JENTIK

Jurnal Pendidikan Teknologi Informasi dan Komunikasi
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Web-Based Mind Mapping Learning Media to Improve Students' Conceptual Understanding of Magnetic Field Material at SMAN Kota Bengkulu

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Article Information:
Received July 31, 2024
Revised December 24, 2024
Accepted December 30, 2024

Keywords:
Concept Understanding; Learning Media; Magnetic Field; Mind Mapping; Web

Abstract

This study aims to describe the feasibility and perception of web-based mind mapping learning media to improve students' conceptual understanding of magnetic field material from students. This study is a research and development (R&D) with a 3D model with steps of definition, design, and development. The data collection technique is a non-test technique that uses observation data, document review, and questionnaires. The data analysis techniques used are descriptive, qualitative, and quantitative methods. The subjects used in this study were physics teachers and grade XII students at SMA 9 Bengkulu City. The results of the study obtained data that the mind mapping learning media developed is included in the very feasible criteria with an average percentage of 86%, so it is worthy of being tested for readability so that it gets a very good perception assessment with an average percentage of 87%. Based on the results of the study obtained, it can be concluded that the mind mapping learning media developed received a very good response and can be used as an alternative learning media in the classroom.

A. Introduction

The development of science and technology continues along with the progress of the times. This drives changes in the way we use technology in the learning process. Global demands emphasize the need for the world of education to continue to adapt to technological developments, especially in integrating information and communication technology into education in order to improve the quality of learning (Budiman, 2017). The increasingly advanced development of information and communication technology (ICT) requires teachers to innovate in learning activities (Goh & Sigala, 2020). One way to achieve this is to develop learning media that can help teachers deliver material to students effectively and efficiently.

The 2013 Curriculum, which highlights the primary role of students in the learning process, is now used in Indonesian education. In compliance with the Minister of Education and Culture's decree Number 69 of 2013 regarding the fundamental framework and structure of the Senior High School (SMA) or Madrasah Aliyah (MA) curriculum, this curriculum places a strong emphasis on the use of technology in the classroom. Three primary factors—internal obstacles, external challenges, and initiatives to enhance mindsets—were taken into consideration when developing the 2013 curriculum. Information and communication technology (ICT), which is growing rapidly and impacts education through its usage in the learning process, is one of the external challenge factors (Ministry of Education and Culture, 2013).

According to the 2013 curriculum, technology-based learning should make learning more fun, which will increase students' motivation, enthusiasm in learning, and knowledge while also making the learning process more student-centered.

How to Cite : Refiana, R., Risdianto, E., & Purwanto, A. (2024). Web-Based Mind Mapping Learning Media to Improve Students' Conceptual Understanding of Magnetic Field Material at SMAN Kota Bengkulu. *JENTIK : Jurnal Pendidikan Teknologi Informasi Dan Komunikasi*, *3*(2), 61–67. https://doi.org/10.58723/jentik.v3i2.282
ISSN : 2963-1963
Published by : CV Media Inti Teknologi

The teaching and learning process is substantially aided by learning media, which can also help make the content that teachers will provide to pupils more understandable (Ramli, 2015). Learning media is an intermediary/conductor and message carrier in the learning process, according to Suryani in Melianti et al., (2020). Because of this, the usage of media can standardize the way that learning materials are delivered, make the learning process more engaging, encourage student participation, make learning time more effective, and enhance the quality of learning. Thus, it may be claimed that one of the purposes of educational media is to serve as a teaching tool that can affect the environment in which students learn.

Based on the results of the initial study from observations at SMAN 9 Bengkulu, it shows that the school uses the 2013 Curriculum. Commonly used teaching materials include Student Worksheets (LKPD), printed books, and other supporting materials. Learning media that are often used are PowerPoint presentations and interactive videos. However, despite this, students are less interested and have difficulty in understanding the material presented. This is reflected in the lack of interest and enthusiasm of students in the learning process. Based on the needs analysis, it was found that students prefer learning that involves something systematically because of the lack of understanding of the concept from students and also most of the students need more accessibility to learning media via smartphones so that it can be accessed anytime and anywhere.

Effective and efficient learning requires improvements in the education system and the use of new techniques. One of the new techniques that can be implemented is using the mind mapping learning model. This model can be developed into a learning medium as an intermediary for teachers and students in teaching and learning activities (Cobena et al., 2019). Because it can reach students directly, web-based mind mapping is a comprehensive and information-rich teaching tool that does not require printing. Additionally, WEB-based mind mapping adds a new dimension to learning because of the features of WEB technology, which allow students to view extremely comprehensive learning materials along with the accompanying sound, making them feel as though they are in the same location as the program that is broadcast on the WEB. As is well known, if students are acquiring knowledge more through their senses of sight and hearing, their degree of retention (absorption and memory) toward learning materials might rise noticeably.

Previous research results show that the mind mapping method is effective in improving student learning outcomes. By using this method, students can record and physically turn off their thoughts, and help them organize information and remember material better (Pangestu et al., 2019) . This is also in line with research which explains that the use of the mind mapping learning model can improve student understanding. The use of web technology in learning can increase accessibility and interactivity. This is very important in facing the challenges of technological limitations and allowing students to learn from various places.

From the description above, it is very necessary to have a good script flow. According to Daryanto (2013, 85) writing a *Mind Mapping script* means planning images and materials in such a way that when displayed and watched, they can attract the audience's interest. *Mind Mapping* is a very effective medium to help the learning process, both for mass, individual, and group learning. In mass learning, the benefits of video cassettes are very real. The visualization or writing on the board is a fixed size, it cannot be enlarged or reduced. While the display size *Mind Mapping* on *the WEB* is very flexible and can be adjusted according to needs, namely by adjusting the distance between the screens for display.

Based on several problems, it is necessary to study the Development of *Web*- Based *Mind Mapping Learning Media* to Improve Students' Interest and Conceptual Understanding of Magnetic Field Material at SMAN Kota Bengkulu with the following problem formulations: 1) how is the feasibility of web-based mind mapping learning media to improve conceptual understanding 2) how are students' perceptions of web-based mind mapping learning media to improve conceptual understanding.

B. Research Methods

Research and development (R&D) is the type of research that is being done here. Research and development is a research technique used to create specific items and evaluate their efficacy, claims Sugiyono (2013). Thiagarajan (1974) created the 4D development model (Four D Models), which stands for Define, Design, Develop, and Disseminate, and it is the R&D methodology utilized in this study. There are only three steps in this study's process: definition, design, and development.

Descriptive, qualitative, and quantitative analysis methods are used in this study's data analysis. Validators' input throughout the validation phase, as well as input from media, language, and material specialists,

provided the study's qualitative data. On the other hand, quantitative data describes the outcomes of product development in the form of web-based mind mapping and learning media. Statistics were used to analyze the data collected throughout the study using the assessment tool. It is anticipated that this approach will be able to comprehend the data more thoroughly. The generated product is revised based on the findings of the data analysis. A University of Bengkulu physics lecturer completed the response questionnaire.

Next, calculations are made for each statement item. Interval data can be analyzed by calculating the percentage of answers for each item using the following formula:

$$P_s = \frac{S}{N} \times 100\% \quad (1)$$

Furthermore, the percentage of eligibility obtained is then interpreted into the eligibility criteria based on Table 1 as follows.

Table 1 Eligibility Criteria

Percentage (%)	Criteria
0% - 20%	Very Less Worthy
21% - 40%	Less Worthy
41% - 60%	Quite Decent
61% - 80%	Worthy
81%-100%	Very Worth It

Based on these criteria, learning media is said to be feasible if the percentage is ≥60% of all aspects (Anesia, Regita., Anggoro, BS, & Gunawan, 2018) . Furthermore, the feasibility of the media is known, then a readability test is carried out based on student perceptions which are interpreted into student perception criteria based on Table 2 as follows.

Table 2 Student Perception Criteria (Nurfasiah, 2015)

Percentage (%)	Criteria
81%-100%	Very good
61%-80%	Good
41%-60%	Enough
21%-40%	Not enough
0%-20%	Very less

C. Results and Discussion

Definition Stage

The following are the findings of the analysis of the learning implementation plan (RPP): 1) the RPP used is Curriculum 13; 2) indicators, objectives, learning materials, learning methods, learning media, learning implementation, learning outcome assessment, and approval sheets are among the components of the RPP used; 3) the learning objectives in the RPP do not yet include the ABCD rules (audience, behavior, condition, and degree); and 4) the learning materials in the RPP do not yet contain facts, concepts, principles, and procedures.

The results of observations and needs analysis in the journal of Utami et al. (2021) are in the observation activities obtained the results that SMAN 2, SMAN 4, and SMAN 9 Bengkulu City have used the 2013 curriculum, in teaching and learning activities teachers use LKPD, printed books and other supporting teaching materials. The learning media that are often used are PowerPoint and interactive videos. The results of the needs questionnaire given to teachers and students of class XII MIPA SMAN 2, SMAN 4, SMAN 9 Bengkulu City in accordance with (Utami et al., 2018) show that some students are interested in physics lessons but they cannot understand or have difficulty in physics lessons. This can be seen from the average percentage of student response aspects of 85% which falls into the strongly agree criteria. Students prefer pictorial learning rather than being fixated on text. Students need learning media that can be accessed via smartphones that are related to daily activities and life to help increase students' learning motivation, therefore digital media is very important to develop (Utami, 2022) .

Design Phase

Following the implementation of the define stage, this step is completed. At this point, the exercises have produced mind mapping learning materials. created as a learning tool that students can access from

anywhere at any time. More emphasis is placed on mind mapping learning materials to pique students' curiosity and inspire them to study physics. Competencies 1 and 2 (learning objectives, material descriptions, practice questions), the title of the content, the compiler, the table of contents, the idea map, the introduction (mind mapping identity, basic competencies, brief description of the material), and the evaluation are all included in this media.

Development Stage

Three validators examined the product design findings during the development phase to assess their suitability for use in physics education. The following figure displays the final result diagram of the validation of the language, presentation, content, and conceptual comprehension elements.

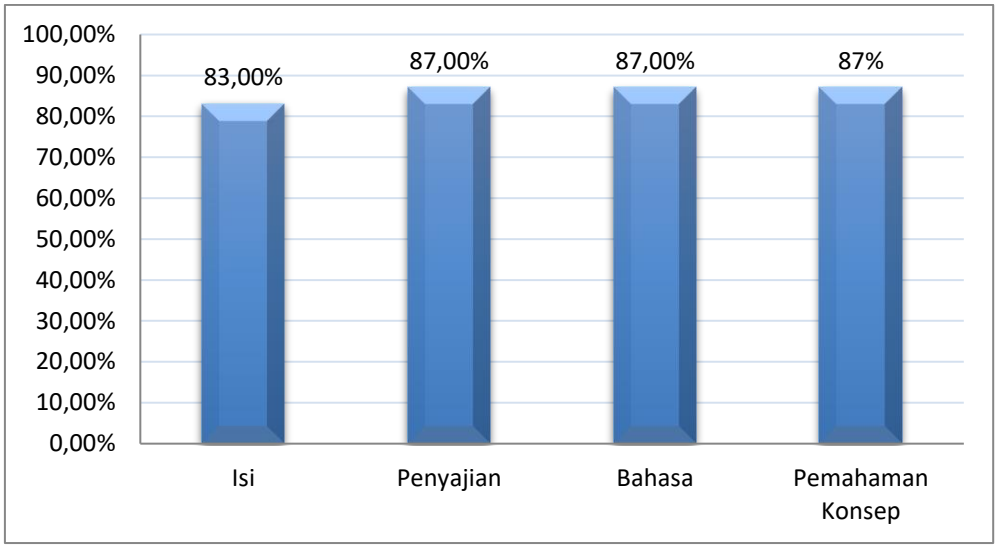

Figure 1. Final Result Feasibility Diagram According to Experts

Based on the feasibility test of the content, presentation, language, and conceptual understanding aspects in the development of web-based mind mapping learning media with 3 experts, namely 2 lecturers of Physics Education at the University of Bengkulu and 1 teacher at SMAN Kota Bengkulu, the results were very feasible with a percentage value of 86%. After being declared eligible, a readability test was conducted based on student perceptions at SMAN 9 Kota Bengkulu. The diagram of the results of the readability test on the material and learning aspects can be seen in the following table:

Table 3. Results of Student Perceptions

Aspect	Average value	Criteria
Material	85%	Good
Learning	89%	Very good
Average	87%	Very good

Based on the readability test of the material and learning aspects, the development of web-based mind mapping learning media based on student perceptions at SMAN 9 Bengkulu City, obtained very good results with a percentage value of 87%.

This study incorporates the define, design, and development phases of the Research and Development (R&D) approach using a 3D model. Web-based mind mapping learning materials are the main focus of product development, and it is anticipated that these will enhance conceptual knowledge of the subject of magnetic fields. The define stage is the initial action done in this investigation. This step includes gathering tools at the define stage, examining the RPP, assessing needs, and keeping an eye on things. In order to analyze the curriculum, the tools used for the define stage must be prepared. It was discovered that the learning implementation plan (RPP) utilized at SMA N 09 Bengkulu City complied with the elements of the 2013 curriculum RPP. The outcomes of the observation exercises demonstrated that the 2013 curriculum was utilized in SMA Negeri 9 Bengkulu City. Teachers utilize printed books, LKPD, and additional instructional resources in their instruction. Interactive movies and PowerPoint are often utilized learning resources. Students' interest in comprehending the content is nevertheless lowered by the educational resources and media offered. Students' lack of enthusiasm and eagerness to react to teachers'

inquiries during the learning process is evidence of this; as a result, relatively few students interact with teachers during the physics learning process.

The results of the observation, supported by the needs analysis, students prefer learning that involves something systematically due to the lack of understanding of the concept from students and also most of the students need more accessibility to learning media via smartphones so that it can be accessed anytime and anywhere.

The next step after carrying out the define stage is the design stage. This stage is the initial step in developing web-based mindmapping learning media to design products in the form of web-based mindmapping learning media to improve conceptual understanding of magnetic field material and design mindmapping learning media evaluation instruments. The design of mindmapping learning media is Competence, containing KI, KD, learning indicators to help achieve the learning process. Concept map, containing a flow/diagram that describes the relationships contained in the magnetic field material. Cover or front cover, contains the title of the learning media, the title of the material (Magnetic Field), the author's name, and is equipped with a picture of the magnetic field. Content, contains material presented in the form of mindmapping. Evaluation and sample questions. The final process in making mindmapping is the gitmind web process which can be accessed online via smartphones or computers. After the product design is carried out, an evaluation instrument can be designed to assess the mindmapping product that has been developed based on its assessment aspects.

Two professional judges and one practitioner conducted a validity test, and the results showed that the mindmapping learning medium was feasible based on four assessment aspects: concept understanding, language, presentation, and content. With an overall average percentage of 86% of the maximum score of 100%, the web-based mindmapping learning material generated fell into the "very feasible" category, according to the average validation results for the four assessment components. This is because the validator received a number of recommendations or inputs due to the fact that multiple evaluation statements on the content, presentation, language, and concept understanding aspects received low scores.

The suggestions or input from the validator are used as a reference in revising the mindmapping learning media in terms of presentation, language, and understanding of concepts. Revisions to the presentation aspect include image sources and formula accuracy.

The mindmapping learning media that has been developed can be said to be feasible if the score intervals on all averages are in the criteria of "feasible" or "very feasible". Based on this statement, it can be concluded that the web-based mindmapping learning media that has been developed is feasible so that this mindmapping learning media can be used for testing because it has met the four aspects of assessment, namely the content aspect, presentation aspect, language aspect, and concept understanding aspect with several revisions.

The results of the study show that the implementation of learning that applies the Mind Mapping method can improve student learning outcomes. This method is effective in recording and turning off thoughts physically, as well as helping students organize information and remember material better. Mind mapping allows students to interact with the material actively and visually, which is very important in understanding science material such as magnetic fields. Visualizing information with tree diagrams can help students understand the relationships between concepts better (Hikmawati, 1991). The mind mapping method encourages students to come up with their ideas and the students' thought process becomes more effective. Students can create concept maps of the material they are studying according to their respective levels of creativity, which helps in improving conceptual understanding. The development of web-based learning media can increase accessibility and interactivity, which is in accordance with the needs of modern students. Web technology allows students to interact with materials directly and from various places.

These results are in line with research conducted by Ritari & Setiawan (2021) that based on an evaluation of three aspects, namely material presentation, media presentation, and language, validation states that Mind Map-based learning media using the Mindjet Mindmanager application can be considered suitable for use by educators (Ritari & Setiawan, 2021). The research is relevant to research conducted by Putri, Yusandika, & Makbuloh (2019), which focuses on the development of Mindjet MindManager 2017-based learning media on business and energy materials, with the aim of improving student learning outcomes and producing attractive mind map products. Although the study involved small-scale and large-scale tests, the results showed that Mind Map-based learning media are suitable for use (Putri et al., 2019).

After the mindmapping learning media's viability was established, tests were conducted to find out how students felt about the newly created learning tool. It is known that the web-based mindmapping learning media that has been developed receives a readability perception with very good criteria, which include aspects of material and learning, based on the findings of students' assessments of the readability of the mindmapping learning media that was conducted. With an average score of 87%, it can be inferred from these two factors that students generally have a very positive opinion of the readability of this web-based mind mapping learning resource.

These results are in line with research Putri et al. (2019) which states that educators who were given a questionnaire with three aspects to assess their responses to the media developed, so that the media was categorized as "Very Interesting". Meanwhile, field trials on students who were also given questionnaires with three aspects also categorized the media as "Very Interesting".

When developing a product there are several obstacles. The obstacles faced when developing mindmapping learning media are because in making this web-based mindmapping must use a good internet connection so that in the process of making it there are many steps that make the product finishing process take a long time.

Based on the limitations of the product developed, the suggestions for research are: 1) the mindmapping learning media produced cannot be accessed via *smartphone* without using the internet, for further research it is expected to create *web- based mind mapping learning media* that can be opened directly via *smartphone.* 2) conduct research and development of mindmapping learning media with different approaches and materials. 3) this study has obtained a very good perception of media readability from students. So this research should be continued or tested in the learning process in the classroom.

D. Conclusion

Based on the development results that have been explained above, it can be concluded that the results of the feasibility test of web- based mindmapping learning media to improve conceptual understanding of magnetic field material against the average results of the four assessment aspects can be concluded that "Very Eligible" is used for testing because it has met the content aspects, presentation aspects, language aspects, and conceptual understanding aspects with an average score of 86%. The results of student perceptions of web- based mind mapping learning media to improve conceptual understanding of magnetic material against the average results of media readability covering material and learning aspects are in the "Very Good" criteria with an average score of 87%.

E. Acknowledgments

The researcher would like to thank the main supervisor (Dr. Eko Risdianto, S.Si, M.Cs.) and accompanying supervisor (Andik Purwanto, S.Pd, M.Sc.) who have helped researchers systematically compile thoughts related to the development of this learning media. In addition, researchers would like to thank the expert validators (Dr. Iwan Setiawan, S.Sc., M.Sc., Bodi Gunawan, M.Sc. and Awal Fitri, SP) and class XII MIPA students of SMA Negeri 9 Kota Bengkulu who have helped in the research and development of this mind mapping learning media.

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