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Development of Interactive E-LKPD Based Mind Mapping Helpful Sigil Software on Impulse and Linear Momentum Material in SMA/MA

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Abstract

The subject of impulse and linear momentum is one of the relatively complicated subjects in class X physics in the even semester. In general, students at SMA Negeri 1 Trienggadeng consider impulse and linear momentum to be one of the physics materials that is difficult to understand. This difficulty lies in the learning media which only uses printed books in the process of teaching and learning activities, making it difficult for students to understand abstract impulse and linear momentum material. So Interactive E-LKPD media is needed as a learning medium other than printed books which can help students understand the material on impulse and linear momentum. This research aims to determine (1) the design of an Interactive E-LKPD based on mind mapping assisted by sigil software on impulse and linear momentum material (2) the feasibility of an Interactive E-LKPD based on mind mapping assisted by sigil software on impulse and linear momentum material. This research uses the Research and Development (R&D) research method and the models used in this development are the allesi and trolllip models. Alessi and Trolip consist of three research stages, namely planning, design and development. The instruments used in this research were validation sheets by media experts, material experts and practical validation sheets by students. The research results show that the E-LKPD based on mind mapping assisted by sigil software on impulse and linear momentum material developed is very suitable for use by obtaining an average score of 95.41% with a very valid assessment category. Based on the results of product validation by media experts, they obtained an average score of 96.07% in the very valid assessment category, and the validation results by material experts obtained an average score of 94.75% in the very valid assessment category.

Keywords: Development, E-LKPD, Mind Mapping, Sigil Software

INTRODUCTION

Education is one supporting factors progress a country. Learning Physics is something activity form knowledge , ideas and concepts about natural approximately earned from a number of Suite experience through a scientific process . Learning physics No only aim For understand concepts physics but also for grow ability think participant useful education For solve a number of problem in life daily. Thereforethat is, implementation good learning is participant centered learning educate and encourage participant educate For involved active in the learning process so that learning can taking place in a way effective .

Use of learning media can help participant educate For involved active in the learning process teach. Process carried out This will effective if participant educate involved active with use available media interesting attention so that participant educate No feel bored at the moment learning taking place . One of possible business carried out by the teacher so

that the activity learning taking place more effective and more independent is with using E-LKPD. E-LKPD is lkpd executed in electronic format with computers and electronic media other. E-LKPD can displays text, images, animations, and videos via device electronic in the form of a computer. Progress technology also allows E-LKPD to be displayed via smartphone.

Need exists application method required learning can raise that will happen Study students, use method Proper learning is very crucial success Study participant educate. One of suspected method capable produce atmosphere interesting learning as well as enjoyable in delivery material learning is method mind maps. Mind maps is something method very good learning the teacher uses it for increase Power memorize participant educate as well as understanding draft strong student through freedom imagine.

Based on analysis researchers ' needs get it at SMAN 1 Trienggadeng to difficulty material with share questionnaire to participants Educator, physics teacher so that obtain that data participant educate experience difficulty understand material impulse and linear momentum of results have been shared to participant educate. the material is one of the material Class X in the even semester is classified as to in difficult material understood by participants educate. Researcher choose material impulse as well as linear momentum due to based on results pre-study 71.4% of participants educate state that difficulty in learn material the . During this time the learning process No using E-LKPD. This matter is known from participant educate who stated that during This method teacher teaching on learning is with through assignments , and also sources learning used is the internet as well source the considered not yet can help participant educate in understanding the material. Most answer participant educate temporary That more want teaching materials in it load like pictures, colors, lines as well projecting schema material taught to in form map thought so that help participant educate during the learning process. Based on from statement that, you can is known that teaching materials load criteria desired by students is an E-LKPD with a mind mapping strategy.

This matter strengthened with results observation field showing that, the teacher has teach use appropriate teaching materials, only just Not yet use test simple direct about material impulse and linear momentum due to limitations tools and LKPD containing experiments simple.

Based on the statement above, then the right solution is required effort from teachers to prepare and organize strategies in the delivery process material to participant educate for increase understanding participant educate. That strategy can form election teaching materials, doing test simple, and selecting the right media. Knowledge Developing Knowledge and Technology (IPTEK). fast moment this requires teachers to literate technology.

This is in line with the results of research conducted by Oktaria Rahayu, et al entitled "Development of Electronic Modules for Momentum Materials and Impulse Based Mind Mapping In PUBLIC HIGH SCHOOL City Bengkulu.” Obtained results research shows that the teaching materials that have been developed are electronic modules momentum and impulse material based on mind mapping based on feasibility tests has been in the very worthy category with an average score of 83%. Furthermore study Which done by Alifa Juliana, et al Which title "Development Mind Folder On principal Discussion Momentum, Impulse And Momentum.” Obtained results study that mind mapping on principal discussion momentum, impulse and collision with a validation average of 4.52 are categorized as valid And can be used for development testing.

RESEARCH METHOD

a. Research Approach

Type of research used is Research and Development (R&D) development. Research purposes This is produce product form teaching materials in the form of *e- lkpd* interactive based *mind mapping* assisted by *software* sigils. Model used in study This For produce product form *e- lkpd* are Alessi and Trollip. This model consists from three stages research, namely *planning*, *design*, and *development.*

b. Research Participants

Subject study This includes 3 media expert validators, 5 expert validators material, and 15 participants student at SMA Negeri 1 Trienggadeng. Deep objects study This is *e- lkpd* interactive based *mind mapping* assisted by *software* sigils on material impulse and linear momentum in SMA/MA.

c. Research Instruments

Instruments used in study this is :

1. Validation Sheet

Validation sheet required For see appropriateness product. For develop something product required sheet validation that will given to expert validators. Validation sheet This cover validation media experts and experts material.

2. Practicality Test Sheet

Practicality test sheet given to participant educate for provide response data participant educate to product, so can used and utilized by participants educate in the learning process.

d. Data Collection

Data collection techniques are very important component in study. Data collection techniques used in study This is:

1. Alpha Test

Validators do evaluation . As well as giving details revision If There is shortage, and filling suggestions section if There is input. Validator assessment consists from media experts and experts material.

2. Beta Test

Analysis results Study participant educate done with using pretest and posttest acquisition data. As for know the level of completion participant educate determined KKM of 70.

e. Data Analysis

Analysis techniques qualitative and technical analysis quantitative used For analyze data. Analysis descriptive qualitative This used For analyze the results data review from media expert, expert material, and responses participant educate in the form of ideas and comments For improvement *e- lkpd* interactive based *mind mapping.*

Practicality test results data and sheet validation analyzed use analysis descriptive quantitative. Validator analysis is descriptive qualitative form input and criticism, while the data used in validation *e- LKPD and* practicality test participant educate nature quantitative.

1. Analysis Quantitative Validity Product

Data used in validation *e- lkpd* is quantitative data with refers to 4 criteria assessment (Widoyoko., 2012), namely as following :

a. Score 1, if evaluation invalid

b. Score 2, if evaluation less valid

c. Score 3, if valid assessment

d. Score 4, if very valid assessment

Data obtained from sheet assessed validation or filled by 8 expert validators, three media validators, and five material validators. The level of validity Then will evaluated with use method percentage like under this:

$$\%K = \left(\frac{N}{N_m}\right) \times 100\%$$

Source (Sugiyono ., 2019)

Results obtained from formula above, will refer to the table criteria appropriateness like under this :

Eligibility Percentage Criteria	Eligibility Levels
81 .26 % ≤ x ≤ 100%	Very Worth It
62.51 % ≤ x ≤ 81.25 %	Worthy
43.76 % ≤ x ≤ 62.50 %	Less Eligible
25 % ≤ x ≤ 43.75 %	Not feasible

2. Analysis Quantitative Practicality Test Response Learners

Practicality test analysis participant educate nature descriptive qualitative form input and criticism, while the data used in sheet test practicality participant educate is quantitative data with refers to 4 criteria assessment, ie as following:

a. Score 1, if evaluation invalid

b. Score 2, if evaluation less valid

c. Score 3, if valid assessment

d. Score 4, if very valid assessment

Data obtained from practical test results filled in by participants educate used For count level practicality with use calculation percentage as below this:

$$\%K = \left(\frac{N}{N_m}\right) \times 100\%$$

Source (Sugiyono ., 2019)

Results obtained from formula on will refer to the table criteria evaluation as below this:

Table 2 . Eligibility Percentage Criteria

Eligibility Percentage Criteria	Eligibility Levels
81.26 % ≤ x ≤ 100%	Very Worth It
62.51 % ≤ x ≤ 81.25 %	Worthy
43.76 % ≤ x ≤ 62.50 %	Less Eligible
25 % ≤ x ≤ 43.75 %	Not Easy

RESULTS AND DISCUSSION (70%)

Research result Development of Interactive E-LKPD Based *Mind Mapping* Assisted by Sigil Software on Impulse and Linear Momentum Material in SMA/MA

1. Analysis

Analysis needs of this level be equipped with do observations and interviews to the Physics subject teacher at SMA Negeri 1 Trienggadeng For identify difficulty in the learning process. Based on observation early ones for analysis needs on January 18 2023 at SMA Negeri 1 Trienggadeng, researcher find that teachers only use One teaching materials and more choose method lecture because lack of facilities and infrastructure. This matter strengthened with results observation field showing that, the teacher has teach use appropriate teaching materials, only just Not yet use test simple direct about material impulse and linear momentum due to limitations tools and LKPD containing experiments simple.

2. Design

After done stage analysis needs, next done stage planning *e- lkpd.* Stage planning This covers planning *e- lkpd*, election material, and preparation plan learning. Cover front and back designed use canva application, meanwhile fill *flow chart* until end designed use application Microsoft Word, and change lkpd to *e- lkpd* use application *sigil software.*

Appropriateness Interactive E-LKPD Based *Mind Mapping* Assisted by Sigil *Software* on Impulse and Linear Momentum Material in SMA/MA

Based on *e- lkpd* interactive based *Mind mapping* has been done designed Then tested eligibility by expert validators To use get feedback and suggestions on *e- lkpd*. The following table show percentage appropriateness *e- lkpd* interactive based *mind mapping* in a way whole as following:

Table 1 . Validation Percentage Data

Validator	Percentage	**Criteria**
Media Expert	96.07%	Very Worth it
Material Expert	94.75 %	Very Worth it
Average Total Score	95.41 %	**Very Worth it**

This E-LKPD based information in the table above. Interactive E-LKPD based developed *mind* mapping reach score the average percentage is 95.41% with very valid criteria.

Response Students Against Appropriateness Interactive E-LKPD Based *Mind Mapping* Assisted by Sigil *Software* on Impulse and Linear Momentum Material in SMA/MA

Participant students involved in study This only totaling 15 people or its spread only done in scale small, this because need more time and more funds big. Response participant educate to development Interactive E-LKPD Based *Mind Mapping* With the help of Sigil *Software* on Impulse and Linear Momentum material in SMA/MA you can seen in the table following:

Assessment Aspects	Respondent														Total	Practicality
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Interest																
The appearance of the E-LKPD makes me more enthusiastic about studying physics	4	4	4	4	4	4	4	4	3	4	4	4	4	4	3	58	96.66%
I am interested in the *mind mapping display* impulse and linear momentum material in E-LKPD	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	59	98.33%
I am interested in studying impulse and linear momentum using E-LKPD	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	58	96.66%
Using LKPD doesn't make me bored in studying impulse and linear momentum material	4	4	4	3	3	3	4	4	4	4	4	3	4	4	3	55	91.66%
This E-LKPD supports me in mastering the material on impulse and linear momentum step by step	4	4	4	4	4	4	4	4	3	4	4	3	4	4	4	58	96.66%
Having practical stages and observation tables can help me understand the material	3	3	4	4	3	4	4	4	4	4	4	4	3	4	3	55	91.66%
Practical activities and evaluations in the LKPD helped me to develop my basic experimenting skills	4	4	4	4	3	4	3	3	4	4	4	3	4	4	3	55	91.66%
E-LKPD gives me the opportunity to study independently	4	4	3	4	4	4	4	4	4	4	4	3	3	4	3	56	93.33%
E-LKPD is practical to use	4	4	4	3	4	4	3	3	4	4	4	3	3	3	4	54	90%

The presentation of material in the LKPD is related to everyday life	4	4	3	4	4	3	4	3	4	4	3	3	4	4	4	55	91.66%
Interest	**38**	**38**	**38**	**38**	**37**	**38**	**38**	**37**	**38**	**40**	**39**	**34**	**37**	**39**	**34**	**563**	**93.83%**
Material																	
Presentation of material in E-LKPD is easy, more practical and efficient so it is easy to understand	4	4	4	4	4	4	4	4	4	4	3	4	3	4	3	57	95%
E-LKPD contains practical stages and observation tables so as to strengthen understanding of the material on impulse and linear momentum	4	4	4	4	4	4	4	3	4	4	4	4	3	4	3	57	95%
The mind mapping presentation in E-LKPD is more flexible and contextual than concept maps in textbooks	4	4	4	4	4	4	3	3	4	4	4	3	4	3	3	55	91.66%
I easily understand *mind mapping* in the material on E-LKPD	4	4	4	4	4	4	4	4	3	3	4	4	3	4	3	56	93.33%
The material presented is in accordance with the K-13 curriculum	4	4	4	4	4	3	3	3	4	3	4	3	3	4	4	54	90%
The material presented is from easy to complex.	3	3	4	4	3	4	4	4	4	3	4	4	4	4	3	55	91.66%
Material	**23**	**23**	**24**	**24**	**23**	**23**	**22**	**21**	**23**	**21**	**23**	**22**	**20**	**23**	**18**	**333**	**92.5%**
Language																	
The language used in E-LKPD makes it easy for me to understand the material on impulse and linear momentum	4	4	4	4	4	4	4	4	4	3	4	4	3	4	4	58	96.66%
Use of words according to the characteristics of the students	4	4	4	4	4	4	3	3	4	3	4	4	4	4	3	56	93.33%
The grammar used makes it easier for me to understand the material on impulse and linear momentum	4	4	4	4	4	4	4	4	3	4	4	4	4	4	3	58	96.66%
The symbols used are easy to read and understand																	

	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	59	98.33%
Language	**16**	**16**	**16**	**16**	**16**	**16**	**15**	**15**	**15**	**14**	**16**	**16**	**15**	**16**	**13**	**231**	**96.25%**
Total Average Score																**1127**	**93.91%**

From table on is known test percentage practicality participant educate againste-lkpd interactive based on developed mind mapping obtained 93.91% with criteria very valid assessment .

Discussion

a. Interactive E-LKPD Design Based *Mind Mapping* Assisted by Sigil *Software* on Impulse and Linear Momentum Material in SMA/MA

Findings study the supported by research previous about *E-LKPD development* interactive based *mind mapping*, the results of research conducted by Oktaria Rahayu, et al entitled "Development of Electronic Modules for Momentum Materials and Impulse Based *Mind Mapping* In PUBLIC HIGH SCHOOL City Bengkulu". Obtained results research shows that the teaching materials that have been developed are electronic modules momentum and impulse material based on *mind mapping* based on feasibility testing has been in the very worthy category with an average score of 83% .

Furthermore study Which done by Alifa Juliana, et al Which title "Development *Mind Folder* On principal Discussion Momentum, Impulse AndMomentum." Obtained results study that *mind mapping* on principal discussionmomentum, impulse and collision with a validation average of 4.52 are categorized as valid And can be used for development testing.

Furthermore, research was conducted by Suartika and I Wayan entitled "Application of the Mind Map Learning Method in Efforts Towards Improving Student Learning Outcomes in Class XII Physics Lessons "SMAN 1 Pringgabaya 2018 Academic Year." It was obtained that the average valuestudents was 71.82. Of the 28 students who took part in the evaluation, there were 25 students who complete Study. So that completeness Study on cycle 1 is 89% mark This Stillless than 90%. So it can be concluded that in cycle 1 lessons not yet reach completeness Study in a way classic, with thereby need done repair on cycle next.

b. Feasibility of Interactive E-LKPD Based *Mind Mapping* Assisted by Sigil *Software* on Impulse and Linear Momentum Material in SMA/MA

Appropriateness *e- lkpd* interactive based *mind mapping* can seen with validation media and validation expert expert material. Media experts assess from the two aspects contained in the sheet validation that is aspect appearance and aspect programming. Whereas expert material evaluate three aspect that is aspect appropriateness content, aspect appropriateness presentation, and aspects language. Results data evaluation in the form of modified score data become four category that is invalid, less valid, valid, and very valid. The score of each validator will be changed become percentage condition appropriateness. Based on Table 3 of the research above, the results validation earned media experts percentage as big as 96.07% with criteria assessment is very valid, whereas results validation expert material obtain score percentage as big as 94.75% with criteria very valid assessment. With Very valid criteria, total obtained from validation media experts and experts material is 95.41%. The results, findings validation show that E-LKPD is Interactive Based *Mind Mapping* The assistance of Sigil *Software* in Impulse and Linear Momentum material in SMA/MA is very useful.

Validity results from expert validator assessment with a total score of 95.41% incl in category the assessment is very valid and very worthy used as *e-lkpd* learning. So you can

concluded that module that has been declared very valid by the validator can used in the learning process.

c. Response Students towards Interactive E -LKPD Based *Mind Mapping* Assisted by Sigil *Software* on Impulse and Linear Momentum Material in SMA/MA

With use practicality test survey participant educate, me test reaction participant educate to *e-lkpd* interactive based *mind mapping.* Table 4 data analysis from practicality testing participant educate show that answer participant educate in a way whole including in category very valid assessment. Based on results table 4, products *E-LKPD* provided to 15 participants educate have percentage amounting to 93.91% with criteria very valid assessment. In terms of aspect interest obtain percentage as big as 93.83%, of facet aspect material obtain percentage as big as 92.5%, and from facet aspect Language obtain percentage as big as 96.25%. Can be said that The designed *e- LKPD* is very attractive for participant educate, proven from practicality test results participant educate.

Based on description above can concluded that developed *E-LKPD* has in accordance with need participant educate,This seen from feasibility test results by media expert validators and experts material. Then test it also limited to participants student at SMA Negeri 1 Trienggadeng. The result *e- lkpd* This considered very practical or interesting by the participants educate.

CONCLUSIONS AND SUGGESTIONS

Planning *e- lkpd* interactive based *mind mapping* assisted by software sigils on the material impulse and linear momentum in SMA/M, ie stage election material and composition as well as preparation syntax. At stage election material form fill *e- lkpd,* compiler *E-LKPD* , and related cover designs with material *e-lkpd* interactive. Then on stage preparation syntax in the form of a RPP. Interactive E-LKPD based *mind mapping* based on appropriateness The SMA/MA level produced by the validator meets criteria appropriateness. This matter seen from whole results validation data analysis media experts and experts material obtained percentage as big as 95.41 % with very valid criteria.

Based on practicality test data participant educate to *e-lkpd* interactive based *mind mapping* aided sigil software obtain response positive from participant educate . This matter proven from results analysis of the data obtained as big as 93 .91% with very valid criteria.

Based on results obtained, *e-lkpd* interactive based *mind mapping* in a way theoretical can used For reduce saturation participant educate. Research result this also shows that teachers can apply *e-lkpd* in learning,This Because based on the response participant students who think *e-lkpd* this is very practical For used in learning .

The results of this research can be used as a learning medium for impulse and linear momentum material in SMA/MA because the learning E-LKPD uses *mind mapping* assisted by sigil *software* and a virtual lab which can explain the concept of impulse and linear momentum material.

The author hopes that for further research he can develop an Interactive E-LKPD Based on *Mind Mapping* Assisted by Sigil *Software* by visualizing concepts in other materials. For future researchers, they can continue this research by implementing the product of developing

an Interactive E-LKPD Based on *Mind Mapping* Assisted by Sigil *Software* in the material impulse and linear momentum in the process of teaching and learning activities in schools.

Suggestions

1. The author hopes that for further research he can develop an interactive E-LKPD Based on Mind Mapping Assites by Sigil Software by visualizing concepts in other materials.

2. For future researchers, they can continue thus research by implementing the product of developing an Interactive E-LKPD Based on Mind Mapping Assited by Sigil Software on impulse and linear momentum material in the process of teaching and learning activies in schools.

3.

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