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Development of visual thinking strategy in augmented reality (ViTSAR) to facilitate visual literacy skills on magnetic field material

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ABSTRACT

Students poorly understand the magnetic field material concept due to difficulties visualizing it. So, it takes a skill that can support the ability to visualize magnetic field material to practice these skills requires the right strategy and learning media. Therefore, this study aims to develop and determine the feasibility and response of students to the acceptance of *Visual Thinking Strategy in Augmented Reality* (ViTSAR) learning media technology to facilitate *visual literacy skills* on magnetic field material. The research method used is *Research and Development* (R& D) with a 4-D development model (*Define, Design, Develop, and Disseminate*). Through due diligence conducted by material experts, the average value of all aspects was 6.7 with feasible criteria, and media experts obtained an average value of 6.81 with feasible criteria. In contrast, the trial was limited to 15 3rd-semester students of Physics Education at Sultan Ageng Tirtayasa University, who responded well to technology acceptance with an overall average assessment result of 6.36. These results show that ViTSAR learning media on magnetic field material can be used as a learning supplement in introductory Physics II lectures on magnetic field material.

Keywords: learning media, magnetic field, visual literacy skills. vitsar mamema.

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INTRODUCTION

Introductory Physics II is one of the compulsory courses in the Physics Education Study Program of Sultan Ageng Tirtayasa University. In physics courses, students must know the correct concepts and not experience misconceptions (Handhika et al., 2014). One course prone to misconceptions is magnetic field material (Setyaningsih et al., 2018). The results of the interview of 3rd-semester students of Physics Education at Universitas Sultan Ageng Tirtayasa show that there is still a lack of understanding of the concept of magnetic field matter, especially difficulties in determining the direction of the magnetic field. The learning media used are power points, Google Meet, and learning videos that make students still find it difficult to imagine or visualize the direction of the magnetic field and the decrease in the formula used.

This is reinforced based on research conducted by several researchers, including a study by Pateda et al. (2015). Regarding understanding the concept of magnetic field material, physics students are still relatively low, such as determining the direction of magnetic force, magnetic field, and electric current using the right-hand rule. Next is done by Scaife & Heckler (2010), many students experience misconceptions about the representation of field lines, especially regarding the concept of magnetic field direction and its application. Research by Afriyanto (2015) said that there are still difficulties in understanding the concepts of physics related to magnetic fields because you have to imagine invisible magnetic fields. Based on the above problems, it takes a skill that supports the ability to help visualize the concept of magnetic field matter. One of the skills that supports this ability is *visual literacy skills.*

Visual literacy is understanding and using images, including thinking, learning, and interpreting a photo (Lohr, 2008). A person with visual literacy skills in his development can distinguish and interpret visual actions, objects, and symbols made naturally or artificially that they encounter in the environment (Avgerinou, 2009).

Therefore, it is hoped that it can facilitate the *visual literacy skills* of Physics Education students. The results of a previous study entitled "Facing Visual Generation; Visual Literacy to Stimulate Thinking Skills in the Learning Process" (Nurannisa, 2017) said that good visual literacy competence can shape a person to be able to express ideas that summarize their thoughts and inform them back to others.

The right learning strategy is needed to facilitate visual literacy skills (Nurannisa, 2017). *Visual thinking (VTS) is a learning strategy that encourages* active thinking and analytical processes to understand, interpret, and produce visual messages (Sutama et al., 2020). The solution to support *visual thinking strategy* is to develop practical, appropriate learning media and use relevant technology. One technology that can be utilized is *augmented reality* (Nainggolan, 2019).

Augmented reality principally creates real-looking three-dimensional images (Kholiq, 2020). *Augmented reality* is a technology that can combine 2-dimensional or 3-dimensional virtual objects into an actual state and then project it in real-*time* (Mustaqim, 2016). 2D or 3D images are visualizations commonly used in teaching and learning (Mahendra, 2016). *Augmented reality* can help visualize abstract concepts for understanding and structuring an object model (Mustaqim, 2016).

Previous research conducted by Mustaqim & Kurniawan (2017) titled "Development of Augmented Reality-Based Learning Media" concluded that *augmented reality* can make learning media fun, interactive, and easy to use. *Augmented reality* can also replace learning modules in virtual or virtual form.

Based on the facts, problems, and previous research, the author got the inspiration to conduct research entitled "Development of Visual *Thinking Strategy in Augmented Reality* (ViTSAR) to Facilitate *Visual Literacy Skills* in Magnetic Field Material," which is expected to be an exciting learning medium and can facilitate students' visual literacy skills. This study aims to develop and determine the feasibility and response of students to the acceptance of *Visual Thinking Strategy in Augmented Reality* (ViTSAR) learning media technology to facilitate *visual literacy skills* on magnetic field material.

RESEARCH METHODS

Research methods used in this study are Research and Development (R&D) or research and development, which is a research method used to produce specific products and test the effectiveness of these products (Sugiyono, 2010). The research model used in this study is a development model developed by (Thiagarajan et al., 1974), namely 4-D, which consists of 4 stages: *Define*, *Design*, *Develop*, and *Disseminate*. The limited test subjects in this study were 15 3rd semester students of the Department of Physics Education, Sultan Ageng Tirtayasa University. The validators of this study consist of experts and experts. The following are data analysis techniques used to develop ViTSAR learning media. The scoring rules obtained from the due diligence of expert assessment can be seen in the following table 1.

Table 1. Rules for Giving Feasibility Test Scores

Scale	Score
Very Agree	7
Agree	6
A Little Agree	5
Neutral	4
A Little Disagree	3
Disagree	2
Very Disagree	1

(Munshi, 2014)

The formula used to calculate the score of the feasibility test results by experts using average processing techniques. The values obtained are then interpreted according to the criteria that can be seen in Table 2.

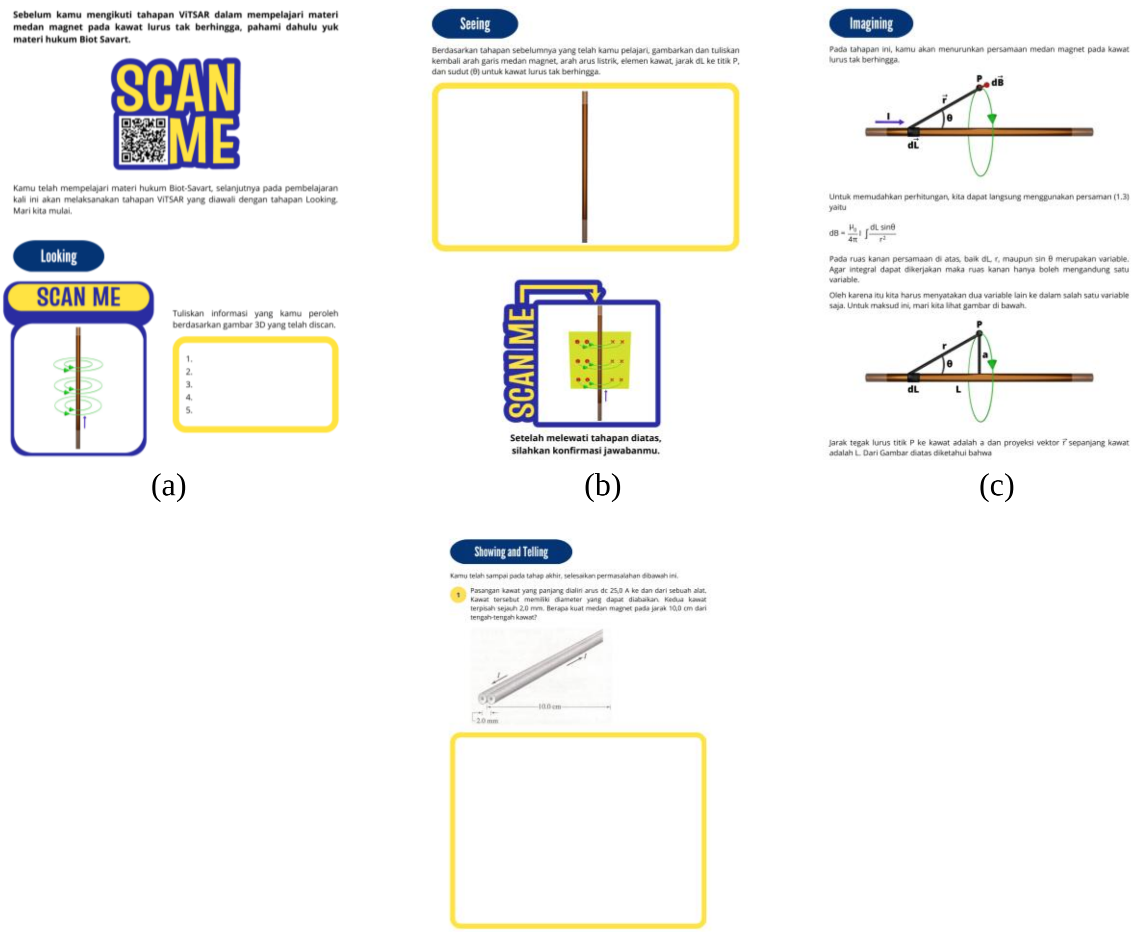
Table 2. Interpretation of Feasibility Test Criteria

Score	Criteria
≥ 4	Proper
< 4	Not Worth It

RESULTS AND DISCUSSION

The media generated from this research is from LKM, e-modules, and applications called "ViTSAR (*Visual Thinking Strategy in Augmented Reality)."* This media was developed to facilitate *visual literacy skills* in students through magnetic field material.

This learning media uses the ViTSAR *(Visual Thinking Strategy in Augmented Reality)* stage, which consists of four learning stages: *looking*, *seeing*, *imagining*, *showing*, *and telling.* Here's a picture of the ViTSAR learning media display.



(a) (b) (c)

(d)

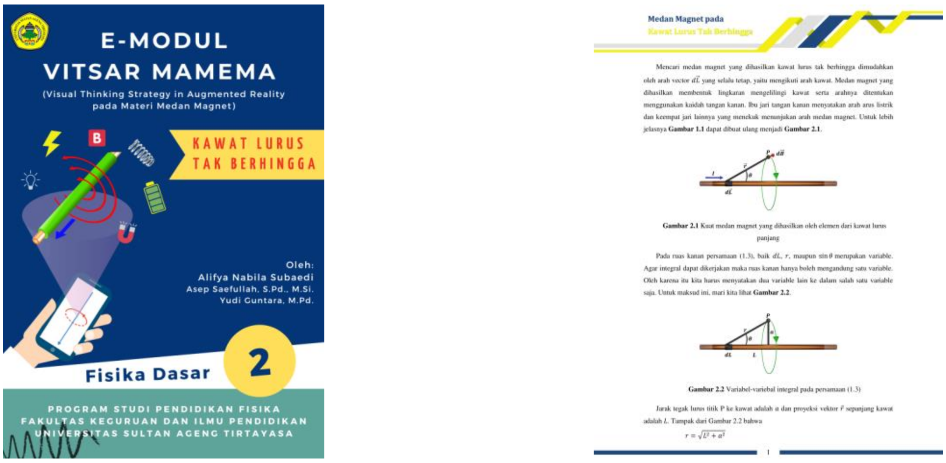
Figure 1. Display LKM ViTSAR (a) Looking; (b) Seeing; (c) Imagining; (d) Showing and Telling

LKM uses the ViTSAR stage, which consists of four learning stages: *looking*, *seeing*, *imagining*, *showing*, *and telling*. At the looking stage, students see and collect information by scanning markers using the ViTSAR application; after the marker is successfully scanned, a three-dimensional animation will appear, a three-dimensional animation will appear because it has previously been connected to a marker so that a three-dimensional animation will appear when the marker is scanned, after seeing a three-dimensional animation students write down what information is seen in the column provided as initial knowledge. This stage can facilitate visual thinking indicators in visual *literacy skills* where students identify information seen to help communicate it.

The second stage is *seeing* students understand and analyze the problem by describing and rewriting what was seen in the previous stage, then scanning markers using the ViTSAR application to display three-dimensional animations to find the correct results. This stage can facilitate visual association indicators in *visual literacy skills*, where students connect images that display the theme's unity, connecting information obtained from the three-dimensional animation given in the previous stage.

In the *stages of imagining*, students lower the equation, then scan the barcode using a *barcode* scan application or use a smartphone's built-in camera that can detect QR code scans to check answers and deepen the material that will be transferred to the e-module. This stage can facilitate indicators of meaning construction in visual *literacy skills* where students construct the meaning of the visual message, in this case, compiling a derivation of formulas.

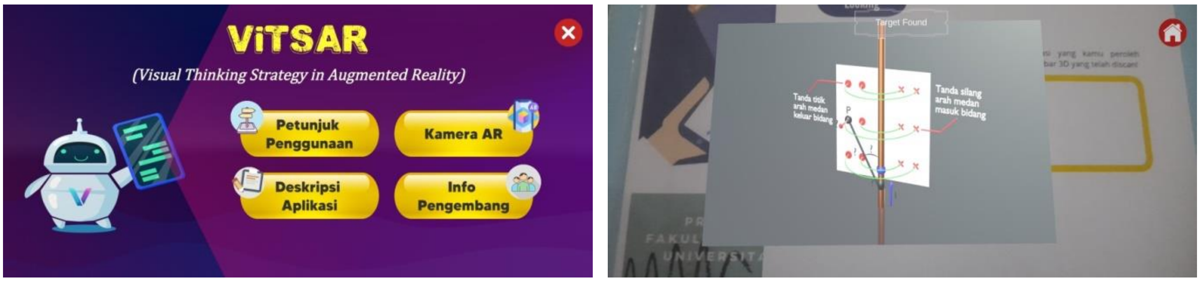
The last stage is *showing and telling* students to do practice questions that aim to assess the extent of students' understanding of magnetic field material after learning to use ViTSAR learning media. This stage can facilitate visual reconstruction indicators in visual *literacy skills*, where students can reconstruct visual messages in their original form to help solve problems and conclude correctly.



(a) (b)

Figure 2. E-modul (a) cover; (b) E-modul page

ViTSAR media is validated by material and media experts through validation sheets that refer to aspects of assessment.



(a) (b)

Figure 3. (a) ViTSAR menu; (b) Scan AR

Theresults of expert validation can be seen from some of Figure 4.

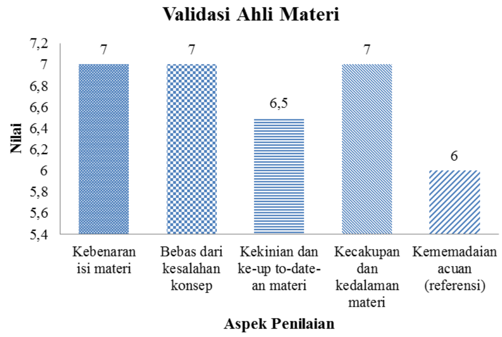


Figure 4. Material expert validation results

The validation results by material experts on ViTSAR media in all aspects of assessment obtained an average score of 6.7 with the criteria "**Eligible"**.

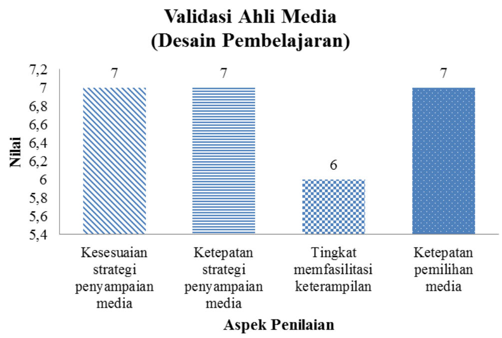


Figure 5. Results of media expert validation in the learning design feasibility category

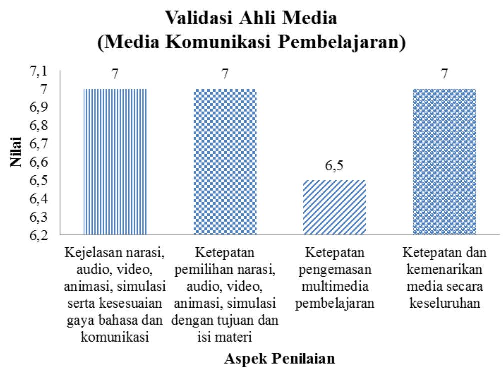
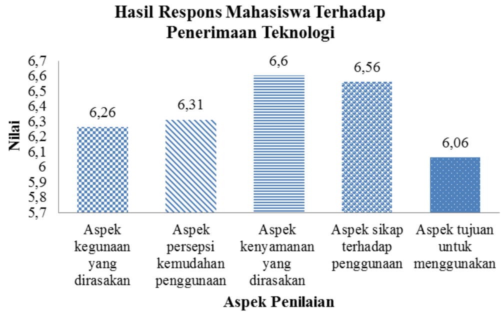


Figure 6. Results of media expert validation in the learning communication media feasibility category

The validation results of media experts from the two categories have a total media service value of 6.81 with the criteria "**Eligible."** The results of expert validation tests on all aspects of the assessment show that ViTSAR learning media on magnetic field material is very feasible to be used in learning, so it can be concluded that ViTSAR learning media is viable and appropriate to implement. The results of this study are in line with research that has been carried out by Purwandari et al. (2021), Where learning media equipped with *augmented reality* is valid to be implemented in physics teaching in the classroom.

Based on the material expert validation results on material coverage and depth, there is a question on number 9, namely "material compatibility with visual literacy skills," obtaining a score of 7 (strongly agree). The results of media expert validation on the possibility of facilitating skills, there is a question on number 3, namely "Can facilitate *visual literacy skills*," obtaining a score of 6 (agree). This shows that ViTSAR media on magnetic field material can facilitate *visual literacy skills*. This is supported by the results of the study by Marques et al. (2013) That the use of *augmented reality* can facilitate *visual literacy*, and is reinforced by the results of research by Marwanti et al. (2019) that visual literacy can support the physics learning process.

ViTSAR learning media on magnetic field material is attractive, creates a pleasant learning atmosphere, and can increase learning motivation. This is in line with the opinions of Mustaqim & Kurniawan (2017), which reveal that fun learning activities are strongly influenced by various factors, one of which is the selection of learning media used must be exciting but not reduce the essence of the material delivered, besides that the development of learning media that is currently still new is learning media using *augmented reality*, and is strengthened by research results Hartono (2022) Through the use of *augmented reality* that is carried out when learning takes place, it turns out that many people are liked. Users feel happy, motivated, and satisfied with learning activities. ViTSAR learning media can also help students visualize the concept of physical material, especially magnetic field material, and this is supported by research results Nistrina (2021) *Augmented reality* learning media can help visualize abstract learning concepts.



Gambar 14 Results of Student Responses to Technology Acceptance

The results of student responses to the acceptance of ViTSAR learning media technology on magnetic field material obtained an overall average score of 6.36 with the criteria of "**Good.**"

Based on these results, it can be said that the ViTSAR learning media on the developed magnetic field material is exciting and easy to understand. This is supported by the research results by Rizti Yovan & Kholiq (2022). A*ugmented reality-based* media creates interesting learning and increases mastery of physics concepts in magnetic field materials.

In addition, based on the results of questionnaires that were given to students, some students said "The use of ViTSAR learning media is interesting, the design is good, does not make you easily bored and makes it easier to understand the material because of the three-dimensional animation" This shows that ViTSAR learning media on magnetic field material get good response results, in line with opinion Mustaqim (2016) The use of learning media with augmented reality is very useful, this is because *augmented reality* has characteristics and functions that are almost the same as teaching media, which functions to convey information between recipients and senders, can clarify the delivery of the information supplied and can provide motivation and interest in learning.

Research conducted by Kanti et al. (2022) reveals that innovation in learning is needed. Innovating activities require strategies and skills that can be used in education. One of the innovations that can be developed is the development of *augmented reality-based* learning media. This is in line with this research because the use of ViTSAR learning media on magnetic field material is the latest in the learning process, especially in the introductory Physics II course, which previously only used PowerPoint points. Google Meet and learning videos became more attractive because they used ViTSAR stages that can facilitate *visual literacy skills*.

CONCLUSION

Research on developing a *Visual Thinking Strategy in Augmented Reality* (ViTSAR) learning media to facilitate *visual literacy skills* on magnetic field material has been successfully created and tested for feasibility. Based on the results of assessments by material experts, media experts, and limited trials, students' responses to technology acceptance obtained scores of 6.7, 6.81, and 6.36, respectively. Based on this, it can be concluded that the ViTSAR learning media developed can be said to be feasible and good for use in learning fundamental physics II on magnetic field material. Four stages are used in the resulting media: *looking, seeing, imagining, showing, and telling*.

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