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Profile of Students Creative Thinking Skills and Implementation of Inquiry-based Learning Assisted by Physics 3D Module

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ABSTRAK

Selama ini pada mata pelajaran fisika, khususnya materi yang banyak memuat rumus-rumus, siswa mengeluhkan kesulitan dalam menerima materi tersebut. Hal ini dikarenakan model pembelajaran dan media pembelajaran yang digunakan masih belum sesuai dengan materi yang diberikan. Penelitian ini bertujuan untuk menganalisis survei tentang model pembelajaran yang digunakan dalam pembelajaran fisika dan tes dengan menggunakan indikator kemampuan berpikir kreatif khususnya pada materi elastisitas. Penelitian ini merupakan penelitian pendahuluan dengan desain penelitian deskriptif. Penelitian ini tidak menggunakan desain tes hipotesis melainkan proyek penelitian deskriptif. Penelitian ini dilakukan terhadap 181 siswa yang terdiri dari: 78 siswa laki-laki dan 103 siswa perempuan. Penelitian ini menggunakan tiga instrumen untuk mengumpulkan data, yaitu a.) instrumen tes berpikir kreatif empat indikator fleksibilitas, elaborasi, orisinalitas dan kelancaran pada materi elastisitas dan hukum hooke, b.) lembar wawancara guru tentang model pembelajaran yang digunakan dalam pembelajaran fisika, c.) angket siswa tentang perspektif pembelajaran fisika, model pembelajaran dan media pembelajaran. Hasil penelitian menunjukkan kemampuan berpikir kreatif siswa masih termasuk dalam kategori rendah. Implikasinya, guru harus mampu menerapkan model pembelajaran dan media pembelajaran yang tepat dalam prosesnya agar siswa mampu menerima materi dengan baik dan memiliki kemampuan berpikir kreatif.

ABSTRACT

So far in physics subjects, especially material that contain many formulas, students have complained about difficulties in accepting the material. This is because the learning model and learning media used are still not in accordance with the material provided. The study aimed to analyze surveys about learning model used in physics lesson and tests using indicators of creative thinking ability specially on the material elasticity. This research is preliminary research with a descriptive research design. This research does not use a hypothetical test design but rather a description research project. The study was conducted on 181 students consisting of: 78 male students and 103 female students. The study uses three instruments to gather data, i.e. a.) a creative thinking test instrument of four indicators flexibility, elaboration, originality and fluency on material elasticity and Hooke law, b.) teacher interview sheet about learning model used in physics lesson, c.) student questionnaire about perspective of physics lesson, learning models and learning media. The results showed the creative thinking ability of students still belongs to the low category. The implication is that teachers must be able to apply appropriate learning models and learning media in the process so that students are able to receive the material well and have the ability to think creatively.

1. INTRODUCTION

The students of Higher Secondary School (SMA) at this time are expected to graduate not only by having a value of knowledge, but also by having the ability to think. This thinking ability is expected to be

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possessed by the student in order to prepare for the life challenges that will be faced by him. Currently, students experience difficulties in analyzing problem-based questions, especially in physics subjects which contain many formulas, this is because the learning model and learning media used are still not appropriate (Amin et al., 2020; Lestari et al., 2021). Furthermore, many learning models currently in use do not sufficiently promote active learning or deeper conceptual understanding. Instead of encouraging students to engage with the material in a hands-on and inquiry-driven manner, these models may lead to passive absorption of information, where students memorize formulas without truly understanding the underlying principles (Andrian & Rusman, 2019; Avando Bastari et al., 2021). This lack of conceptual depth makes it difficult for students to apply knowledge to novel situations, as they are unable to connect theoretical concepts with real-world applications.

Previous study said today's education can create Human Resources by having good collaborative and communication skills, being able to use technology expertly, having creative and innovative thinking skills and having the ability to solve a problem. This is in line with the concept of 21st century learning, including critical thinking and problem solving, creativity and innovation, collaboration, and communication (Fatimah & Santiana, 2017). Unlike conventional learning models, this student centered learning model will direct students more actively in Inquiry Based Learning. Not only that, according to Sumarni the selection of inappropriate learning models can affect the learning outcomes of pupils (Diah Ratna Sari et al., 2018; Winarti et al., 2020). Research results from previous study show that 70% of students score on below the criteria of learning intensity, which is due to the learning model used still using lecture methods.

Inquiry Based Learning is one of the models that can be applied to the learning process according to the curriculum that is in force at the moment. Previous study said that inquiry based learning is a learning model that involves student activity in research or concept search to know the curiosity of the pupils (Basyoni et al., 2020). Inquiry Based Learning is a type of learning and approach that in the learning process is centered on the observation, ideas and questions of students. A common feature of this Inquiry Based Learning model is working in teams or groups, conducting research or experiments, interpreting data, explaining concepts, and evaluating (Gorghiu et al., 2015; Srifitriani et al., 2022). From these characteristics, it can encourage students to think creatively and innovatively. The Inquiry Based Learning model is famous for its practicum-based learning model, so this Inquiries Based learning model is suitable for application in the learning process of physics, where physics is a subject that belongs to difficult to understand so that students need practicum in the process of understanding concepts (Darmaji et al., 2022; Santosa et al., 2017).

Creative thinking is the ability that can be used to solve a structured problem and development. Creative thinking is the ability to find a variety of possible answers to a problem, where the quantity, relevance, and diversity of answers based on available information and data is a form of emphasis (Saputri & Syukri, 2022; Srifitriani et al., 2022). Creative thinking will reflect abilities with a variety of indicators, including flexibility, fluency, elaboration, and authenticity (originality). When a person has the ability of these four indicators, then the person has a ability to think creatively. In the learning process students cannot develop creative ideas due to the presence of time constraints in learning (Primayonita et al., 2020; Srifitriani et al., 2022).

Based on the description above, it can be concluded that the development of creative thinking skills requires students to engage with real-world problems that challenge their ability to think beyond conventional solutions. Creative thinking thrives when students are encouraged to explore, experiment, and apply their knowledge in novel ways. To foster these skills, researchers utilized the inquiry-based learning (IBL) model, which is specifically designed to engage students in active problem-solving and discovery. This approach is particularly well-suited for physics, as the subject matter is inherently connected to everyday life. Physics concepts often require students to conduct experiments, investigate phenomena, and explore cause-and-effect relationships, making it an ideal platform for fostering creativity.

Inquiry-based learning not only encourages students to ask questions but also prompts them to seek out their own solutions, thereby enhancing their ability to think creatively. By guiding students through a process of questioning, hypothesizing, and testing, IBL allows them to approach problems from multiple angles, promoting flexible thinking and innovation. This process of exploration enables students to develop a deeper understanding of the subject matter while simultaneously building their creative problem-solving skills. The aim of this research is to analyze the effect of Inquiry Based Learning on improving high school students' creative thinking skills. From existing research, namely the application of Inquiry Based Learning, the novelty of this research is knowing the application of IBL which will be carried out with the help of interactive media to improve students' creative thinking skills. This research uses the descriptive research design method to determine the creative thinking skills of high school students in learning physics.

2. METHOD

This research is a preliminary research with a descriptive research design. This research does not use a hypothetical test design but rather a descriptional research project (Taufiq et al., 2019). The results of this preliminary study will be used as a consideration to improve learning models and learning media that can enhance students' creative thinking skills in high school. The study was conducted on 181 students in XI MIPA class at SMAN 1 Wonoayu, consisting of: 78 male students and 103 female students. The study uses three instruments to gather data, i.e. a.) a creative thinking test instrument of four indicators on material elasticity and hooke's law, b.) teacher interview sheet, c.) student questionnaire.

A written test with a creative-thinking indicator consisting of 16 questions to determine the level of creative thinking of the students. After working on the writing test, the students were given time to fill in a lift of 10 questions that could describe the conditions related to the learning process of physics in the school. The interview was conducted by giving some questions to the physics teacher to obtain information related to the learning process of physics whether the Inquiry Based Learning model has been used in order to improve the creative thinking ability of the pupils, as well as to know the opinion of the teacher regarding the model of inquiry based learning with the help of learning media in the form of 3D digital modules based on android. The stages of this study are as shown in Figure 1.

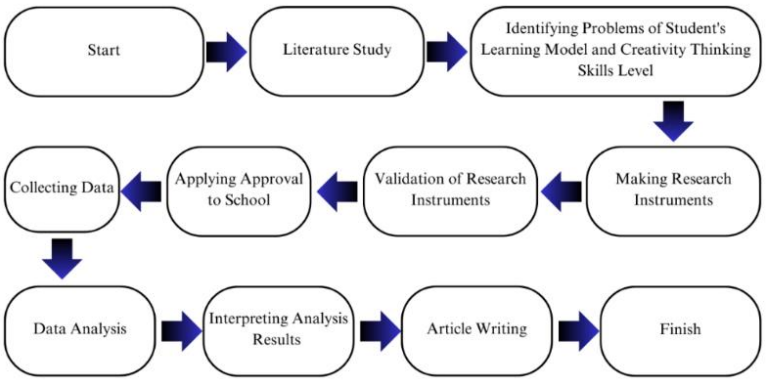

Figure 1. Research Stages

This research aims to determine the profile of students' creative thinking skills on elasticity and Hooke's law. At the data collection stage, students were given 16 questions containing indicators of creative thinking skills. According to Munandar, indicators of creative thinking are elaboration, fluency, originality and flexibility. From the questions given to students, validity and reliability tests are carried out first. The questionnaire sheet was analyzed using a Likert scale. And ask the teacher some questions. To determine the level of students' creative thinking skills, it can be determined from the students' answers. For the description of indicators, if answered completely, correctly and in detail, you will get a score of 10; for indicators of flexibility, originality and flexibility, if answered completely and correctly then you get a score of 5. For all questions, if the student's answer is wrong then you get a score of 0. So the maximum score for all questions is 100. Category level of creative thinking is show in Table 1.

Table 1. Category Level of Creative Thinking

Percentage of Achievement of The Creative Thinking Aspect	Creative Thinking Skill Category
81-100	Very Good
61-80	Good
41-60	Enough
21-40	Less
0-20	Very Less

3. RESULT AND DISCUSSION

Result

Based on the criteria that have been collected above, it is possible to know the value of creative thinking skills acquired by students. The study was conducted by providing a written test with 16 questions containing indicators of creative thinking ability. Each of the indicators has four questions. There are four indicators of creative thinking, elaboration, flexibility, originality, and fluency. Students are expected to be able to answer the questions in a complete and complete manner. Then from the answers that have been

obtained, the examiner can determine the level of creative thinking ability of the student. The results of the creative thinking abilities of the entire student can be seen in Figure 2.

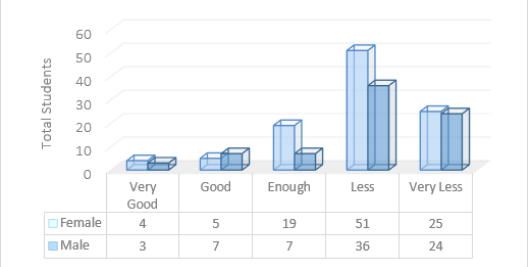

Figure 2. Creative Thinking Skills Category

Figure 2 can be seen that the level of students' creative thinking skills is still dominated in the sufficient category. From the results presented in Figure 2, it can be seen that there are quite significant differences between male and female genders. This significant difference was obtained because many male students did not take the test seriously. In this study, only 3.87% of 181 students got or were in the very good category. For the very good category there are 4 female students and 3 male students, for the good category there are 5 female students and 7 male students; for the quite large category there were 19 female students and 7 male students; in the low category there are 51 female students and 36 male students, and in the very low category there are 25 female students and 24 male students. It can be seen that students' ability to answer questions that measure creative thinking skills is still low, this is because students have difficulty explaining or relating the problems in the questions to indicators of creative thinking skills. for example, when carrying out formula calculations, most students immediately answer the form of the result, without writing down the origin of the formula and the results obtained. So from the table you can see the results of the level of creative thinking of high school students on the material Elasticity and Hooke's Law. Students average results based on creative thinking indicators is show in Figure 3.

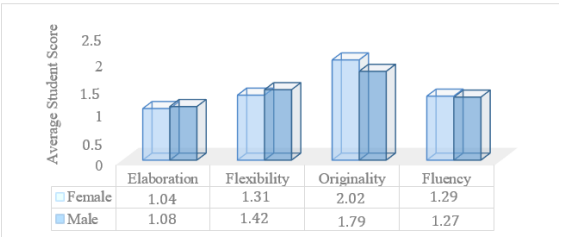

Figure 3. Students Average Results Based on Creative Thinking Indicators

Figure 3 presents the results of the study in the form of a written test that includes four indicators of creative thinking ability, namely, elaboration, fluency, flexibility and originality. Then find the average score of each indicator obtained by the pupils. Based on the above image, on the indicator elaboration and flexibility, male students have a higher average score than female students. On the originality and fluency indicator women have higher average scores than women. Although there is a difference in average score between males and females, the difference is not significant. So we can conclude that the creative thinking ability of male students and female students is equal, but only different in the ability of each indicator.

The test with the elaboration indicator has the lowest value compared to other indicators of creative thinking ability. For the indicator of flexibility, male students have a higher average score than female students. For the indicator of originality holds the highest average score of the other indicators of creative thinking ability. It's because the issue given is still at an easy level. And for the indicator of fluency itself the answer is still incomplete or there are still some reasons unanswered. Students' response to physics learning and creative thinking skills is show in Table 2.

Table 2. Students' Response to Physics Learning and Creatif Thinking Skills

No.	Statement	Answer (%)(n=181 Students)			
		Strongly Disagree	Disagree	Agree	Strongly Agree
Q1	Physics learning is fun	7.18 (13)	45.30 (82)	45.86 (83)	1.66 (3)
Q2	Physics learning is difficult	0 (0)	6.08 (11)	59.12 (107)	34.80 (63)

No.	Statement	Answer (%)(n=181 Students)			
		Strongly Disagree	Disagree	Agree	Strongly Agree
Q3	Learning physics many formulas that need to be memorized	0 (0)	4.42 (8)	53.04 (96)	42.54 (77)
Q4	Physics learning must be done directly (Practicum)	1.66 (3)	14.91 (27)	43.65 (79)	39.78 (72)
Q5	Elasticity material and hooke's law are easy to understand	6.08 (11)	64.09 (116)	28.73 (52)	1.10 (2)
Q6	Elasticity and Hooke's law are widely applied in everyday life	0.55 (1)	24.86 (45)	66.85 (121)	7.74 (14)
Q7	Creative thinking is hard to do	1.1 (2)	39.78 (72)	58.57 (106)	0.55 (1)
Q8	In the material on elasticity and Hooke's law, the ability to think creatively is needed to solve a problem	0 (0)	3.31 (6)	70.17 (127)	26.52 (48)
Q9	Teachers in elasticity and hooke's law have applied creative thinking skills to students	4.97 (9)	49.72 (90)	42.54 (77)	2.77 (5)
Q10	I am interested in learning the physics of matter elasticity and Hooke's law using E-Modules	5.53 (10)	19.89 (36)	55.8 (101)	18.78 (34)

Table 2 shows the results of the lift given to the students. 45.30% of students disagree that learning physics is fun. 59.12% agree that physical is one of the tough lessons.53.04% of students agree that in physics learning there are many formulas or equations that need to be discussed. (practice). Students assume that the material elasticity and the law of the hook is difficult to understand despite the material flexibility and the laws of the Hook are widely applied in everyday life. 58.57% of students agree that creative thinking is hard to do. 70,17% of students agree that on the material elasticity and the law of the hook requires the ability to think creatively to solve problems. In the learning of the material flexibility and hooke law still do not provide the creativity of thinking in it. And students are interested in studying physics on the matter elasticities and the laws of the Hooke using the 3D E-Module. This research is limited to the number of respondents to interview physics teachers, because SMAN 1 Wonoayu school only has two physics teachers, so the answers obtained are still lacking in diversity. Relevant research is show in Table 3.

Table 3. Relevant Research

Author	Research Purposes	Research Result
(Srifitriani et al., 2022)	Knowing the effects of implementing the Inquiry Based Learning method can enhance creative thinking.	Physics learning done using Inquiry Based Learning can enhance students' creative thinking skills.
(K. Yani, 2016)	Learn how to apply Inquiry Based Learning to creative thinking.	Application of Inquiry Based Learning can enhance creative thinking abilities very well and significantly.
(Kurniati et al., 2018)	Describe the influence of Inquiry Based learning guided towards creative thinking skills.	Guided application of inquiry can enhance the ability to think creatively.
(Nurlaela et al., 2018)	Analyze the results of creative thinking after applying Inquiry Based Learning.	There is a significant difference between before and after applying Inquiry Based Learning in learning.
(Y. A. Putri et al., 2019)	Analyses the effects of the application of the Inquiry Based Learning model in physics learning.	In the application of the Inquiry Based Learning model can improve the creative thinking ability of students.
(Haryati Mahyudin, 2022)	Know the impact of the application of Inquiry Based Learning on the creative thinking ability of the students.	By applying Inquiry Based Lerning in physics learning can enhance the creative thinking ability of students.
(I. K. Putri & Hutahaean, 2019)	Learn about student learning outcomes and student learning activities.	There is a significant difference between learning outcomes using Inquiry Training compared to without inquiry training.

Author	Research Purposes	Research Result
(Octavia, 2019)	Applying the Guided Inquiry Based Learning model to practise students' creative thinking skills.	Guided Inquiry Based Learning can enhance the creative thinking ability of students.
(Sumarli & Rosdianto, 2022)	Determine the relationship between process skills and student creativity in creative problem solving using Inquiry.	Students whose scientific process skills are high do not always have high creativity.

Table 3 demonstrates that the application of Inquiry Base Learning can improve the understanding of the concepts of the students, the learning outcomes of the learners, and the thinking skills of the pupils. Thus, it can be said that the implementation of Inquiry Based Learning has a positive impact on the students in the learning process.

Discussion

Based on the results of the analysis, it can be seen that students' creative thinking skills are still relatively low. This low skill can be caused by various factors that influence the teaching and learning process. One of the main factors is the learning method that may not fully support the development of student creativity. Learning that tends to focus on cognitive understanding of concepts, without providing enough space for students to explore new ideas and find innovative solutions, has the potential to limit the development of their creative thinking (Firdaus et al., 2021; Leasa et al., 2021). Although the Inquiry-Based Learning (IBL) learning model used offers a more interactive approach, its implementation is still not optimal in encouraging students to innovate and think creatively. IBL should provide students with the opportunity to actively seek and discover new knowledge through the process of discovery, experimentation, and reflection (Gorghiu et al., 2015; Winarni et al., 2022). However, without the support of appropriate teaching strategies, such as providing relevant challenges, directed guidance, and freedom to explore concepts, students may only focus on solving routine problems rather than creating original ideas.

The use of 3D physics modules, which theoretically can improve visualization and understanding of physics concepts, should have a positive impact on students' creativity. However, this module does not seem to have been utilized optimally to inspire students to think creatively (Agung et al., 2019; Ramadayanty et al., 2021). This shows that simply using sophisticated technology or media in learning does not automatically improve creative thinking skills if it is not supported by teaching methods that can stimulate imagination and out-of-the-box thinking skills. Thus, the low level of students' creative thinking skills is not only related to the learning model applied, but also how the model is implemented strategically. Teachers have an important role in creating a learning environment that facilitates creativity, by providing intellectual challenges that encourage students to think more broadly and deeply (Cahyana et al., 2017; Moma, 2017). Without the right approach, even potential learning methods such as IBL and 3D physics modules may not be able to achieve optimal results in developing students' creativity. One of the main implications of this finding is the need for adjustments in the learning strategies implemented by teachers. Teachers not only need to master the teaching materials, but also have a deep understanding of how to apply learning models that support the development of creative thinking skills. The IBL model basically provides opportunities for students to explore and develop new ideas, but this must be supported by relevant learning media and appropriate facilitation methods.

The use of 3D physics modules in this study shows great potential in helping students understand physics concepts better through interactive visualization. However, the effectiveness of this media needs to be improved so that it not only helps conceptual understanding, but is also able to stimulate students' creativity. Teachers may need to integrate additional activities that encourage students to think divergently, for example through challenging tasks and encouraging students to create innovative solutions (Dian Christi et al., 2020; Ramadayanty et al., 2021). Furthermore, this study underlines the importance of more active and collaborative learning in developing creative thinking skills. IBL equipped with learning media such as 3D modules is indeed promising, but the process of implementing this model requires an active role from teachers in guiding and providing space for students to explore their creative ideas (Rahmatsyah & Dwiningsih, 2021; Sofyan et al., 2019). Thus, teachers must continue to evaluate and develop new approaches that allow students to be more actively involved in the learning process.

Overall, the results of this study highlight that the development of students' creative thinking skills requires a more comprehensive approach, both in terms of learning models, media, and teaching strategies. The implementation of IBL supported by 3D physics modules has great potential, but needs to be further optimized so that it not only improves understanding of the material, but also develops students' creative thinking skills.

4. CONCLUSION

Based on the research results from the findings above, it can be concluded that the creative thinking skills of SMAN 1 Wonoayu students are still in the low category. From this research it is known that the learning model has a great influence on students' creative thinking skills. So researchers admit that learning innovation is very important to improve students' creative thinking skills. One effort to improve students' creative thinking skills is by implementing Inquiry Based Learning with the help of 3D E-Module. From this research, researchers recommend implementing the IBL learning model assisted by E-Modules to improve students' creative thinking skills. Things that need to be considered when implementing a media-assisted model are looking at the suitability of the material with the model and learning media that will be used.

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