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Perception of Science Teacher Candidates Toward Creative Thinking Ability

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Abstract

This study aims to explore the perceptions of prospective science teacher students regarding creative thinking abilities. This study is an exploratory research with research subjects as many as 14 biology education students. The research instrument used is a closed questionnaire which has been developed referring to indicators of creative thinking abilities, namely fluency, flexibility, originality and elaboration. The questionnaire has answers using a Likert scale that has been validated by experts and declared valid. This research data was analyzed using quantitative descriptive statistics and inferential statistics with the Anova test. The results of this research are (1) biology education students have an average perception score regarding creative thinking abilities, namely the Fluency indicator is 2.52 in the Tall category, Flexibility is 2.61 in the Tall category, Originality is 2.63 in the Tall category, and Elaboration of 2.67 in the Tall category; (2) there is no significant difference in students' perceptions of creative thinking abilities on the indicators of fluency, flexibility, originality and elaboration, as evidenced by the results of the Anova test with a significance value of 0.719>0.05.

Keywords: Creative Thinking Ability, Science Teacher Candidates

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INTRODUCTION

The 21st century is marked by the era of industrial revolution 4.0, which in the 21st century is a century of openness or a century of globalization (Mardhiyah et al., 2021). This century witnesses the rapid development of information technology and the emergence of a new era in human civilization, where swift changes occur in various aspects of life (Masfufah, 2022). This was emphasized by Samura (2019) that advances in information and communication technology can change a person's thinking pattern from unstructured to structured, so that people who master information technology are able to develop themselves through their thinking abilities. Thus, human life in the 21st century is experiencing many changes and demands quality human resources in all efforts and work results (Mardhiyah et al., 2021). According to Hidayati & Widjajanti (2018) that education plays a big role in improving the quality of advanced and competitive human resources. Improving the quality of human resources through education at all levels is the key to being able to follow the development of the Industrial Revolution 4.0 (Lase, 2019).

Education is an important vehicle in efforts to improve the quality of human resources (Nurhayati & Rahardi, 2021). 21st century learning is required to be technology-based to balance the demands of the millennium era so that students are accustomed to 21st century life skills (Sugiyarti, Arif & Mursalin, 2018). The abilities that students must have to face the

challenges of the 21st century are: (1) the ability to think critically and creatively, (2) the ability to communicate effectively, (3) the ability to innovate, (4) the ability to find solutions to a problem, and (5) the ability to collaborate (Whitby, 2007; Bray, Girvan & Chorcora, 2023). According to Sugiyarti, Arif & Mursalin (2018) that 21st century learning is required to facilitate students to apply the 4C abilities (Critical Thinking, Communication, Collaboration, Creativity). The ability to think creatively has an important role in life because creativity is a reliable source of human resource power to drive human progress in developing and discovering new things (Ghufron & Rini, 2014). Mardhiyana & Sejati (2016) emphasized that creative thinking skills are needed to develop students themselves and solve problems faced in everyday life. Thus, creative thinking is an important skill for every student to develop in preparing themselves to compete as superior human resources (Abidin, Rohaeti & Afrilianto, 2018).

The 21st century education framework states that one of the abilities that students as the current generation of the nation must have is the ability to think creatively (Hanni et al., 2018). This was emphasized by Saidah, Dwijanto & Iwan (2020) that in the current modern era requires every individual to think creatively. Creative thinking can make it easier for someone to create and find new ideas, so that they are able to overcome a problem in a certain situation (Khoiriyah & Husamah, 2018; Sihaloho, Sahyar & Ginting, 2017). According to Septianawati (2019), the ability to think creatively is important for students because this ability can overcome the challenges of scientific progress. Another opinion expressed by Wartono, Diantoro & Bartlolona (2018) is that students must have the ability to think creatively in order to become agents of change who are expected to be able to change society's life order into a more advanced life order. This is confirmed by the view of Silver (1997) who states that creative actions are seen as rare mental characteristics, produced by extraordinarily talented individuals through the use of extraordinary, fast and spontaneous thought processes. This view emphasizes that creativity is formed through a long and structured process in the world of education (Samura, 2019).

Creative thinking can be defined as a mental activity that a person uses to develop new ideas or thoughts (Meador, 1997; Garaigordobil & Berrueco, 2011). One of the main competencies in creative thinking is divergent products, including fluency, flexibility, originality and elaboration (Torrance, 1998). These four indicators are important because with the ability to think fluently, students will be able to provide various thoughts about things they do not yet understand (Malik, Agustina & Wardhany, 2019), flexible thinking will help students provide several alternative ideas or thoughts in solving problems (Vally et al, 2019), students can use original thinking to find unusual ideas, thoughts that are different and rarely given by other people (Arvianto & Ardhana, 2020), and elaborative thinking skills will be able to detail various ideas or expand the ideas produced (Sugiyanto et al., 2018). Based on the description of indicators of creative thinking abilities, it is hoped that students will be able to become mentally flexible modern humans to survive and compete in facing challenges in the 21st century (Himmah, Handayanto & Kusairi, 2021).

Wartono, Diantoro & Bartlolona (2018) emphasized that students as *agents of change* must have the ability to think creatively in order to be able to change society's life order into a more advanced life order. It is possible that the ability to think creatively is closely related to the creative thinking process, and the creative thinking process is related to the creation process (Abidin, Rohaeti & Afrilianto, 2018). Creating means arranging elements to form a related and functional unity, or rearranging elements into a new structure or pattern (Siswono, 2008). Sari, Ikhsan & Saminan (2017) explain that creating is related to the creative thinking process because it is related to three cognitive processes, namely generating, planning and producing. Anwar et al (2012) emphasized that the importance of creative thinking skills is because it is a way of generating new ideas that can be applied to various world problems. According to Septianawati (2019), the ability to think creatively is important because it can overcome the challenges of scientific progress. This opinion is confirmed by Wang (2011) that a person's

creative thinking ability will be able to solve complex problems, social problems and global problems. This is reinforced by the opinion of Samura (2019) who explains that creative thinking is part of high-level thinking skills which have an essential role in life, work and other aspects of life (Nurhayati & Rahardi, 2021).

The ability to think creatively has a strong relationship with individual development and individual thinking skills (Asiri, 2020). With the ability to think creatively, students have initial sensitivity to the situation they are facing (Prasetyo, Zulela & Fahrurrozi, 2021). According to Tandiseru (2015), students who have the ability to think creatively will be able to find solutions to every problem simply and flexibly. This is because creative thinking is a cognitive ability, originality, and a problem-solving process (Potur & Barkul, 2009). Thus, creative thinking abilities must be developed in students through the learning process in higher education. Learning for students must be developed by involving real world experience and the ability to collaborate with other people, giving students the opportunity to construct and organize their own knowledge through research, writing and analysis activities, as well as the ability to communicate effectively with other people (Johnson, 2002). This learning is expected to facilitate biology students to be able to think creatively as prospective science teachers in the 21st century (Prasetyo, Zulela & Fahrurrozi, 2021). The ability to think creatively is needed by prospective science teacher students in developing effective and enjoyable learning for students at school. This was emphasized by Prihadi (2017) that 21st century teachers must be able to design and implement learning that is able to facilitate the development of 4C skills (Critical Thinking, Communication, Collaboration, Creativity) and students can apply it in their daily lives.

According to Prasetyo, Zulela & Fahrurrozi (2021), the development of students' creative thinking abilities in tertiary institutions has not been optimal, so the level of students' creative thinking is still low. Rahayuningsih's research results (2017) explain that prospective teachers do not understand, do not know, and do not apply creative thinking skills in the learning process in the classroom. This is evident from the survey results that 90.47% do not understand and recognize the concept of creative thinking skills and 99.04% have never measured students' creative thinking skills. The results of this research show that prospective teacher students have never applied creative thinking skills in the learning process in the classroom, even though in the future, to become professional teachers, one of the skills they currently have is creative thinking skills (Masingila, 2017). This finding is in contrast to the concept of education in several countries which prioritizes developing and enhancing student creativity (Hwang et al., 2007). This is because someone who has the ability to think creatively will be able to solve complex problems, social problems and global problems (Wang, 2011). The importance of creative thinking skills for prospective teacher students in the 21st century means it is necessary to carry out mapping to determine the perceptions of biology students at the Mandalika University of Education regarding creative thinking abilities.

METHOD

This study is an ex post facto research with an exploratory descriptive approach (Cohen, Manion & Morrison, 2007; Muliadi, Mirawati & Prayogi, 2021), to describe students' perceptions of creative thinking abilities. Ex post facto research is used because researchers only study and measure existing student attitude data without carrying out manipulation or treatment (Cooper & Schindler 2001; Fraenkel, Wallen & Hyun, 2012). The respondents for this research were third semester biology education students at the Mandalika University of Education. Respondents were obtained using a convenience sampling technique with consideration of accessibility and students' willingness to fill out questionnaires distributed online (Fink, 2011; Creeswell, 2012).

This research uses an instrument in the form of a closed questionnaire with answers according to a Likert scale (Muliadi et al., 2022) with scale degradation namely Always, Often, Sometimes, Never (Creeswell, 2014; Singarimbun, 2007) which is presented in online media

in the form of google form (Adha et al., 2020). The student perception questionnaire developed refers to indicators of creative thinking abilities, namely fluency, flexibility, originality and elaboration. The questionnaire is prepared in 25 statements and has been validated by experts and declared valid.

Research data was analyzed using quantitative descriptive statistics and inferential statistics. Quantitative descriptive analysis is used to describe student perception data regarding creative thinking abilities. Average student perception data is interpreted in the form of categories using assessment criteria developed by Nugroho et al (2023) as presented in Table 1 below.

Table 1. Conversion criteria for average science teacher candidates perception scores

Average score ($\bar{p}$)	Category
3,25 < X ≤ 4,00	Very High
2,50 < X ≤ 3,25	Tall
1,75 < X ≤ 2,50	Low
1,00 < X ≤ 1,75	Very Low

The inferential statistical analysis used is (1) Anova test (Analysis of Variance) at a significance level of 5% to determine differences in student perceptions in creative thinking indicators, namely fluency, flexibility, originality and elaboration with the formulation of a statistical hypothesis, namely H_0 : μ1 = μ2 (there are no significant differences in student perceptions on the fluency, flexibility, originality and elaboration indicators) and H_1 : μ1 ≠ μ2 (there are significant differences in student perceptions on the fluency, flexibility, originality and elaboration indicators). If the results of the Anova test and t-test produce p-value smaller than 0.05, then H_0 is rejected and H_1 is accepted or vice versa.

RESULTS AND DISCUSSION

Description of the data from measuring biology education students' perceptions of creative thinking abilities on the indicators of fluency, flexibility, originality and elaboration is presented in Table 2 below.

Table 2. Results of data analysis of student perceptions about creative thinking

Creative Thinking Indicators	N	Σ Score	Average	Category
Fluency	14	35.33	2.52	Tall
Flexibility	14	36.60	2.61	Tall
Originality	14	36.89	2.63	Tall
Elaboration	14	37.37	2.67	Tall

Based on Table 2, it is known that biology education students have an average perception score regarding creative thinking abilities, namely the Fluency indicator is 2.52 in the Tall category, Flexibility is 2.61 in the Tall category, Originality is 2.63 in the Tall category, and Elaboration was 2.67 in the Tall category. Description of the average student answer scores on the indicators of fluency, flexibility, originality, and elaboration is presented in the following figure 1.

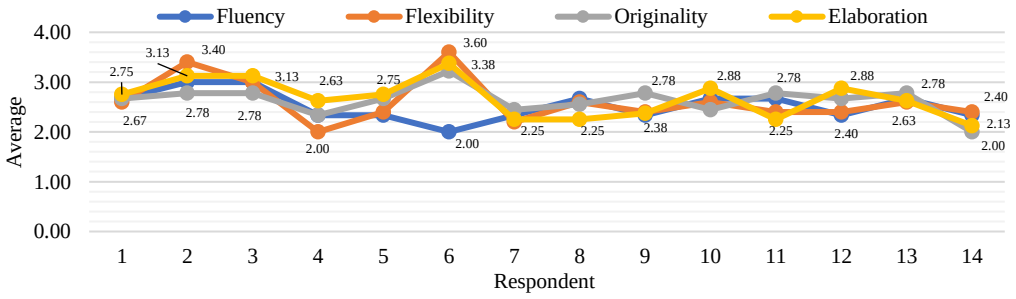

Figure 1. Average student perception scores about creative thinking

Data on differences in biology education students' perceptions regarding creative thinking abilities on the indicators of fluency, flexibility, originality and elaboration were analyzed using parametric statistics, after fulfilling the prerequisite tests, namely the homogeneity test and normality test as presented in Table 3 below.

Table 3. Homogeneity and normality test results

N	Homogeneity		Normality	
	Levenes Statistics Test Score	Sig.	Kolmogorov-Smirnov's Test Score	Sig.
14	0.867	**0.464**	0.886	**0.412**

The results of the normality test in table 3 show that the student perception data regarding creative thinking abilities has a significance value of 0.412 which is greater than 0.05 (>0.05), which means the data is normally distributed. Meanwhile, the homogeneity test results show that student perception data regarding creative thinking abilities has a significance value of 0.464 which is greater than 0.05 (>0.05), which means the data variance is homogeneous.

Analysis of differences in student perceptions regarding creative thinking abilities on the indicators of fluency, flexibility, originality and elaboration was carried out using the Anova (Analysis of Variance) test at a significance level of 5% (0.05) with the results of the analysis presented in Table 4 below.

Table 4. Anova test results

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	0.169	3	0.056	0.448	**0.719**
Within Groups	6,542	52	0.126		
Total	6,712	55			

The Anova test results in table 4 show that the F value is 0.448 with a significance value of 0.719 which is greater than 0.05 (>0.05), so that H_0 is accepted and H_1 is rejected. This means that there is no significant difference in students' perceptions of creative thinking abilities on the indicators of fluency, flexibility, originality and elaboration.

The results of this research explain that biology education students at the Mandalika University of Education have a fairly good perception of their creative thinking abilities in terms of fluency, flexibility, originality and elaboration. This confirms that prospective science teacher students have fairly good initial knowledge about creative thinking abilities, because student perception is the process of interpreting stimuli received through the five senses to be processed into understanding (Zhafira, Ertika & Chairiyaton, 2020). According to Irwanto (1994), student perception describes the knowledge they have about the object they perceive. Thus, this research confirms that students' positive perceptions about creative thinking have shown their ability to think divergently such as fluency, where students are able to provide various thoughts about things they do not yet understand (Malik, Agustina & Wardhany, 2019); flexibility, where students are able to provide several alternative ideas or thoughts in solving problems (Vally et al, 2019); originality, where students are able to find unusual ideas, different thoughts that are rarely given by other people (Arvianto & Ardhana, 2020); elaboration, where students are able to detail various ideas or expand the ideas produced (Sugiyanto et al., 2018). In this way, biology education students at the Mandalika University of Education will be able to become prospective science teachers who think modernly and are flexible to face educational challenges in the 21st century (Himmah, Handayanto & Kusairi, 2021).

The perception of students in the high category confirms that there is a strong desire in students to develop creative thinking abilities, so there is a need for a learning process that can facilitate the creative thinking abilities of prospective science teacher students at the Mandalika University of Education. This is in accordance with the opinion of Hidayat & Widjajanti (2018) that students' fairly good initial perception of creative thinking abilities becomes positive initial

capital in strengthening creative thinking abilities in the learning process. Another opinion was confirmed by Suwarma & Apriyani (2022) that the results of identifying creative thinking abilities can be used by educators to improve the quality of learning in order to facilitate the development of students' creative thinking abilities. Thus, measuring students' initial perceptions about creative thinking abilities is the first step in designing appropriate learning to facilitate the development of students' creative thinking abilities (Hidayat & Widjajanti, 2018). According to Samura (2017), the development of creative thinking abilities has been set as a learning objective both explicitly and implicitly in the 1994 curriculum, 2006 curriculum and 2013 curriculum. This is based on the regulations in Law Number 20 of 2003 concerning the National Education System, in Article 3 emphasizes that national education functions to develop abilities and shape the character and civilization of a dignified nation in order to educate the life of the nation, aiming to develop the potential of students so that they become human beings who believe in and are devoted to God Almighty, have noble character, are healthy, knowledgeable and capable, creative, independent, and become democratic and responsible citizens.

The positive perception of students who confirm their knowledge of creative thinking abilities is a positive potential for students in facing global competition in the 21st century. This is in accordance with the opinion of Anwar et al (2012) that the importance of creative thinking skills is because it is a way of generating new ideas that can be applied in various world problems. Septianawati (2019) opinion emphasizes that the ability to think creatively is important because it can overcome the challenges of scientific and technological progress. Another opinion is summarized by Wang (2011) that a person's creative thinking ability will be able to solve complex problems, social problems and global problems. This is reinforced by the opinion of Samura (2019) who explains that creative thinking is part of high-level thinking skills which have an essential role in life, work and other aspects of life (Nurhayati & Rahardi, 2021). The strategic role of creative thinking abilities makes it possible that creative thinking abilities are closely related to the creative thinking process, and the creative thinking process is related to the creating process (Abidin, Rohaeti & Afrilianto, 2018). Creating means putting elements together to form a related and functional whole, or rearranging elements into a new structure or pattern (Siswono, 2008). Sari, Ikhsan & Saminan (2017) explain that creating is related to the creative thinking process because it is related to three cognitive processes, namely generating, planning and producing.

Good knowledge about creative thinking abilities shows that prospective science teacher students have initial sensitivity to the situation they are facing (Prasetyo, Zulela & Fahrurrozi, 2021). According to Tandiseru (2015), students who have the ability to think creatively will be able to find solutions to every problem simply and flexibly. This is because creative thinking is a cognitive ability, originality, and a problem-solving process (Potur & Barkul, 2009). Thus, students' creative thinking abilities must be developed within students through the learning process. Learning for students must be developed by involving real world experience and the ability to collaborate with other people, giving students the opportunity to construct and organize their own knowledge through research, writing and analysis activities, as well as the ability to communicate effectively with other people (Johnson, 2002). This learning is expected to facilitate biology students to be able to think creatively as prospective science teachers in the 21st century (Prasetyo, Zulela & Fahrurrozi, 2021). The ability to think creatively is needed by prospective science teacher students in developing effective and enjoyable learning for students at school. This was emphasized by Prihadi (2017) that 21st century teachers must be able to design and implement learning that is able to facilitate the development of 4C skills (Critical Thinking, Communication, Collaboration, Creativity) and students can apply it in their daily lives. Thus, students' positive perceptions about creative thinking abilities indicate that prospective science teacher students have creative thinking abilities as one of the essential skills within the framework of 21st century education (Hanni et al., 2018).

CONCLUSION

Based on the results of the research above, it can be concluded that (1) biology education students have an average perception score regarding creative thinking abilities, namely the Fluency indicator is 2.52 in the Tall category, Flexibility is 2.61 in the Tall category, Originality is 2, 63 in the Tall category, and Elaboration of 2.67 in the Tall category; (2) there is no significant difference in students' perceptions of creative thinking abilities on the indicators of fluency, flexibility, originality and elaboration, as evidenced by the results of the Anova test with a significance value of 0.719>0.05.

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