Research Article

Development of ICARE-based Geography E-Module Integrated with STEM Using a Spatial Approach to Improve Students' Spatial Thinking Ability

Naurah Najifatuz Zuhria[1], Purwanto[2], Ferryati Masitoh[2], Djoko Soelistijo[2], Ella Pertiwi[3]

[1,2]Geography, State University of Malang, Indonesia
[3]MAN Kota Batu, Indonesia

Abstract.
The research objectives in this article are (1) to develop an ICARE-based Geography E-Module integrated with STEM using a spatial approach, and (2) to conduct trials and apply the results of product development to determine the improvement of students' spatial thinking skills. The type of research used is RnD with a mixed analysis method. The development model used in this research is ADDIE. The research design used is one group pretest posttest design through paired sample T-test. The value of paired sample T-test is used to determine the effectiveness of using the product. Data collection instruments were used in interviews and questionnaires. The results of this study indicate that (1) The ICARE-based Geography E-Module product integrated with STEM using a spatial approach is included in the very feasible category with a percentage of 92%. (2) The use of E-Module products can improve students' spatial thinking skills.

Keywords: E-Module, ICARE, STEM, Spatial, Geography

Corresponding Author: Naurah Najifatuz Zuhria; email: naurah.najifatuz.1807216@students.um.ac.id

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1. INTRODUCTION

The use of digital teaching materials becomes very important along with the demands for mastery of technology in the 21st century in the field of education. One of the uses of digital teaching materials is the use of digital modules. The existence of digital modules and the use of adaptive learning systems can also improve student learning [1]. Anwar in [2] defines digital modules as teaching materials that are arranged in a structured manner, including content materials, methods, and evaluations for independent use to achieve competency targets. This digital module is free of access, does not use space and time restrictions, and only requires internet access [3], hence, digital modules allow adaptive learning, assessment, and feedback [4]. Learning using digital modules is innovative because it can display teaching materials that are complete, interesting, interactive, and function to make the user have decent knowledge [5].

Nowadays, the skills needed in learning geography are critical thinking and problem-solving skills [6] these are related to spatial thinking that can help in solving spatial problems. Spatial thinking skills are identified as important in geography education because spatial studies make geography different from other disciplines [7]. According to the National Research Council 2006 in [8] spatial thinking skills are defined as a collection of cognitive skills including knowing the concept of space, using representational tools, and reasoning processes. Several studies suggest that spatial tasks can improve students' overall intelligence. Improvements in spatial thinking can be achieved through clear instruction [9]. Cognitive processes related to spatial thinking require broad mental abilities, so that spatial thinking skills can be useful for managing spatial problems in everyday life independently and promoting effective and efficient solutions [10].

Various kinds of strategies and models to train 21^{st} century skills have often been carried out, considering the efforts needed by individuals to face global competition [11]. The ICARE model is one of the learning models that has structured steps so that it can increase and encourage student activity [12]. The ICARE-based module is a teaching material that integrates active learning, directs students to be more independent, process-oriented, and reflective, and strives to provide students with a learning experience in the classroom [13]. Reinforced by the results of previous research by [14], it is said that ICARE learning is practical and effective to use, while the findings from [15] show that ICARE learning can influence and improve students' critical thinking skills.

The phenomenon of digital integration in everyday life, where humans are aligned with machines to solve problems and find new learning innovations [16]. The development of learning modules is also carried out using STEM (Science, Technology, Engineering, and Mathematical) approach. STEM learning has the intention that education integrates the four disciplines to support improving student learning outcomes, both academic and non-academic [17]. The use of STEM learning can improve students' scientific abilities and innovation in technological products in global competition [18]. Another study was conducted by [19], which shows that learning using an outbound-based STEM approach can be done to create a generation that understands the existence of technology and the creation of new technologies. STEM requires student independence through STEM-based project sheets so that students can carry out their investigative activities to solve problems independently [20]. STEM learning contains methods that train how to think, behave, and solve problems. It can make teachers easier to create learning concepts that can connect knowledge and skills so that they are easily understood by students.

The 21st century has high demands in realizing quality human resources, so that humans in this century are required to have innovation skills and are distinctive [21]. The need for learning and practice in the 21st century to prepare a quality generation is one of the effects of the industrial revolution that changed the relationship and pattern between machines and humans [22]. The current era of education requires students to adapt to technology-based learning. and Students are also required to be able to solve complex problems, and must be active to build their knowledge and be able to apply it. Based on the results of interviews and questionnaires given to students and teachers at MAN Kota Batu, it can be seen that the limitations of teaching materials that integrate innovatively and technology-based learning models make the teacher maintain the provision of conceptual and less in-depth learning.

The selection of this material is based on the needs analysis at MAN Kota Batu, namely on the Rivers and Streams Patterns material, as well as watershed conservation. The need analysis shows that 67.2% of students have difficulty visualizing abstract material. It is also found that students do not have enough activities to apply the knowledge that has been obtained and connect it with real life. They also lack activities of geospatial technology uses. [23] indicate that the use of geospatial technology can improve Spatial Thinking for geographic expertise. Therefore, it is necessary to develop innovative digital modules based on spatial and geospatial technology. This research leads to the development of teaching materials in the form of modules with an innovative learning model, namely an ICARE-Based Geography E-Module Integrated with STEM using a spatial approach that aims to improve students' spatial thinking skills.

2. METHOD

This research is a type of research and development with mixed analysis methods. The development model used in this research is ADDIE (Analyze, Design, Development, Implementation, and Evaluation). The reasons for choosing the ADDIE development model include: (1) The ADDIE model is easy to apply to the curriculum, this is supported by the opinion [24] that ADDIE is an easy model to apply in a curriculum that teaches science, skills, and attitudes. (2) The model used is suitable for the development of teaching materials because it has complete, systematic and simple stages, and it is also in line with the perspective [25] that the ADDIE model is simple and it has systematic application. While the perspective of [26] stated that the ADDIE model is considered more rational and complete, so this model can be used for various forms of product development including models, learning methods, learning strategies, media, and teaching materials.

This research was carried out in some stages according to the order of the ADDIE model. At the implementation stage, product development is carried out with a research design of One-Group Pretest-Posttest Design. This design is considered to be more accurate because it can compare scores with conditions before and after being given treatment [27]. The implementation time of the development product is in the even semester of the 2021/2022 academic year It was conducted in May 2022. The product is tested on X IPS 1 students at MAN Kota Batu. The subjects were selected by random sampling method based on the location and criteria of the school.

This research and development consist of two types of data, namely quantitative and qualitative data. Quantitative data in the form of numerical data obtained from the results of product trials, namely pretest and post-test scores, as well as filling out product feasibility questionnaires by a material expert, media expert, and language expert, teachers, and test subjects. Qualitative data were obtained from interviews, comments, and suggestions from the material expert, media expert, language expert, teachers, and also test subjects that will be used as the basis for product improvement. The data that has been obtained from several instruments are then analyzed to determine the feasibility and effectiveness of the product.

In this research and development, quantitative and qualitative data analysis techniques are used as follows.

a. Qualitative Data Analysis Techniques

Qualitative data in the form of interviews before the study is then used as a basis for needs analysis. In addition, qualitative data were also obtained from comments and suggestions from the material expert, media expert, language expert, teachers, and test subjects. The data obtained will be used as the basis for product improvement so that it is feasible and effective.

b. Quantitative Data Analysis Techniques

Quantitative data in the form of data in numbers obtained from the results of validation and trials. The percentage obtained from the validation questionnaire from the material expert, media expert, language expert, teachers, and test subjects was then calculated to determine the level of product validity.

$$P = \frac{\sum R}{N} x\ 100\% \text{..........}(1)$$

Equation 1. The Formula for Calculation of Overall Data Percentage

Equation 1 is the formula used to calculate the percentage of the data obtained. P is the percentage, R is the total number of respondents' scores, and N is the number of ideal scores. The results of the average percentage of the material expert, media expert, language expert, teachers, and test subject's validation questionnaires aim to determine the feasibility of the product. Product feasibility assessment is based on several criteria. The following are the product validity criteria.

Table 1: Product Validity Criteria.

Nu.	Eligibility Level (%)	Qualification	Annotation
1.	85,01-100 %	Excellent	Very Feasible
2.	70,01-85%	Good	Feasible
3.	50,01-70%	Not Good	Not Feasible
4.	01,00-50%	Very Not Good/Unsatisfactor	Very Not Feasible/ Unsatisfactory

(Source: [28])

The next process of analyzing data is related to the results of trials using pretest and posttest scores. The data scores were tested for normality. If they show normal distribution results, then they will be continued with the Paired Sample T-Test to determine the significance of the differences between the classes before and after using an ICARE-Based Geography E-Module Integrated with STEM using a spatial approach. The significance level of the Paired Sample T-Test is 0.05 with a 95% confidence level.

3. FINDING AND DISCUSSION

3.1. Analysis

This analysis phase includes identifying the curriculum, student characteristics, and analyzing existing teaching materials. Researchers identified this by conducting interviews with Geography teachers of MAN Kota Batu and distributing questionnaires to the students. Curriculum analysis is an analysis consisting of an analysis of core competencies and basic competencies by the curriculum applied in schools [29]. From the results of interviews with the geography teachers of MAN Kota Batu, it can be seen that the current curriculum applied is the revised 2013 Curriculum. The implementation of the revised 2013 curriculum requires a learning implementation plan that can build students' knowledge, actively involve students in the learning process, and make them be able to adapt to technology [30]. Based on the questionnaires that have been distributed and as many as 64 students have filled them out, students find it difficult to understand geography material, especially inland waters and watershed conservation, as evidenced by the percentage of 67.2% of students find it difficult. Students seek information about Geography subjects through their devices with a percentage of 57.8% quite often. Students also prefer digital teaching materials as evidenced by the percentage of 68.8% agree and 28.1% strongly agree, digital teaching materials are very necessary for learning, it is supported by the school system that is allowed to bring cellphones and laptops. Students are also able to use technology and information media such as laptops, computers, cellphones well which is proven to get a percentage of 76.6%.

The result of the analysis of teaching materials obtained shows that the use of digital teaching materials for geography sub-materials in inland waters and watershed conservation is still low. It is proven that 70.3% of students do not have digital teaching materials. The result also indicates that the spatial concepts in teaching materials also have not appeared. Then, geography subjects still memorize a lot of concepts and rarely do geospatial technology practicum. Consequently, students find it difficult to understand the material and tend to forget easily. Printed teaching materials only contain pictures, explanations of the material, and practice questions. Students need concept maps, pictures, videos, maps, and links to help students understand abstract material. It is proven by as many as 59.4% of students answered agree and 40.6% of students answered strongly agree.

3.2. Design

This stage includes the steps of making a framework, designing, and making module teaching materials. The product developed is in the form of an electronic module by utilizing technology. The product is packaged in a QR Code-based flipbook, and presented with a structure including Cover, Introduction, Connection, Application, Reflection, Extension, and Bibliography. The use of the ICARE system can ensure students have the opportunity to apply what they have learned [31]. This module refers to [32] which consists of titles, instructions, basic competencies (KD), main materials, supporting information, exercises (student activities), and evaluations. So that, the arrangement in the introductory section of this e-module contains an introduction to KD 3.7 Hydrospheric Dynamics inland waters sub-material, an explanation of learning objectives, and the working steps of using the module for students. Connection contains a series of materials and Geoinfo regarding spatial information related to students' lives and environment, this e-module is equipped with geospatial technology practicum assisted by Google Earth in the form of practicum on making maps of lake distribution and digitizing the boundaries of watersheds (DAS) along with calculating their area. some spatial problems are also presented in the application section. The reflection section contains questions for learning reflection, as well as stating the weaknesses and strengths that students have when understanding the material. Additional exercises to strengthen and expand students' knowledge are in the expansion section. The following is a design of the e-module that was developed.

This e-module uses the STEM approach, this approach is flexible in the use of various learning models. The integration of each discipline from the STEM approach to this development product, namely, a) Science, presentation of inland water and watershed conservation materials through reliable reference sources and equipped with explanatory videos, visualization images, and several spatial case exercises, b) Technology on this e-module product uses Google Earth, ArcGIS, ArcView, 3Dmapper, QR Code, Filmora to visualize abstract spatial object representation tools, especially inland water materials, c) Engineering in the e-module in the form of work steps and video tutorials to create a lake distribution map, digitizing watershed boundaries, and calculating the area as a guide for students in doing practical work independently, d) Mathematical, the presentation of calculation material is found in formulas and examples of questions to calculate water balance, discharge, volume, and flow time in the watershed conservation sub-chapter.

This E-module also integrates a spatial approach. Materials and cases are presented using spatial components consisting of spatial concepts, use of representation tools, and reasoning processes. Students are required to carry out a reasoning process (Input-Process-Output) in every spatial problem that will be studied in the module. The spatial problems contained in the module contain four topics. In the topic I, a spatial case is given in the form of the distribution of lakes based on the Tecto-Vulcan process in Indonesia. Furthermore, topic II discusses the spatial phenomenon in Selorejo Reservoir, Malang Regency. Topic III discusses the flooding that occurred in Bumiaji District, Batu City, while the last topic, namely topic IV, discusses the spatial phenomena in Karangkates Reservoir. Students are targeted to be able to achieve the output of the given project and are expected to be able to reason on the case.

The integration of materials in e-modules using the ICARE model, STEM, and spatial approaches to inland waters and watershed conservation is intended to improve students' spatial thinking skills. This ability aims so that students can solve everyday problems from a spatial point of view so that they can make the best decisions [33]. The improvement of students' spatial thinking skills can be seen by comparing the results of the pretest and posttest, in line with research [34] which uses a pre-experimental design method which is claimed to be more effective because it can determine students' abilities before and after being given treatment.

3.3. Development

This development stage consists of the e-module product development process as well as the revision results after conducting a feasibility test with an expert validator. The development of this product contains sub-material indicators of potential, distribution, and utilization of inland waters, as well as watershed conservation which is packaged with an integrated STEM ICARE model structure with a spatial approach. The material in this sub-indicator consists of rivers, watersheds, lakes, swamps, and watershed conservation. This e-module teaching material is produced using the 2020 version of the Corel Draw application as a layout design for teaching materials. This e-Module is equipped with a practicum of geospatial technology assisted by Google Earth and several questions that aim to improve students' spatial thinking skills. The practicum section and questions about the student reasoning process are shown in Figure 1.

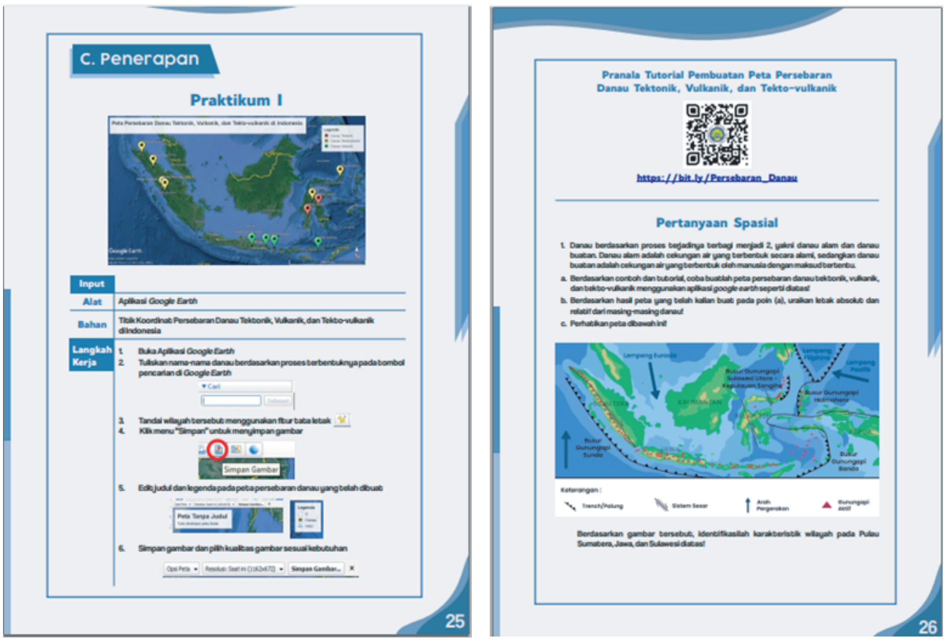

Figure 1: Practicum Section and Questions About the Student Reasoning Process on the E-Modul.

This e-module is in the form of a flipbook in HTML 5 format and is distributed via link (website address). The appearance of this e-module is like a digital book that can be flipped to make it easier for users to read it. Figure 2 shows how the E-Module looks when accessed via link.

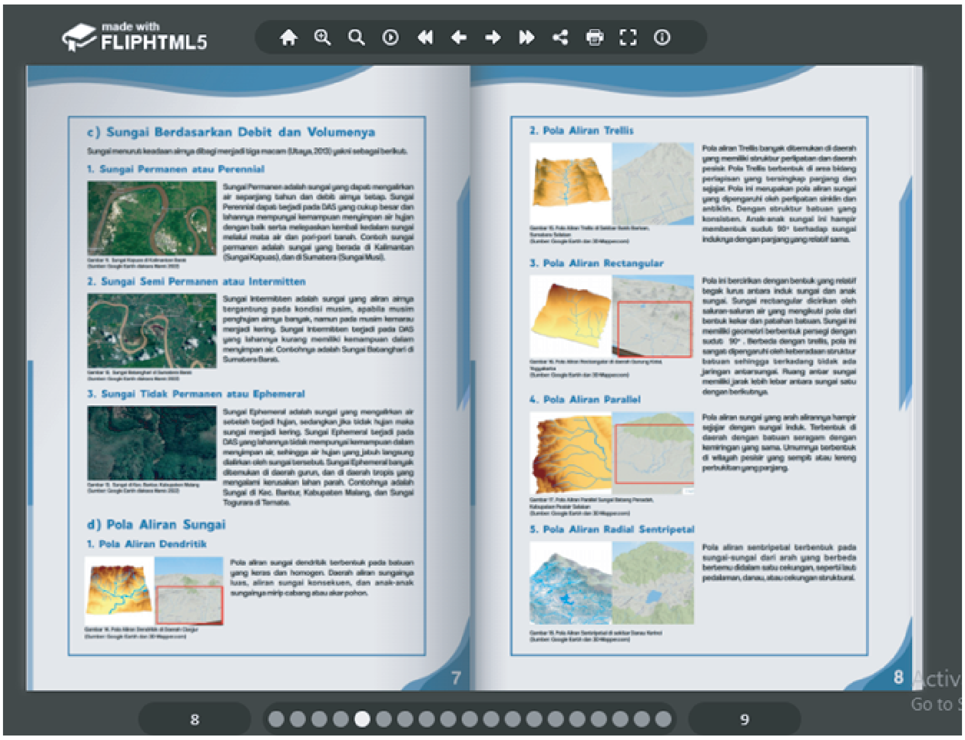

Figure 2: The Appearance of the E-Module When Accesed Via Link.

The next stage is product validation consist of media, material, and language experts. It aims to obtain eligibility from teaching materials that have been developed before trials are carried out to students.

Table 2: The Results of Validation Experts.

Nu.	Validator	Value (%)
1.	Material Experts	95 %
2.	Media Experts	98%
3.	Language Experts	83%

Based on the results of validation experts as a whole, this e-module belongs to the very feasible or valid category with a percentage gain of 92%, so that this e-module product is feasible to be tested in the field with a revision.

3.4. Implementation

At the implementation stage, the product was tested on all students of class X IPS 1 and teachers of MAN Kota Batu. The percentage result of the e-module achievement level from the geography teacher's assessment is 95% with a very valid meaning, while the percentage result from student responses is 90% with a very valid meaning.

Furthermore, to find out about the effectiveness of the product and the improvement in students' spatial thinking skills, several learning activities were carried out at this trial stage, namely, a) in the first meeting, students were given pretest questions and materials regarding inland waters, b) in the second meeting, students practiced practicum in the form of making a map of the distribution of tectonic lakes, volcanic, and tecto-volcanic, as well as digitizing watershed boundaries and calculating their area. Furthermore, students were divided into 4 groups, each group given a different spatial case study, c) in the third meeting students continued with group assignments and presentations, and at the end of the lesson students were given a posttest.

The improvement of students' spatial thinking skills can be seen from the results of students completing various projects on each spatial topic and working in each group. The selected project has been adapted to the spatial thinking component. Students are trained to convey ideas, discuss among friends, complete project assignments, and be able to adapt to technology-based learning. This activity aims to improve spatial thinking skills in solving everyday problems. The results of increasing students' spatial thinking skills can be seen in the results of students' products and their reasoning. The following are the results of the project from each group.

Group I was given a topic about the distribution of lakes based on tecto-volcanic processes in Indonesia. The product of this project is a map of the distribution of volcanic, tectonic, and tecto-volcanic lakes with the help of the Google Earth application. Students are expected to be able to do the reasoning process after making the map. Based on the results of the work, students have achieved complex spatial abilities by using a representation tool in the form of maps, while in the reasoning process students can analyze the spatial relationship between the distribution of tectonic, volcanic, and tectonic-volcanic lakes with tectonic-volcanic activities in Indonesia. This indicates that students have mastered the indicator of spatial association with the cognitive level of C4. The assessment of the use of this spatial representation tool is based on several things, namely, providing placemarks, inserting legends, and laying out maps on Google Earth. Based on these criteria, it can be seen that students' mastery of technology is good because the e-module is also equipped with practical steps and video tutorials to do the task. At the time of reflection, students expressed difficulties in making placemarks and turning them into different symbols, but the results of using the technology obtained turned out to be very good, although not perfect.

Group II was given a topic about spatial phenomena in Selorejo Reservoir, Malang Regency. The product of this project is an image of the stream pattern of the river around the Selorejo Reservoir. Students are expected to be able to reason about the

Figure 3: The Results of the Distribution Map of Volcanic, Tectonic, and Tecto-volcanic Lakes in Indonesia.

phenomena that occur around the area. Based on the results of this work students have achieved complex spatial abilities by using representation tools in the form of pictures of river flow patterns and their descriptions, while in the reasoning process students can analyze the relationship between regions in the Konto Subwatershed to the Selorejo Reservoir problem, but in the section predicting phenomena and planning solutions , students get the not good criteria. This indicates that students have not yet mastered the spatial association indicator.

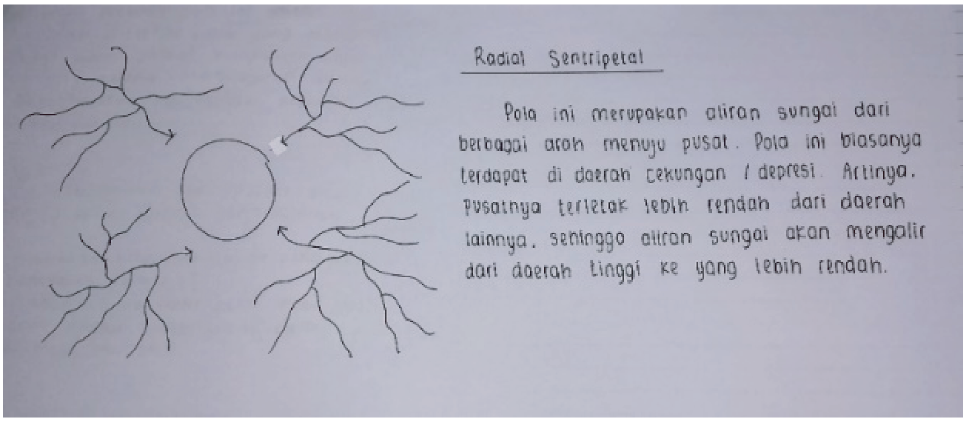

Figure 4: The Results of the Description of River Stream Pattern around Selorejo Reservoir.

Group III was given a topic about the flood phenomenon in Bumiaji District, Batu City. The product of this project is the digitization of watershed boundaries and drawings of river flow patterns in the Bulukerto and Sumbergondo sub-watersheds. Students are expected to be able to reason about the phenomena that occur around the area. Based on the results of the work, students have achieved complex spatial abilities by using representation tools in the form of screenshots of digitized watershed boundaries and images of river flow patterns along with their descriptions. The digitization of the watershed boundary is based on the accuracy of digitizing the watershed boundary in the form of ridges and calculating the area. The value of the results of this practicum is quite successful and shows the lack of shortcomings. While in the reasoning process students can analyze the relationship between regions in the Bumiaji Sub-District to the flood phenomenon, however in the planning part of the solution, students do get not good criteria. This indicates that students have not yet mastered the indicators of inter-spatial association.

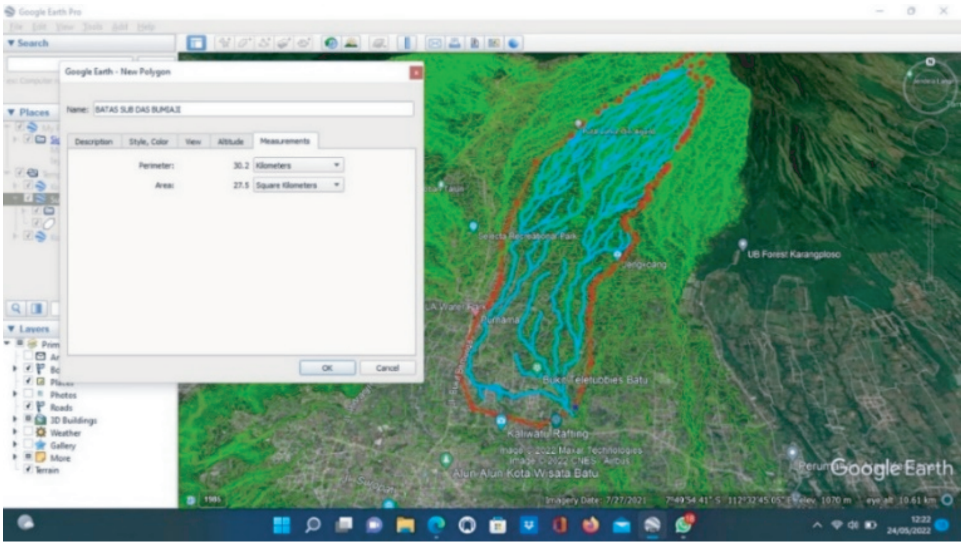

Figure 5: The Results of Digitizing Boundaries and Calculating Sub-watershed Area around the slopes of Mount Arjuna.

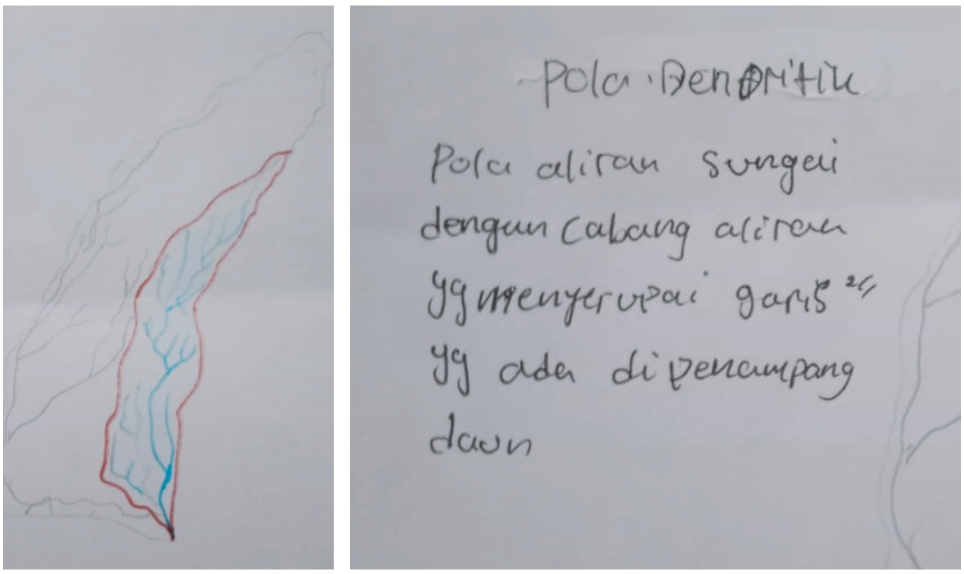

Figure 6: The Results of the Description of the River Stream Pattern Around The Slopes of Mount Arjuna.

Group IV was given a topic about spatial phenomena in Karangkates Reservoir, Malang Regency. The product of this project is the digitization of watershed boundaries and drawings of river flow patterns around the Karangkates Reservoir. Students are expected to be able to reason about the phenomena that occur around the area. Based on the results of the work, students have achieved complex spatial abilities by using representation tools in the form of screenshots of digitized watershed boundaries and images of river flow patterns along with their descriptions. while in the reasoning process students can analyze data, however in analyzing spatial relationships and planning solutions, students do get not good criteria. This indicates that students have not yet mastered spatial association, as well as planning solutions.

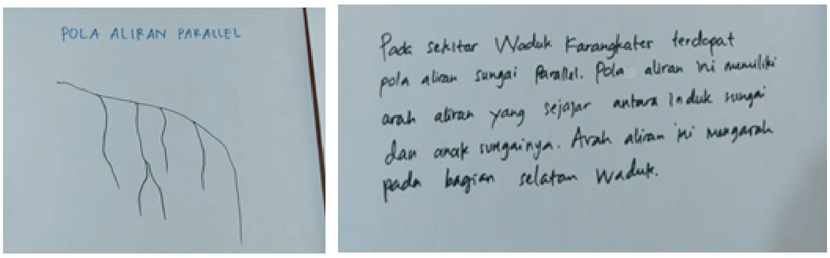

Figure 7: The Results of the Overview of River Stream Patterns which is located around the Karangkates Reservoir, Malang Regency.

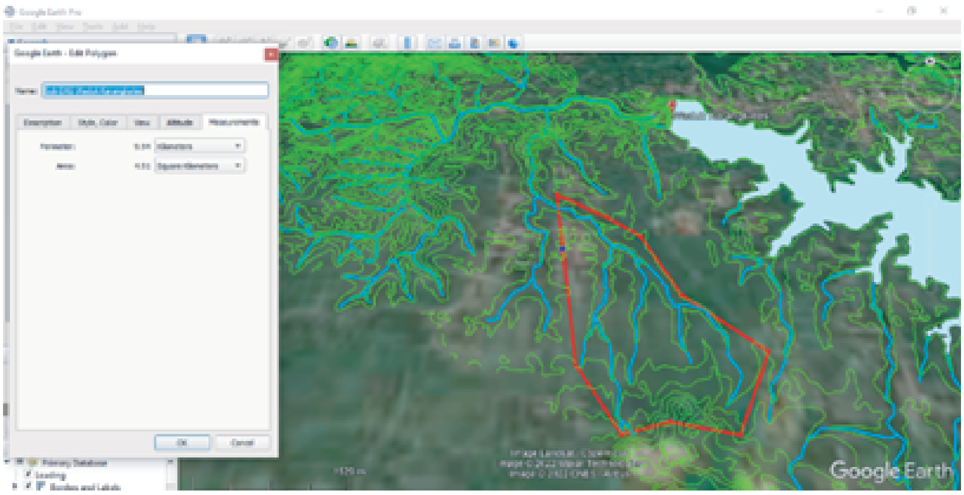

Figure 8: The Results of Digitizing Boundaries and Calculating the Area of Sub-watersheds around Karangkates Reservoir.

Furthermore, the provision of pre-test questions before learning activities and post-test questions after learning activities aims to determine changes in students' spatial thinking abilities. This is in line with research from [35] which uses the One Group

Pre-test Post-test design technique by carrying out 2 activities, namely before the experiment and after the experiment. The pre-test and post-test scores were then tested for normality as a prerequisite test for the Paired Sample T-Test. The results of the Kolmogorov-Smirnov normality test showed that the pretest and posttest scores were normally distributed and each had a significance score of more than 0.05.

Table 3: Normality Test Results.

TEST TEST NORMALITY			
Kolmogorov-Smirnov			
	Statistic	df	Sig.
PRE-TEST	0,136	35	0,088
POST-TEST	0,141	35	0,077

The data from the pretest and posttest scores showed a normal distribution because the significance was more than 0.05, namely the pretest significance was 0.088, while the posttest significance was 0.077. Furthermore, the pretest and posttest data were analyzed using the Paired Sample T-Test test to determine the differences in students' spatial thinking abilities. The results of the Paired Sample T-Test are listed in table 4.

Table 4: Paired Samples Statistics.

Paired Samples Statistics				
	Mean	N	Sandar Deviation	Standar Error Mean
PRE-TEST	42,3	35	11,052	1,868
POST-TEST	74,11	35	12,328	2,084

Table 5: Paired Samples Test.

Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	POST-TES PRE-TES	32,086	14,218	2,403	36,970	27,202	13,351	34	0,000

In table 4 it can be seen that the average pre-test score is 42.3 with a standard deviation of 11.052 and the average post-test score is 74.11 with a standard deviation of 12.328. It can be concluded that the post-test score is higher than the average pre-test score. In table 5 obtained the score of sig. (2-tailed) is 0.000 and less than 0.05. If sig. (2 tailed) < a then Ho is rejected and Ha is accepted. So that it can be concluded that there are differences in spatial thinking skills between, before, and after the treatment. The development of this e-module product is declared effective and feasible to use in learning because it is proven to improve spatial thinking skills which can be seen from the post-test results.

3.5. Evaluation

The last stage is the evaluation and revision stage, based on the results of research at each stage from analysis, design, development, and product implementation, it can be concluded that the ICARE-Based Geography E-Module Integrated with STEM using a spatial approach needs to be evaluated and revised so that it will be better in the future. At the development and implementation stage, data were obtained through suggestions and comments from validators, teachers, and students that could be used as guidelines for product improvement by researchers and further researchers.

The material, media, and language expert validators stated that this module was feasible and could be piloted. Furthermore, the comments of teachers and students as a whole stated that this learning module was interesting and complete because the module has an attractive appearance and visualization of objects, there are materials, videos as material supplements, geospatial technology practicum, video tutorials, calculation questions, and spatial cases. Overall student comments were interested in gaining new knowledge, meaningful experiences, and being more interactive. However, during the implementation of student learning, there are difficulties in practicum because many students whose laptop qualifications do not support installing the Google Earth application, so students work on group assignments, take a long time, and lack of deepening of student material.

The last evaluation stage is product effectiveness. The development of e-modules on inland waters and watershed conservation has been declared effective for improving students' spatial thinking skills. This is in line with [36] research regarding the development of effective spatial learning modules to improve students' spatial abilities, while [35] research regarding the development of electronic modules in geography subjects with lithospheric dynamics material is effective for improving student learning outcomes. The success of students in answering posttest questions on each component of spatial thinking is shown in Table 6.

Annotation:

(4) = Very Good

(3) = Good

Table 6: The Success of Students' Spatial Thinking.

Spatial Thinking Component		Taxonomy	Student Success			
Kategori	Sub kategori		1	2	3	4
Concept	Non-Spatial	-				
	Spatial Primitive	Determining the Location				
	Simple-Spatial	Identifying Regional Characteristics, Determining Shape				
	Complex-Spatial	Linking between spaces (Spatial Association)				
Use of representation tools	Use	Picture				
	Non-Use	-				
Cognitive Process	Input	Region, Volume Data				
	Process	Identify, Count				
	Output	Digitizing, Drawing Phenomenon Shapes, Comparing Data, Predicting Phenomena				
	Reasoning	Analyzing Data, Analyzing Spatial Relationships, Planning Solutions				

(2) = Less Good

(1) = Very Not Good/Unsatisfactory

In the first spatial component, namely the spatial concept, the questions consist of the concept of region, spatial relations, and location. The result of the average percentage of student success in working on the first component questions is 75% with a good average category. In the application of the spatial representation tool with a percentage result of 78% and is included in the very good category, the result is higher than the other two components, which means that students have been able to practice the representation tool in the form of drawings of river flow patterns. This is because the e-module is also equipped with interesting visualizations that make it easier for students to understand. The last component, namely the reasoning process, students get success with a percentage of 73% and is included in the good category. Geography subject at MAN Kota Batu has a Minimum Score Criteria (In Indonesian: KKM) of 75, while the average acquisition of the spatial component is 75.3% complete KKM. Overall the results of these scores indicate that the spatial ability of students is in good category and still needs to be improved.

All product development results are related to the suitability of the material and the environment around students so that students' curiosity and memory are higher [37].

Students' desire to actively ask questions also increases with contextual and interactive teaching materials [38]. This module is equipped with material videos and practical tutorials so that students can practice the use of geospatial technology independently, in line with the opinion [39] that spatial abilities can be trained and improved by training or practicum activities equipped with supporting visual tools, in the form of images and videos. Therefore, it can build thinking representations and understand spatial relationships between objects. This ICARE-based development module has also proven to be effectively applied to the learning process, supported by the opinion of [13] which states that this module can lead students to be more independent, process-oriented, reflective, and provide meaningful experiences for students.

The use of e-module can make students be able to optimize their learning independently, build concepts to learn and develop reasoning processes so that students can master the competencies that must be achieved in learning [40]. While the use of the STEM approach in this digital module can train students to think complexly and adapt to technology according to [18] opinion that the use of STEM can improve students' scientific abilities and innovate on technological products to be able to compete globally. Overall, the development of this digital module can be concluded to be effective and is included in the good category, but there are also some notes that teachers should understand their use and students must also have teacher assistance so that they can support the learning process to be better in the future development of the module.

4. CONCLUSION

The conclusions that can be obtained from the results and previous discussions are, 1) The ICARE-Based Geography E-module Product Integrated with STEM using a Spatial Approach is included in the very feasible category with a percentage of 92% 2) There is an influence on the use of the E-module product on students' spatial thinking skills seen from the results of the Paired Sample T-Test with a value of sig. (2 tailed) is 0.000 and less than 0.05. If sig. (2 tailed) $<$ a then Ho is rejected and Ha is accepted. We recommend paying attention to recommendations, suggestions, and input from validators so that product development is more optimal. That way, it can be concluded that the ICARE-Based Geography E-module Integrated with STEM using a Spatial Approach that was developed is feasible for students to use in the learning process. Suggestions for further research can be done by adding a population and sample so that this product can be reached more broadly by schools and students with different characters. At the trial stage, it should be carried out in the school's ICT laboratory so that the results of the application of this development product are more optimal and can support the learning process for better improvement in the future.

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