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Analysis Creative Thinking Ability of Student's on the Topic of Momentum and Impulse in Senior High School

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Abstract: The capacity for creative thought is one of the skills that people in the 21st century need to have. Creative thinking ability refers to a person's ability to use their way of thinking to generate new ideas. Teachers must choose the best teaching strategy to provide pupils the chance to be creative. This study seeks to give a general picture of students' capacity for creatively thought about momentum and impulse. This study is quantitative and descriptive. As the research subjects, 57 students from classes XI MIPA 1 and XI MIPA 2 of SMA Negeri 1 Menggala participated in the study. The sample for this study was chosen using the cluster random sampling technique. A four-essay creative thinking exam with a reliability score of 0.610 and measures of fluency, flexibility, originality, and elaboration. The study's findings demonstrate that student have a considerable ability for creative thought. The indicator of fluency in thinking received the highest score of 54.67%, the indicator of flexibility of thinking was 47.2%, the indicator of originality was 34.93%, and the indicator of elaboration received the lowest proportion, 28.27%. This shows that students have the ability to develop different ideas in different ways, but they still have difficulty explaining these ideas.

Keywords: Creative Thinking Ability; Impulse and Momentum; The Fine Creative Thinking Ability

Introduction

Every country must have human resources with 21st-century life skills in order to keep up with the quickly evolving science and technology, particularly in the area of education (Asriadi & Istiyono, 2020). Poor learning and low thinking ability, especially students' creative thinking ability, are among the problems faced by education in Indonesia (Ariani, 2020; Astuti et al., 2022). Students are not encouraged to build their capacity for creative thought during the learning process (Astuti et al., 2022). Learning strategies, methods, models, and approaches used in learning activities can be indicators of low education quality (Zulkarnaen et al., 2022). The purpose of education is to educate students to meet the challenges of the twenty-first century (Athifah & Syafriani, 2019). The capacity for creative thought is one of the critical learning skills in the age of the industrial revolution 4.0 (Saputri et al., 2023a; Syafrial et al., 2022). The expectation of education in the twenty-first century is that students be able to think creatively about and solve challenges (Alfiyah et al., 2023; Asrizal et al., 2023; Maimun & Bahtiar, 2022; Nafiah et al., 2023; Zan et al., 2023). The capacity to think creatively is crucial for present and future technology advancements and even serves as a global education quality indicator (Habibi et al., 2020).

According to PISA 2021, creative thinking is the capacity to produce, enhance, and develop ideas that can advance knowledge, produce workable solutions, and impact the expression of imagination (OECD, 2019). Being able to think creatively enables one to approach challenges from several angles and come up with original ideas and answers (Habibi et al., 2020; Sarah et

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al., 2022). Patience and self-control, attention, and mental activity are all necessary components for creative thinking (Doyan et al., 2023). Creative thinking is essential to help learners overcome real-life problems and adjust to new demands (Saputri et al., 2023). Learners need creative thinking ability to solve problems (Asrizal et al., 2023; Batlolona & Diantoro, 2023; Sandopa et al., 2022). When facing problems, a creative person can find solutions and continue to develop themselves (Akmam et al., 2022; Nafiah et al., 2023). In addition, individuals who have creative thinking ability will have the ability to answer challenges around the world, so they can compete wherever they are (Athifah & Syafriani, 2019; Ritter & Mostert, 2017). This ability can help them excel in cognitive, affective, and metacognitive domains (Zulyusri et al., 2023). Additionally, in the age of openness, this ability is crucial for problem-solving (Ceylan, 2022).

Personal and environmental experiences can demonstrate creative abilities (Nikkola et al., 2022). Learners exhibit their capacity for creatively thought through accurate observation, analysis, and problem-solving. They also show creative ways to respond to each problem. Creative thinking ability help learners learn by doing things, such as analyzing, synthesizing, hypothesizing, making something new, and applying what they know (Duval et al., 2023; Hidayah, 2023). Learners' creative thinking ability must be trained and developed by getting them used to answering questions that involve creative thinking ability. Thus, learners should not be afraid to try new ideas and combine them with other people's opinions (Alfiyah et al., 2023; Ramdani et al., 2022). Creativity is defined as an ability that enables a person to make something new, unique, unconventional, and complex (Ďuriš et al., 2023; Mursid et al., 2022).

The capacity to think creatively is one of the crucial abilities that students must possess in order to succeed in physics studies (Batlolona et al., 2019; Rosidin et al., 2023; Siburian et al., 2019). Students are required to use creative thinking to consider physics occurrences from numerous angles and come up with different solutions to address physics issues so that students can choose from a variety of solutions to physics events or difficulties (Rosidin et al., 2023). Therefore, more opportunities should be given to learners to practice their creative thinking ability in the classroom. The goal is to make learners familiar with the creative thinking process (Trio Pangestu et al., 2023). The ability to think creatively, which is described as having the capacity to identify several solutions to a problem, is still not given much emphasis in education. Especially in Indonesia, teachers do not stress decision-making or creative thinking to students (Herman et al., 2022). As a result, learners lack the ability to think creatively and make decisions (Biazus & Mahtari, 2022). Learners cannot compete globally due to the lack of decision-making ability and creativity (Siagian et al., 2023).

According to Saputri et al., (2023) there are four qualities of creative thought that may be measured: fluency, flexibility, originality, and elaboration. The indication profile is as follows: Fluency is the capacity to produce original ideas, flexibility is the capacity to communicate alternate problem-solving strategies, originality is the capacity to solve problems with novel ideas, and elaboration is the capacity to go into further detail about various issues and their solutions (Habibi et al., 2020). In addition, some indicators of creative thinking ability include asking questions about problems, being fluent in putting forward ideas on how to solve a problem, providing different perspectives on a problem, exchanging opinions with friends about the same problem, and asking questions about new problems (Malik et al., 2023; Nasution et al., 2023). The capacity to think creatively must be developed via the use of techniques including prediction based on knowledge, issue definition, creation of hypotheses based on observed occurrences, and hypothesis testing (Nafiah et al., 2023). Changes in the learning environment that are more enjoyable will increase creative abilities (Hasibuan et al., 2022). So that can be able to come up with a variety of unique ideas (Algiani et al., 2023).

Research related to the identification of students' creative thinking skills is still rarely found, so based on the description of the problems above, it is necessary to conduct research by identifying students' creative thinking skills on momentum and impulse material. As a result, this study should be carried out to examine students' the creative thinking ability thought while dealing with physics concepts like impulse and momentum. This research is very important to be used as a basis for the development of educational programs that will help learners understand concepts and use their creative thinking ability, especially on impulse and momentum materials.

Method

The purpose of this study, which is a descriptive quantitative investigation, is to present an overview of students' the creative thinking ability thought on the subject of momentum and impulse. This study was carried out at SMAN 1 Menggala in Lampung. The study used a saturation sampling approach on 57 students from XI MIPA 1 and XI MIPA 2 courses as its samples. This study used tests and interviews with students. The interview method was used against

Physics teachers related to learning in the classroom. The research procedure carried out by researchers begins with determining the focus of the research, conducting a literature review, developing research instruments, collecting field data using research instruments, and analyzing the results of research data collection. The focus of this research is to determine the students' creative thinking ability on the concept of momentum and impulse. Four essay items on the creative thinking ability test have been verified by prior validators with respect to their validity and reliability those are displayed in Table 1.

Table 1. Creative Thinking Ability Test Results: Validity and Reliability

Question Number	Validity	Description	Reliability	Description
1	0.645	Valid	0.610 (High Category)	Reliable
2	0.572	Valid		
3	0.772	Valid		
4	0.757	Valid		

The exam tool is meant to gather information on the students' o the creative thinking ability possessed thought on the topic of momentum and impulse. The components and signs of creative thought, as described by Wechsler et al., (2018) are fluency, flexibility thinking, originality, and elaboration. The intervals shown in Table 2 are used to categorize the score value of the students' creative thinking abilities after the exam has been administered. Table 2 outlines the criteria for evaluating students' ability for creative thought in accordance with Febrianingsih, (2022).

Table 2. Criteria for Scoring Creative Thinking Ability

Score	Category
81 – 100	Very Creative
66 – 80	Creative
56 – 65	Quite Creative
41 – 55	Less Creative
0 - 40	Not Creative

Table 3 provides indicators of test questions provided to students on their capacity for creative thought.

Table 3. Creative Thinking Ability Question Indicator

Items	Creative Thinking Ability Indicator	Problem Indicator
1	Fluency	Expressing opinions fluently about the concepts of momentum and impulse that exist in everyday life
2	Flexibility	Expressing opinions with flexibility about the relationship between momentum and impulse in everyday life
3	Originality	Providing ideas with originality by making a simple technology in solving momentum and impulse problems in everyday life.
4	Elaboration	Identify the types of collisions in daily life elaboration

Result and Discussion

Result

The creative thinking ability exam is used to assess pupils' ability for creatively thought. This research's findings are based on student responses to essay questions on momentum and impulse from a test of creative thinking abilities. Then, statistical descriptions were obtained using the SPSS version 25 program. Table 4 shows descriptive statistical information on the outcomes of the students' creative thinking ability tests that has been assessed.

Table 4. Statistics on Learners' Ability for Creative Thinking

Statistic	Test Result
N	57
Min	20
Max	75
Mean	54.30 (less creative)
Std. Deviation	12.971

The table outcomes include the mean, median, maximum-minimum values, as well as other crucial statistics concerning the distribution of learners' creative thinking skill data. The typical student's ability for creative thought falls within the less creative category, as seen in Table 4. Furthermore, Table 5 displays the descriptive analysis data of the test outcomes for each question number.

Table 5. Descriptive Information for Each Question in the Creative Thinking Ability Test

	N	Range	Min.	Max.	Average (%)
(1) Fluency	57	25	0	25	54.67
(2) Flexibility	57	20	5	25	47.20
(3) Originality	57	15	0	15	34.93
(4) Elaboration	57	25	0	25	28.27

According to Table 5, the fluency indicator has a score range between 0 and 25, with 25 being the highest. The flexibility indicator has a score range from 5 to 25, with 25 being the highest. The originality indicator ranges from a score of 0 to a maximum of 15. The lowest and greatest scores for the elaboration indicator are 0 and 25, respectively.

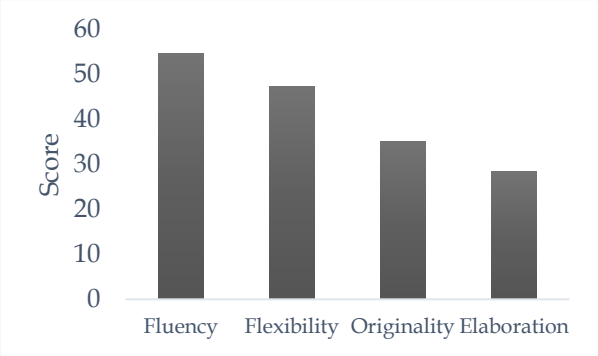

Figure 1. Indicators of Creative Thinking Ability in a Percentage Chart

Table 5 and Figure 1 provide evidence for this, which shows the fluency thinking ability indicator obtained the highest percentage of 54.67%. This shows that students are very capable of being able to provide as many ideas or thoughts as possible. The flexibility thinking ability indicator occupies the second highest score with the percentage of 47.2%. Although none of the learners have been able to achieve the maximum score on this indicator, the results are better than the other two indicators which only obtained a percentage of 34.93% for the originality thinking indicator and the elaboration thinking ability indicator with a percentage of only 28.27%. In other words, students still cannot think original and elaboration, namely being able to produce ideas that are unique or rarely produced by other students, and students still have difficulty detailing the thoughts or ideas produced. The following presents the achievements of students on each question number in various criteria for students' creative thinking ability on Table 6.

According to Table 6, which shows the distribution of data and the proportion of each creative thinking indication, it is clear that the fluent thinking ability indicator has a higher value or that the majority of respondents are extremely creative. Fluency, flexibility, originality, and elaboration are indicator the to think creatively (Saputri et al., 2022). The research results on fluency indicators are shown in Figure 2.

Figure 2 shows that the average percentage and number of students who scored high on the fluency marker had strong creative thinking skills. In question item no. 1, the fluency indicator shows as many as 4 students (7.02%) are not creative, 7 students (12.28%) are less creative, 17 students (28.07%) are quite creative, 10 students (17.54%) are creative and 20 students (35.09%) are very creative. According to these findings, the majority of students already have extremely creative thinking ability strong for fluency indicators. Figure 3 displays the outcomes of studies on flexibility indicators.

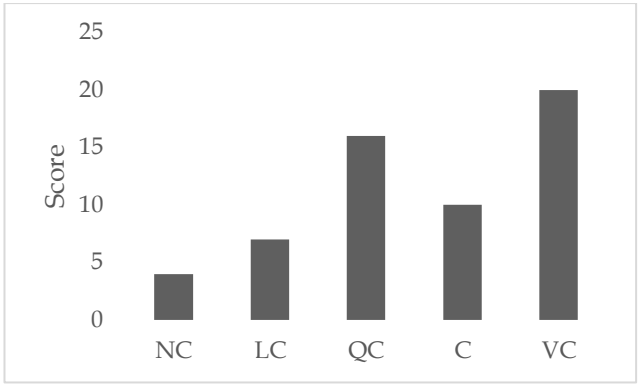

Figure 2. Fluency Indicators Students' Ability for Creative Thinking (NC: not creative, LC: less creative, QC: quite creative, C: creative, VC: very creative)

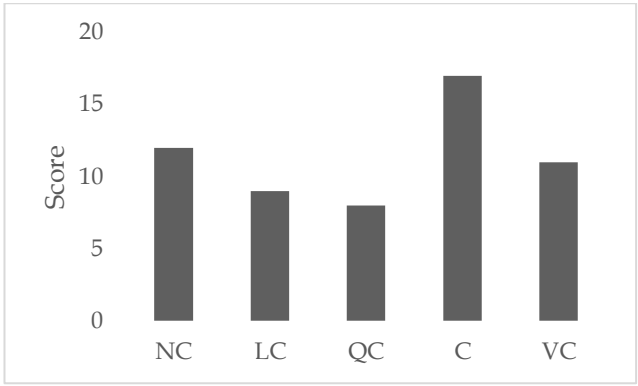

Figure 3. Flexibility Indicators Students' Ability for Creative Thinking (NC: not creative, LC: less creative, QC: quite creative, C: creative, VC: very creative)

According on Figure 3, it is known that the typical student's flexibility indicator score falls into the creative group. In question item no. 2, the flexibility indicator shows as many as 12 students (21.05%) are not creative, 9 students (15.79%) are less creative, 8 students (14.04%) are quite creative, 17 students (29.82%) are creative and 11 students (19.30%) are very creative. These findings indicate that the majority of pupils have the capacity for creative thinking that is creative in the flexibility indication. The research results on the originality indicator are shown in Figure 4.

Table 6. Data Distribution of the Number of Learners and the Percentage of Each Problem Indicator

Indicator Items	Criteria									
	Not Creative		Less Creative		Quite Creative		Creative		Very Creative	
	N	%	N	%	N	%	N	%	N	%
Fluency	4	7.02	7	12.28	17	28.07	10	17.54	20	35.09
Flexibility	12	21.05	9	15.79	8	14.04	17	29.82	11	19.30
Originality	10	17.54	17	29.82	30	52.63	0	0.00	0	0.00
Elaboration	8	14.04	47	82.46	1	1.75	0	0.00	1	1.75

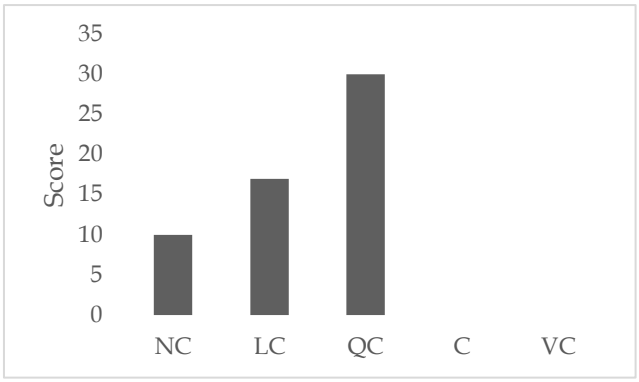

Figure 4. Originality Indicators Students' Ability for Creative Thinking (NC: not creative, LC: less creative, QC: quite creative, C: creative, VC: very creative)

Based on Figure 4, it is known that the average percentage of students' creative thinking ability on the originality indicator is in the quite creative category. In question item no. 3, with the originality indicator showing as many as 10 students (17.54%) were not creative, 17 students (29.82%) were less creative, and 30 students (52.69%) were quite creative. According to these findings, the majority of pupils have the capacity for creative thought and score highly on the originality index. In this indicator there are no learners who reach the creative and very creative criteria The results of research on elaboration indicators are shown in Figure 5.

Figure 5 demonstrates that, on the elaboration indicator, pupils' average creative thinking capacity falls into the less creative category. Concerning query item #4, with the elaboration indicator showing as many as 8 students (14.04%) are not creative, 47 students (82.46%) are less creative, 1 student (1.75%) is quite creative, and 1 student (1.75%) is very creative. These findings indicate that most students have lower levels of creative thinking abilities on the elaboration indicator.

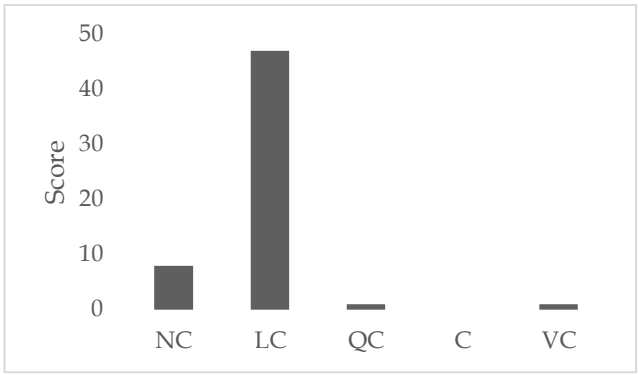

Figure 5. Elaboration Indicators Students' Ability for Creative Thinking (NC: not creative, LC: less creative, QC: quite creative, C: creative, VC: very creative)

Discussion

The findings of the descriptive analysis demonstrate that pupils' levels of creativity are still low. The fluency indicator has the largest percentage of students' creative talents, according to the research results' graph. This demonstrates students are capable of coming up with as many solutions to issues as they can. Numerous varieties of responses or solutions are what define fluency in a person. Directing learners to more organized and interesting activities can improve their fluency. If learners have the ability to change ideas, present different ideas, and explain their ideas, they can be categorized as learners who have creative thinking ability (Aini et al., 2020; Livia Dewi Mashitoh et al., 2021; Tambunan, 2019; Trio Pangestu et al., 2023). In solving problems and developing new ideas, their thinking ability can be improved (Alwi & Suherman, 2020; Ernst & Burcak, 2019). In terms of decision-making and problem-solving, experience and knowledge influence how to find ideas and create new products or ideas (Jia et al., 2019; Pardede, 2020).

Fluency thinking Aspects

Indicators of creative thinking skills in the high group are best developed in fluency thinking. This is consistent with research from studies (Astuti et al., 2022; Saputri et al., 2023). The study by (Kurniahtunnisa et al., 2023) also showed that based on the analysis of each aspect of creative thinking ability, the fluency aspect was in the high category. One aspect of learners' fluency is

their ability to provide different types of answers to questions (Alwi & Suherman, 2020). If learners understand the material well, they have the ability to provide many answers to questions, and their ability to think creatively will increase. Because the issues contain information and context that learners frequently encounter in real life, learners may see the problems presented (Masfufah & Afriansyah, 2021).

Flexible thinking aspect

The aspect of flexible thinking, which means offering various ideas to solve problems or questions and interpreting ideas in different ways, experienced a significant increase. Learners also have a fairly high percentage on the flexibility indicator. This shows that students have sufficient ability to convey ideas or alternative solutions to overcome problems in various ways. In line with (Himmah et al., 2021; Safitri et al., 2019) research, it is suggested that students are able to provide various alternative solutions in seeing problems from different perspectives. According to research conducted by Alwi & Suherman, (2020) thinking flexibility learners can offer various types of solutions. To be flexible, learners must have a lot of concept mastery. They must use multiple points of view when they develop new concepts (Algiani et al., 2023b; Kenett et al., 2018). This is related to the learners' ability to develop answers to questions (Anggraini & Zulkardi, 2020).

Originality Aspects

Originality is when the ideas presented are relatively new and contain unique combinations to solve problems or answer questions (Alwi & Suherman, 2020). However, students still experience significant difficulties in thinking creatively. This demonstrates that the pupils' inability to produce original, intriguing, logical, recently developed, and problems-related thoughts. They are also unable to express their views logically in writing or verbally so that their formulation is more appropriate and understandable. One of the creative thinking abilities that is difficult for students to do is original thinking (Algiani et al., 2023)

Elaboration Aspects

Elaboration is the process of enhancing and structuring a concept to make it of greater quality. The ability to add details and clarify concepts is known as elaboration thinking (Algiani et al., 2023). The elaboration indication shows that learners have the least capacity for creative thought. According to research conducted by Astuti et al., (2022) the elaboration indication is at a low criterion, which indicates that one's capacity creative thought is low. This is in line with research conducted by Himmah et al. (2021) that students are not used to thinking divergently or differently. They are still used to thinking convergently or solving problems in one way. This demonstrates that they still lack the capacity to produce or add details or more thorough justifications for the ideas they convey, and it falls short of the required level of explanation (Algiani et al., 2023). Although the test is designed to allow learners to produce a variety of answer types and details, learners are limited to being able to produce only a few normative solutions to given problems (Satriawan et al., 2020). According to this research, strategies to the learning process are required to enhance students' capacity for creative thought.

Conclusion

The creative thinking skills of the class XI MIPA 1 and XI MIPA 2 SMA Negeri 1 Menggala students are quite good, although there are some students who are less creative. However, this does not mean that students are not creative because they can gain creativity from other activities. Based on the outcomes of the study that has been done on creative thinking ability, it can be said that the indication of fluency creative thinking ability has a superior value or that the majority of students are extremely creative. The indicators with the greatest scores are fluency thinking (54.67%), flexibility thinking (47.2%), originality thinking (34.93%), and elaboration thinking (28.27%); the indicators with the lowest scores are originality thinking and flexibility thinking. This shows that students are able to generate various ideas in other utilization, but still have difficulty detailing their ideas. Someone who has creative thinking ability is someone who can use their thinking to generate new concepts, possibilities, and discoveries. This ability is based on how innovative the product is. Learning should be able to provide learners with learning experiences where they can use their thinking to solve problems. This should be done by adjusting teaching materials and materials to the learners' surrounding environment and using appropriate learning models to improve learners' creative thinking ability.

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Author Contributions

The author's contributions include I Putu Yogi Setia Permana: writing-original draft preparation, collecting data, analyzing

data, result, discussion, methodology, conclusion, and so on; Parno, Endang Purwaningsih, and Marlina Ali: proofreading, review, and editing of writing.

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Conflicts of Interest
The authors declare no conflict of interest regarding the publication of this paper.

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