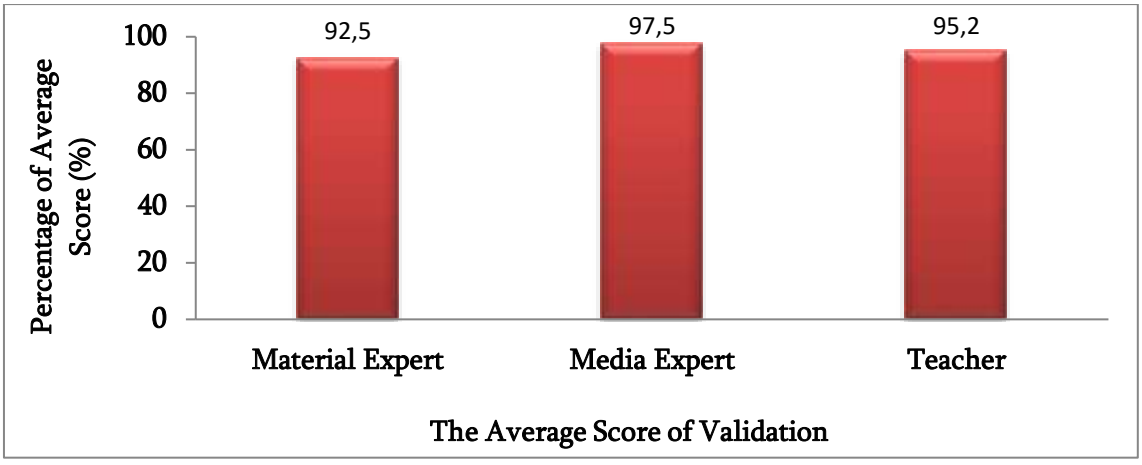

Figure 2. The Average Result Score of Validation

The result of the data in Figure 3. material expert average score covers four aspects, namely (1) the Feasibility of content aspect is 93% with a very worthy category; (2) the Language aspect is 95% with a very worthy category; (3) Presentation aspect is 96% with a very worthy category; and (4) Graphical aspect is 81% with a very worthy category.

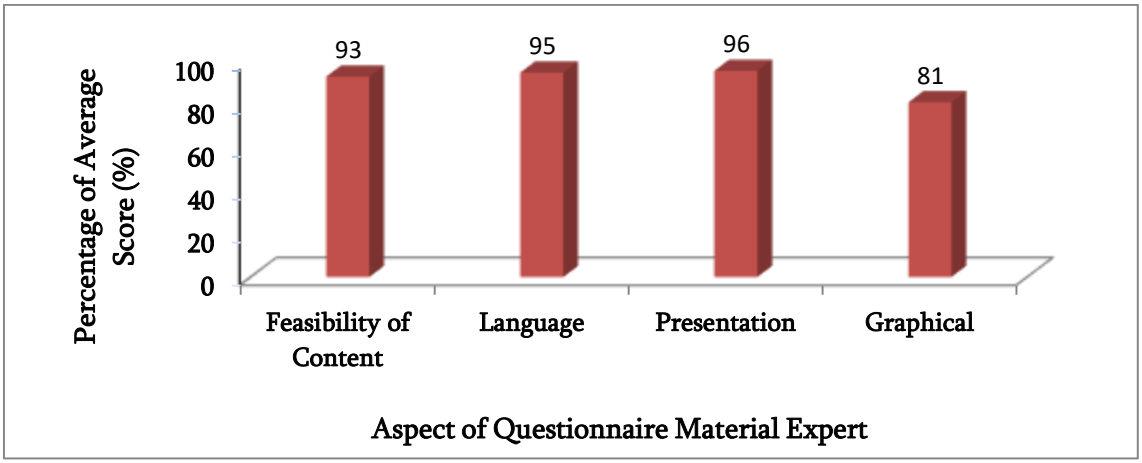

Figure 3. The Average Result Score by Material Expert

The result of the data in Figure 4. media expert average score covers four aspects, namely (1) the Language aspect is 100% with a very worthy category; (2) the Software Engineering aspect is 96% with a very worthy category; and (3) Visual display aspect is 97,5% with a very worthy category.

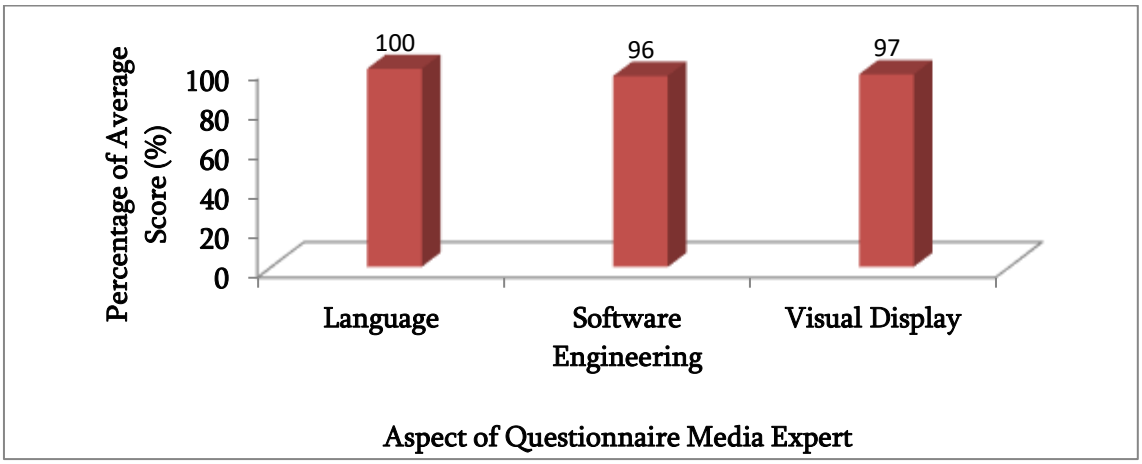

Figure 4. The Average Result Score by Media Expert

The result of the data is in Figure 5. teacher get average scores covering six aspects, namely (1) the Feasibility of Content aspect is 95,4% with a very worthy category; (2) the Language aspect is 92,5% with a very worthy category; (3) the Presentation aspect is 91,6% with a very worthy category; (4) Graphical aspect 100% with a very worthy category; (5) Software engineering aspect

is 93,7% with a very worthy category and (6) Visual display aspect is 100% with a very worthy category.

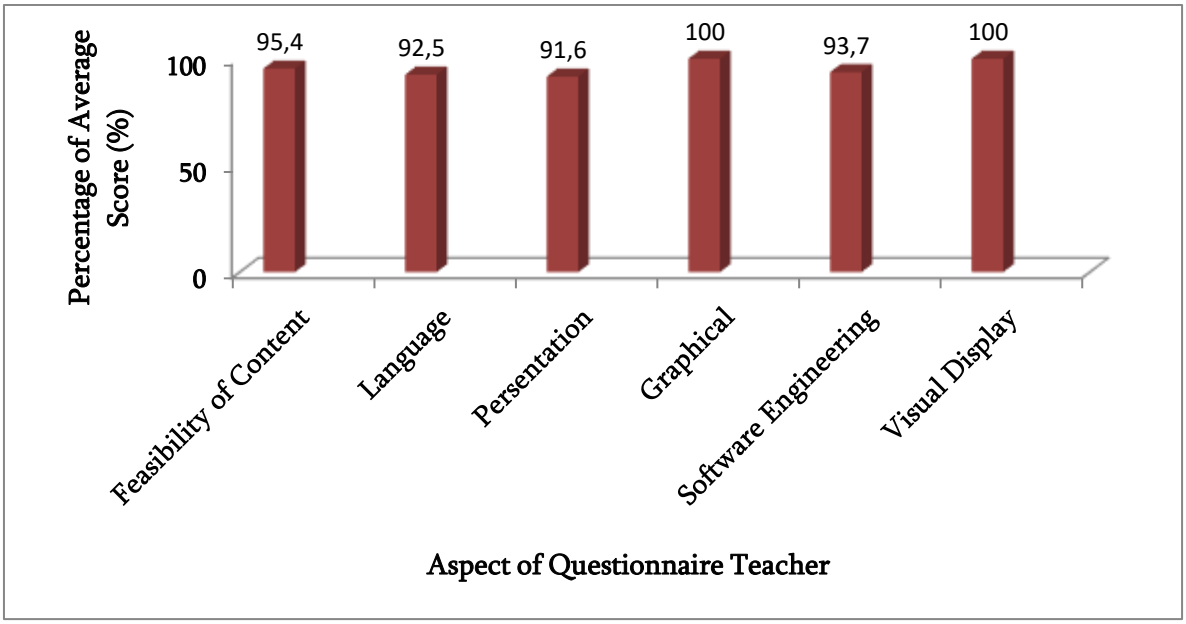

Figure 5. The Average Result Score by Teacher

The validation results of the media expert, material expert, and teacher for the development of e-LKPD based on HOTS with Doppler effect material show that the development carried out by the researcher is very valid. The media expert, material expert, and teacher expert based on proportions meet the quality requirements very feasible as electronic learning, as stated in the study (Pratama & Siregar, 2019). The development of e-LKPD is validated in terms of attractive features, icons, and designs so that the delivery of learning materials looks more attractive (Pratama & Siregar, 2019).

The practicality of the development is determined based on the results of user assessments (Irawan & Hakim, 2021). The practicality of developing e-LKPD based on HOTS with Doppler effect material taken by the development of teacher and student questionnaires. The results of the teacher's questionnaire are shown in Figure 5. get an average percentage of 95,2%, a worthy category with six aspects. The practicality based on the percentage of teacher's questionnaire results, the development of e-LKPD based on HOTS with Doppler effect material with a 4D model is included in the very valid and practicality category.

Practicality students as users get the result with large group tests and small group tests. The results of student questionnaires on large and small group tests indicate that development meets the criteria of practicality (Irawan & Hakim, 2021). The practicality questionnaire data are large group

test with 37 students is presented with 85,5% in the very feasible category, and small group test with 6 students is given 88,5% in the very feasible category. The percentage can see in Figure 6.

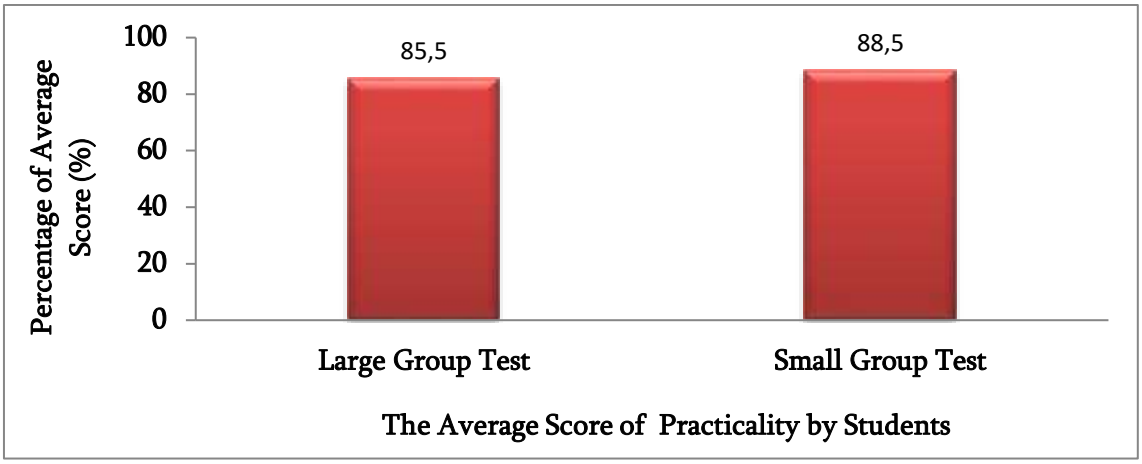

Figure 6. The Average Result Score of Practicality by Students

The results data in Figure 6. that the practicality by students is practicality in a large group because got an average score of 85,5% in the benefit aspect with the very helpful category. The small group test got an average score of 88,5% in the benefit aspect with the very helpful category. The development of e-LKPD as teaching materials get the practicality criteria if 50% of students give a positive response with a minimum option of 70% answer by students. The conclusion is that developing e-LKPD based on HOTS with Doppler effect material with a 4D model is a very practical category. So that teachers and students have no difficulty using the development of e-LKPD as alternative teaching material to realize higher-quality learning (Misbah et al., 2018).

CONCLUSION AND SUGGESTION

The conclusion from the research is:

1. The development of e-LKPD-based HOTS on the Doppler effect material with a 4D model gets a validation level with a very worthy category from media expert, material expert, and teacher expert.
2. The development of e-LKPD-based HOTS on the Doppler effect material with a 4D model gets a practicality level with a very feasible category from teachers and students as users.

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