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Nomographic Technique Development on Global Warming Material for High School Student Grade Eleven of Literacy Class

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Abstract

This research aims to describe the media's feasibility in terms of the validity, practicality, and effectiveness of infographic media as student learning media. This type of research develops ADDIE (Analyze, Design, Development, Implementation, Evaluation) model with data collection techniques in the form of media validation sheets given to media expert lecturers and material experts, as validators, and distributing questionnaires online to 100 Unesa physics students as respondents. Validation measurements from expert lecturers and the ability to understand and practice and the media's effectiveness from respondents used a Likert switch. The validation results from the expert lecturers based on the learning aspects, the material aspects, and the media aspects and physics students' responses based on the ability of understanding and practice and effectiveness. The result of the average value shows that the respondents agreed to the media being developed. Based on the results of student responses, the validity test was obtained with a value of r count> r table, so that the media designed was declared valid, and based on the reliability test with a Cronbach's alpha value greater than 0.6, the questionnaire was declared reliable or consistent. It can conclude that the infographic media that develops nomography techniques are conceptually feasible and can be used in the learning of students' scientific literacy.

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INTRODUCTION

The development of science and technology in globalization is so rapid that it urges people to have the necessary skills to survive. As a competitive generation, science and technology are needed, primarily scientific literacy (Murti, Aminah, & Harjana, 2018). In Indonesia, the term literacy only started when the Minister of Education and Culture, Anies Baswedan, issued Permendikbud Number 23 of 2015 concerning character development that supports the literacy movement.

Literacy is necessary knowledge and competence that a person must possess in society's needs and the times. Scientific literacy is essential to develop because individuals who have these skills can utilize science, identify questions, and draw conclusions based on evidence. Each individual must have scientific literacy, including science, scientific processing, and scientific action. It can conclude that science skills are multidimensional skills that students must have to identify problems related to natural phenomena and their impact on everyday human activities (Murti, Aminah, & Harjana, 2018).

Based on the results of the Program for International Student Assessment (PISA) 2018, it is stated that 70% of Indonesian students are unable to reach level 2 in the PISA framework which wants students to be able to determine the main ideas in the text, look for relationships of various information in the text, and determine simple conclusions from the reading text. Indonesia's score for mathematics and science is 387 from the 2018 PISA score of 489 so that Indonesia is ranked 74th out of 79 countries (OECD, 2019). These results indicate that students' average scientific literacy ability in Indonesia is still low, even though scientific literacy is critical to be taught to students because it is learning with benchmarks to increase students' knowledge and skills to solve problems in everyday life related to science.

Physics is a science that studies objects in nature, events in nature, and physical interactions between objects in nature, so physics is based on experimental observation and quantitative measurements (Trisianawati, Djudin, & Setiawan, 2016). The scope of physics includes matter, energy, and natural phenomena or macroscopic and microscopic events about changes in weight or strength (Tobing & Admoko, 2017). In physics learning, students must understand the material according to the concepts in the applicable curriculum. It requires teacher creativity in designing learning and design strategies to improve creativity, work, and critical thinking skills to encourage student enthusiasm. Learning strategies are teaching activities that are needed by teachers and students to achieve practical learning goals (Apriyanti, Razak, Rahim, Shaharom, & Baharuldin, 2020).

According to Apriyanti, et al. (2020) the facts that occur in the field related to the physics learning process have become a habit that is carried out by conventional methods with teachers as the only learning source so that physics learning in high school has not achieved good results, so it needs improvement, especially in science learning. , physics. Presentation of data in graphical form is often found in this learning, according to Pelita et al. (2011) high school students often experience problems in understanding graphs. It needs to be given learning media to understand graphics and concepts and their relationships and interpret them.

Nomography is a graphical representation of mathematical relationships (Glasser & Doerfler, 2018). The visual presentation is a method used to show and represent values, increases, decreases, comparisons, make predictions, or show reports about how a specific situation was yesterday and the current situation (Fomunyam, 2020). The graph is a data presentation from the table displayed in the form of an image in the form of a combination of numbers, letters, symbols and symbols to provide an overview of the data presented to provide information (Glasser & Doerfler, 2018). According to Gebre (2018), the learning process using representations such as graphics and modelling helps students develop scientific argumentation and writing skills, build relationships between concepts, determine representational adequacy and increase symbolic power.

The use of technology in education can make the learning process more exciting and comfortable for students to understand. The visual characteristics of some technologies can help students understand concepts and principles with ease and meaning. So it is necessary to use learning media that is attractive and can be used to increase student motivation. Visual compensation makes it possible to efficiently display and present information (Apriyanti, Razak, Shaharom, Rahim, & Halili, 2020).

Infographics are visual representations of information, data, or knowledge to present information quickly and clearly to improve cognition

by utilizing graphics to enhance the human optical system's capabilities. Infographics consist of images combined with an experience designed in such a way as to communicate information to readers efficiently. Most infographics focus on current events, which is why they are an exciting way to condense material into a more transparent and more accessible form. Presentation of complex data is fun and straightforward, enabling students to formulate understanding more quickly (Sudakov, Bellsky, Usenyuk, & Polyakova, 2016). It can be applied in the classroom learning process by developing nomography techniques on infographic media.

According to Susetyo (2015) (quoted from Tobing & Admoko, 2017), learning with infographic media will make it easier for students to understand the material and affect students' memory and reasoning power. Based on the results of research conducted by Apriyanti, et al. (2020) stated that technology-assisted infographic media, smartphones, are very much needed in the teaching and learning process, especially in kinematics material. The use of infographic media has been developed by Tobing & Admoko (2017) in learning in high school on global warming material. Based on this research conducted at SMAN 19 Surabaya, it was stated that students still have difficulty understanding the Global Warming material that is delivered either verbally or verbally so that it affects their learning outcomes.

Global warming is one of the impacts of human activity in using fossil fuels excessively as an energy source which causes an increase in the concentration of greenhouse gases (CO2, CH4, N2O, CFC) in the atmosphere, thus causing an increase in the average temperature of the earth's surface (Ghussain, 2018). Based on a report from the IPCC (2018) it is stated that human activities are estimated to have caused about 1.0 ° C of global warming above pre-industrial levels, with a possibility of around 0.8 ° -1.2 ° C. Global warming is likely to reach 1.5 ° C between 2030 and 2052 if it continues to increase at current rates. So, global warming material is considered essential to provide knowledge to students about the phenomenon of global warming, its causes, impacts, and how to overcome it (Ulfah, 2016). Symptoms of global warming and its impact on life and the environment are problems that have become global demands and must be resolved, therefore currently in the 2013 curriculum revision of physics subject for class XI SMA / MA contains basic competencies, one of which is Basic Competence (KD) 3.12 namely analyzing the symptoms of global warming and its impact on life and the environment.

Infographic media is an innovative learning medium that develops nomography techniques, especially on global warming material. Developing this media in the learning process can improve students' literacy skills. Therefore, the researcher wanted to research the title "Development of Nomographic Technique in Global Warming Material on Literacy Skills of Class XI High School Students". The study aims to describe the media's feasibility in terms of the validity, practicality, and effectiveness of the infographic media as a learning medium for students on global warming material.

METODS

Research on the development of nomographic techniques on infographic media on global warming material uses the ADDIE model development (Attachment : Figure 7). ADDIE is a learning model development with five stages, including analysis, design, development, implementation, and evaluation.

This study used a descriptive analysis method by distributing survey questionnaires online (Attachment : Figure 8) to assess the level of practicality and effectiveness of the media from the respondents, namely physics students at the State University of Surabaya. The research procedure is described in Figure 1.

The analysis stage is carried out by analyzing core competencies and necessary competencies through literature studies by examining the gap between expectations and facts. The design stage is carried out by formulating competencies required by KD 3.12 in the 2013 curriculum revision and designing infographic media designs by developing nomographic techniques by the formulated material. The development stage is carried out by combining nomography on infographic media so that problems conveyed through graphics will be more practical and useful and easy to understand after being presented in infographic media because the material formulated will be obtained entirely in one learning media. At this stage there is a media validation sheet that will be validated by expert lecturers, namely media experts and material experts, this is to determine the validity of infographic media that develops nomography techniques as learning media. This research stage only reaches the development stage, namely the validation

stage, because it has not yet reached the field trials that cannot do with current conditions.

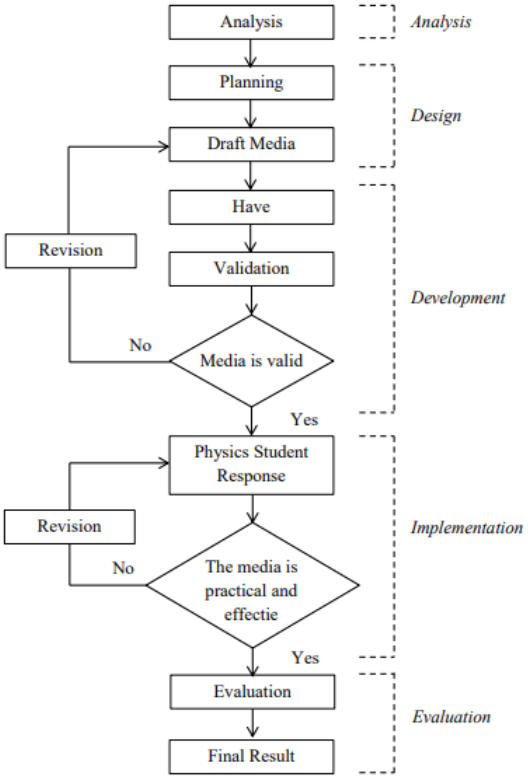

Figure 1. Research Prosedure
(Modificated from Branch, 2013)

Nomographies are graphical representations to show reports on particular situations. In this study, the nomography technique was developed on infographic media by conveying information about the earth's surface temperature anomalies as a topic of global warming material problems. Infographic media that have been validated by expert lecturers are distributed through online questionnaires to Universitas Negeri Surabaya physics students to find out their ability to understand the material and the practicality and effectiveness of the media when applied to the learning process.

Validity is the validator's score to infographic media in terms of learning aspects, material aspects and media aspects. Measurement of the media's practicality and effectiveness is based on the responses of the Surabaya State University physics students in terms of the elements of the ability to understand the material and aspects of the infographic media's practicality and effectiveness.

The use of media is declared conceptually feasible if the percentage of the validator and respondent's eligibility is ≥61%. This study uses descriptive analysis techniques so that the data is analyzed by describing the score for each aspect given by the validator and the respondent so that the feasibility of the media is obtained from all the scores of the validators and respondents.

RESULT AND DISCUSSION

The feasibility of infographic media by developing nomographic techniques was obtained from the validation results of 2 physics lecturers and supported by 100 respondents from Surabaya State University physics students through distributing questionnaires on the ability to understand global warming material and the practicality and effectiveness of online infographic media.

Based on a questionnaire distributed in November 2020, 100 respondents from physics students class 2017 to 2020 stated that 97% of them received global warming material at SMA / SMK / MA, while the rest never received this material. Of the respondents who received global warming material, 74% used books as a medium of learning. In contrast, the rest used videos, posters/infographics / the like, and others, even 4% stated that they did not use media.

Expert validation results on the use of infographic media include validation of learning aspects, material aspects, and media aspects. The results of expert validation on infographic media in terms of learning aspects are shown in Figure 2 below.

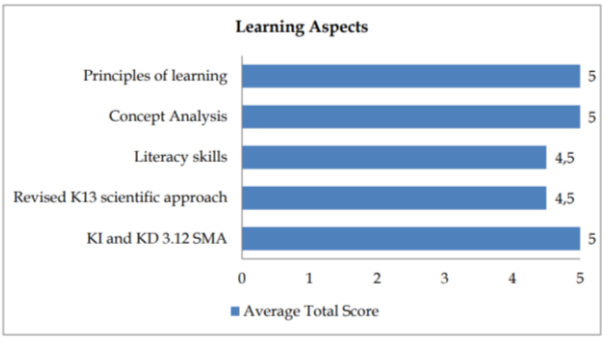

Figure 2. Validity of learning aspects

Figure 2 shows that all learning aspects received good ratings from experts with an average score of 4.8 from the highest score 5. These results indicate that the infographic media that developed the nomography technique in terms of the conceptual aspects of learning is suitable for physics learning.

The results of expert validation on infographic media in terms of material aspects are shown in Figure 3 below.

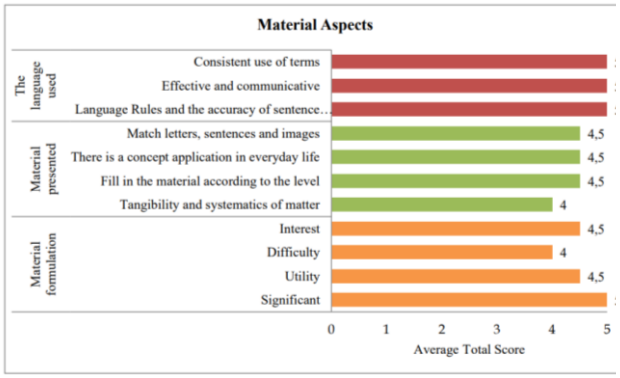

Figure 3. Validity of material aspects

Figure 3 shows that all material aspects received good ratings from experts with an average score of 4.5 from the highest score of 5. These results indicate that the infographic media that developed the nomography technique in terms of the material aspects is conceptually suitable for physics learning.

The results of expert validation on infographic media in terms of media aspects are shown in Figure 4 below.

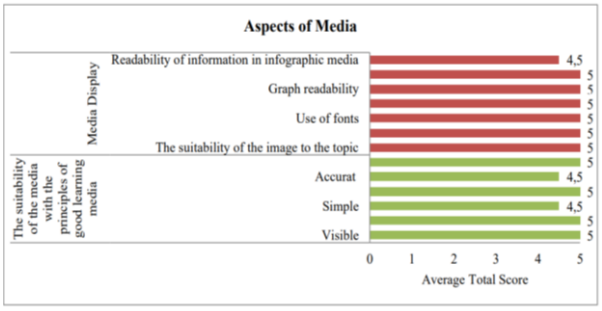

Figure 4. Validity of aspects of media

Figure 4 shows that all media aspects received good ratings from experts with an average score of 4.8 from the highest score 5. These results indicate that the infographic media that developed the nomography technique in terms of the media aspect is conceptually suitable for physics learning.

The distribution of online questionnaires to 100 respondents regarding the development of infographic media in terms of respondent understanding and characteristics of media practicality and effectiveness. Respondents' ability to understand global warming material presented using infographic media by developing nomographic techniques, as shown in Figure 5.

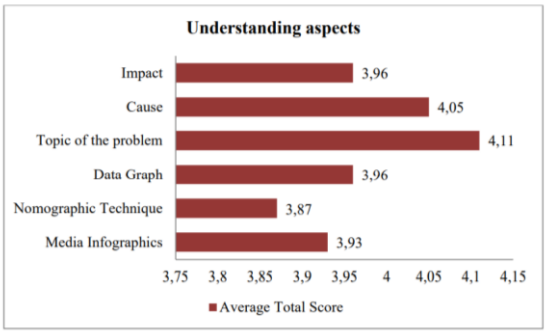

Figure 5. Average total score of respondents understanding ability

Figure 5 shows the respondent's ability to understand the global warming material presented with an average total value of 3.98 from the highest score of 5. This indicates that the respondent can understand the material presented through the developed media. The validity test of the respondent's understanding aspect is obtained from the correlation calculation, where the value of r count is greater than the value of r table at 1% significance, with an average value of r count> 0.8 so that the media developed is declared valid. Whereas in the reliability test, Cronbach's alpha value was 0.899, because it was greater than 0.6, the questionnaire was displayed reliable or consistent.

The effectiveness and practicality of infographic media by developing nomography techniques based on respondents' assessments as shown in Figure 6.

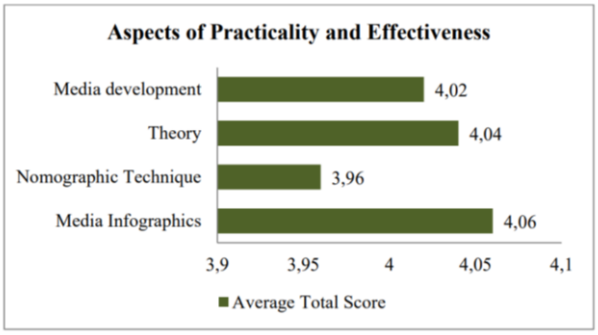

Figure 6. Average total score of Practically and effectively media

Figure 6 shows the practicality and effectiveness of infographic media by developing nomography techniques with a total average value of 4.02 from the highest score of 5. This indicates that the media developed is practical and useful for use in learning. The validity test of the respondent's understanding aspect is obtained from the correlation calculation,

where the calculated r-value is greater than the r table value at 1% significance, with an average value of r count> 0.7 so that the media developed is declared valid. Whereas in the reliability test, Cronbach's alpha value was 0.905, because it was greater than 0.6, the questionnaire was displayed reliable or consistent.

Based on the total average value, the respondents agreed on using infographic media that developed nomography techniques as learning media. This is in line with the research results by Apriyanti et al. (2020) which states that infographic media are needed in the teaching and learning process, especially in physics subjects. In another study conducted by Ozdamli and Ozdal (2018), it is stated that both teachers and students have positive opinions about the use of infographics in schools. The research results show that the infographic media developed are valid, easy to understand, and practical and useful to be applied in the learning process. This is in line with research conducted by Agustini et al. (2019), which states that the resulting infographic media is valid, practical, and effective for use in increasing concept mastery.

The impact of infographic media on scientific literacy skills is that students can analyze the information obtained from the developed infographic media on observing indicators. In the hands of asking questions, students can answer questions based on the results of information analysis. In the indicators of formulating hypotheses, students predict the symptoms and impacts of the information obtained in everyday life problems. In the hands explaining the concept, students can interpret and analyze the results of the observations obtained. This is based on Bicen and Baheshti (2017) research, which states that students must know to understand the material through infographic media and present learning information with infographic media.

CONCLUSION

The conclusions obtained from the research are (1) Based on the results of the validity of expert lecturers, infographic media that develop nomography techniques can be used in learning, (2) Based on the responses of physics students, infographic media that develop practical and effective nomography techniques are used so that (3) Infographic media that develop nomography techniques are conceptually feasible and can be used to learn students' scientific literacy skills.

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ATTACHMENT

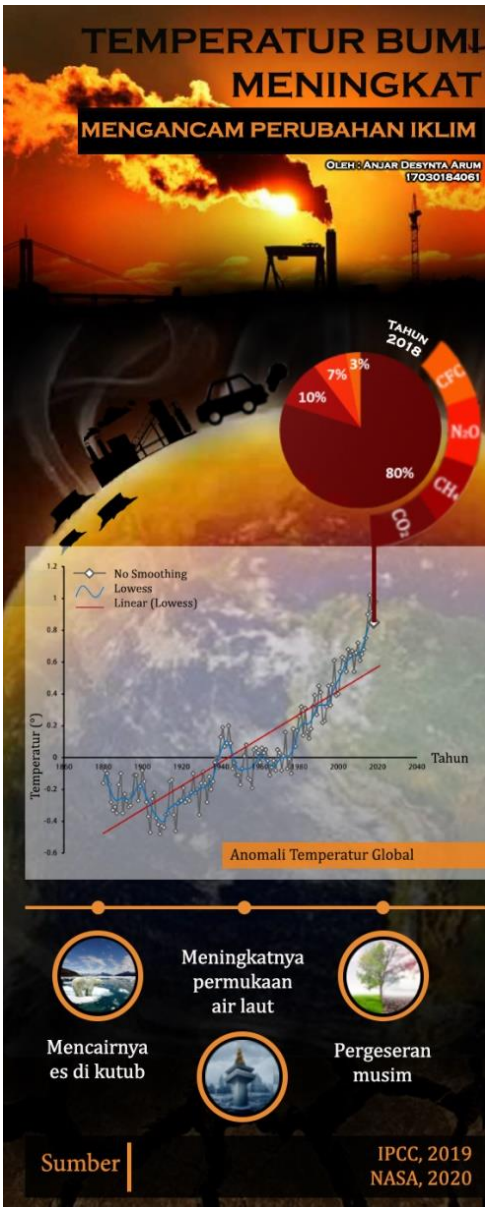

Figure 7. Media Infographics by developing Nomography Technique

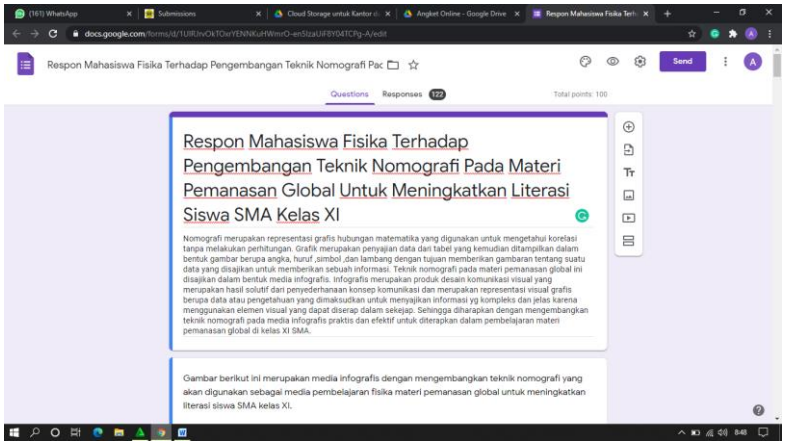

Figure 8. Research questionnaire distributed online to Unesa physics students