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The creative thinking ability of high school student to ecological problem

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Abstract

Creative thinking in the 21st century is needed to prepare humans to become faithful, productive, innovative and creative individuals and contribute to the life of society, nation, and state. Schools make creative thinking skills one of the graduation competencies of students. This study aims to describe the level and character of students' creative thinking skills in solving ecological problems. The research method is descriptive with a qualitative approach. The research subjects were nine students selected based on the purposive sampling method. Data were analyzed using the triangulation analysis method. The study results used four levels of students' ability to solve problems creatively on the concept of ecology. The level of creative thinking ability of students is dominant at a moderately creative level. Characteristics of the creative thinking ability level of students, namely the creative level, have a high fluency aspect achievement, while flexibility and novelty are classified as moderate. The moderately creative level has a moderate achievement of fluency, flexibility, and novelty aspects, and students with a less creative level have a low achievement of fluency, flexibility, and novelty aspects. These results prove that creative thinking skills still need to be optimized at the high school.

Abstrak

Berpikir kreatif pada abad 21 dibutuhkan untuk mempersiapkan manusia menjadi pribadi yang beriman, produktif, inovatif dan kreatif serta berkontribusi pada kehidupan masyarakat, berbangsa dan bernegara. Sekolah menjadikan kemampuan berpikir kreatif salah satu kompetensi kelulusan peserta didik. Penelitian ini bertujuan mendeskripsikan tingkat dan karakter kemampuan berpikir kreatif peserta didik dalam menyelesaikan masalah ekologi. Metode penelitian deskriptif dengan pendekatan kualitatif. Subjek penelitian adalah sembilan orang peserta didik yang dipilih berdasarkan metode purposive sampling. Data dianalisis mengunakan metode analysis triagulasi. Hasil penelitian menggunakan empat tingkat kemampuan peserta didik dalam penyelesaian masalah secara kreatif pada konsep ekologi. Tingkat kemampuan berpikir kreatif peserta didik dominan pada tingkat cukup kreatif. Karakteristik tingkatan kemampuan berpikir kreatif peserta didik, yaitu tingkat kreatif memiliki ketercapaian aspek *fluency* tinggi, sedangkan *flexibility* dan *novelty* tergolong sedang. Tingkat cukup kreatif memiliki ketercapaian aspek *fluency*, *flexibility* dan *novelty* tergolong sedang, dan peserta didik tingkat kurang kreatif memiliki ketercapaian aspek *fluency*, *flexibility* dan *novelty* tergolong rendah. Hasil ini membuktikan kemampuan berpikir kreatif masih perlu dioptimalkan di tingkat SMA.

A. Introduction

Education is a process of influencing students' mindsets to adapt as best as possible to their environment. In addition, environmental conditions that change with the times' development require education to develop. Therefore, the primary purpose of education today is not just to teach, read, write, or arithmetic, but to teach how to use thinking skills. According to Kemitraan, students in the 21st century must develop competency skills that focus on developing higher-order thinking skills (Ariyana et al., 2018).

This is a form of effort to accelerate the world of education to catch up and prepare competent and highly competitive individuals (Hidayani et al., 2020). Various studies that have been conducted in the field of education have concluded that one of the critical thinking skills to be developed is the ability to think creatively (Chan, 2007). Creative thinking is one of the essential things in modern society because it can make humans more mentally flexible, flexible or flexible, meaning that a person has many alternative solutions or has many different points of view on a problem. Someone who thinks creatively is not only based on an answer or point of view (Hidayat & Yuliani, 2011).

Based on an interview at SMA Negeri 4 Banjarmasin about solving problems on ecological material, it was found that students tended not to answer when the teacher asked questions. This resulted in students' abilities not showing fluency in expressing their ideas and answering questions/problems, and students only gave correct answers according to what the teacher exemplified. The ability of students to find alternative solutions to problems is still lacking, so it does not appear that the flexibility of students to think about alternative answers varies. Students tend to memorize still or imitate what is given by the teacher. So, it can be seen that students' creative thinking ability is still not measurable.

Creative thinking is a series of actions that can be taken by someone to create new thoughts from a collection of ideas, information, concepts, experiences, and knowledge possessed. Therefore, based on these four aspects, the researcher only uses three aspects of creative thinking: fluency, flexibility, and novelty. According to Munandar (2009), students' creative thinking abilities can be measured using four aspects of creative thinking: fluency, flexibility, originality, and novelty

Creative thinking is the ability to see various problem-solving abilities, a form of thinking that has received less attention in formal education so far (Munandar, 2009). Fluency, flexibility, and novelty are indicators for using problem-solving in evaluating students' creative thinking (Silver, 1997). Because the existence of a level of creative thinking ability proves that there is a successive level of creative thinking, then it is strengthened by research results (Siswono, 2010). There is a creative thinking level (TBK) 5 levels, namely level 4 (very creative), level 3 (creative), level 2 (creative enough), level 1 (less creative), and level 0 (not creative). Then the results of Siswono's research prove that there are students with characteristics at the level of creative thinking at levels 4, 1, and 0. Although not every level consisting of 5 levels is filled, with the highest level (level 4) and the lowest level (level 0), it is sufficient to prove that this level of creative thinking exists. Based on the description above, the researcher wants to research creative thinking for solving problems about environmental ecology because researchers want to know the level of creative thinking of students in finding solutions to ecological issues.

B. Material and Method

This type of research is descriptive research using a qualitative approach. This study describes the event that became the centre of attention, namely the ability of students to solve problems creatively in ecological concepts descriptively based on the qualitative data. Descriptive research is conducted to determine the value of independent variables, either one or more variables, without making comparisons or connecting with other variables (Sugiyono, 2014). The study was conducted on nine SMA Negeri 4 Banjarmasin students who have studied ecological concepts.

Teachers in this research process act as the main instrument, and written assignments and interview guidelines have previously been validated and declared valid. This instrument will measure students' creative thinking skills in solving ecological concept problems.

The data from the written test instrument categorizing based on the data analysis technique the researcher had compiled. Based on these categories, the next step will analyze the data obtained through the stages of data reduction, data presentation, and concluding.

C. Results and Discussion

After doing the research using a written assignment supporting instrument in the form of a valid student worksheets to several students who were the research subjects, Suyidno et al. (2020) state the indicators used as an assessment in

measuring creativity are aspects of fluency, aspects of flexibility and aspects of novelty. Polya (1985) states that the stages of problem-solving are understanding the problem, developing a problem-solving plan, implementing a problem-solving plan, and re-examining the results of problem-solving. The result is that there are four levels of student creativity in solving problems of ecological concepts. These levels are creative, moderately creative, less creative, and not creative. The following is data on students' creative thinking skills in problem-solving ecological concepts for each level presented in Table 1 to Table 4.

The Table 1 shows that the S5 answers for written tests I, II and III are only able to answer six indicators, so they are categorized as not creative. This categorizes following the hypothesis theory that has been prepared previously. Therefore, if students meet 0-6 of the 36 available indicators, students can be categorized as not creative.

Table 1 Results of student worksheets for non-creative categories (Sample 5)

Problem Solving Stages.	Creative Thinking Indicator	Explanation			Reason
		I	II	III	
Understanding the problem	Fluency	√	√	√	S5 is able to express problems according to the discourse.
	Flexibility	-	-	-	S5 is not able to present problems from multiple points of view
	Novelty	-	-	-	S5 is not able to raise problems that are new or different from other students
Develop a problem solving plan	Fluency	-	-	√	S5 is able to draw up a problem-solving plan in accordance with the problems he raised in student worksheets III,
	Flexibility	-	-	-	S5 is not able to draw up a problem-solving plan from multiple points of view
	Novelty	-	-	-	S5 is not able to develop a problem-solving plan that is new or different from other students
Implement a problem solving plan	Fluency	-	-	√	S5 is able to describe the steps for solving problems according to the plan he put forward in student worksheets III
	Flexibility	-	-	-	S5 is not able to describe the steps for solving problems from various points of view
	Novelty	-	-	-	S5 is not able to describe the steps for solving problems that are new or different from other students
Re-checking the results of problem solving	Fluency	√	-	-	S5 is able to express the impact and solutions of solving problems in accordance with the plans he put forward in student worksheets I
	Flexibility	-	-	-	S5 is not able to express the impact and solutions of solving problems from various points of view
	Novelty	-	-	-	S5 is not able to express the impact and solutions of solving problems that are new or different from other students

The results of the S5 answer on the written test I of creative thinking skills that are met are only fluency indicators at the stage of understanding the problem. These results can be seen from S5's answer, which reads "green pest attack in the river." The results of this answer do not review from various points of view and are also not new or the same as other students. In addition, S5 cannot fulfil the three indicators of fluency, flexibility, and novelty at the stage of preparing a problem-solving plan and implementing a problem-solving plan because there is no answer from S5. In the last aspect, namely the stage of re-examining the results of problem-solving, the answer S5 only meets the fluency indicator is not met is flexibility at the stage of reviewing the results of problem-solving because it only prioritizes one impact and one solution. The same thing can be seen in written assignments II and III.

So S5 is in the uncreative category because students are not familiar with the model applied by the teacher, the combination of technology and learning strategies is still not appropriate, and students' ability is still lacking to understand the problem. In line with this study's results, Meika (2017) research shows that creative thinking and problem-solving abilities are still relatively low. Heriyanto (2020) explains that students' creative thinking abilities are influenced by several factors, the ability of students to exchange ideas, the learning approach applied by the teacher, learning models, and strategies.

Table 2 Results of student worksheets for less creative categories (S3, S6, and S7)

Problem Solving Stages	Creative Thinking Indicator	Explanation			Reason
		I	II	III	
Understanding the problem	Fluency	√	√	√	S3, S6 and S7 are able to express problems according to the discourse.
	Flexibility	-	-	-	S3, S6 and S7 are unable to present problems from multiple points of view.
	Novelty	-	-	-	S3, S6 and S7 are not able to raise problems that are new or different from other students.
Develop a problem solving plan	Fluency	√	√	√	S3, S6 and S7 are able to draw up a problem-solving plan according to the problem he raises.
	Flexibility	-	-	-	S3, S6 and S7 are unable to draw up a problem-solving plan from multiple points of view.
	Novelty	-	-	-	S3, S6 and S7 are not able to develop problem solving plans that are new or different from other students.
Implement a problem solving plan	Fluency	√	√	√	S3, S6 and S7 were able to describe the steps for solving the problem according to the plan he put forward.
	Flexibility	-	-	-	S3, S6 and S7 are not able to describe the steps for solving the problem from various points of view.
	Novelty	-	-	-	S3, S6 and S7 are not able to describe the steps for solving problems that are new or different from other students.
Re-checking the results of problem solving	Fluency	-	-	-	S3, S6 and S7 were not able to express the impact and solution of solving the problem according to the plan he put forward.
	Flexibility	-	-	-	S3, S6 and S7 are not able to express the impact and solutions of solving problems from various points of view.
	Novelty	-	-	-	S3, S6 and S7 are not able to express the impact and solutions of solving problems that are new or different from other students.

Table 3 Results of student worksheets in the pretty creative category (S1, S2, and S8)

Problem Solving Stages	Creative Thinking Indicator	Explanation			Reason
		I	II	III	
Understanding the problem	Fluency	√	√	√	S1, S2, S8 are able to express problems according to the discourse
	Flexibility	-	-	-	S1, S2, S8 are able to present problems from various points of view
	Novelty	-	-	-	S1, S2, S8 are not able to raise problems that are new or different from other students
Develop a problem solving plan	Fluency	√	√	√	S1, S2, S8 are able to draw up a problem-solving plan according to the problem he raises
	Flexibility	-	-	-	S1, S2, S8 are not able to draw up a problem solving plan from various points of view
	Novelty	-	-	-	S1, S2, S8 are not able to develop problem solving plans that are new or different from other students
Implement problem solving plans	Fluency	-	-	-	S1, S2, S8 were not able to describe the steps for solving the problem according to the plan he put forward
	Flexibility	-	-	-	S1, S2, S8 are not able to describe the steps for solving problems from various points of view
	Novelty	-	-	-	S1, S2, S8 are not able to describe the steps for solving problems that are new or different from other students
Re-checking the results of problem solving	Fluency	√	√	√	S1, S2, S8 are able to express the impact and solutions of solving problems according to the plan he put forward
	Flexibility	√	√	√	S1, S2, S8 are not able to express the impact and solutions of solving problems from various points of view
	Novelty	√	√	√	S1, S2, S8 are able to express the impact and solutions of solving problems that are new or different from other students

Table 2 shows that the answers S3, S6, and S7 for the written tests I, II, and III can meet 9 of the 36 indicators so that they are categorized as less creative, according to the hypothesis theory made earlier if 7-13 of the 36 indicators are met then it is categorized as less creative. However, the results of the answers on the written test I stage of understanding the problem can only meet the fluency indicator. These results can be seen from the answers S3, S6, and S7, namely "problems related to ecological material" the results of these answers do not meet the flexibility indicator. This result is because the answers do not review from different points of view; besides, the novelty indicator was also not achieved because the answers were not new or the same as other students. The same thing also happened at the stage of developing a problem-solving plan and implementing a problem-solving plan. In contrast, all indicators are not met for re-examining the problem-solving results, because students were unable to provide answers at this stage.

In the answers for the written tests II and III, the pattern of student answers is the same as the written test I, so from these results can be concluded that S3, S6, and S7 are in the less creative category. This category is because the students' initial ability to think creatively indicates flexibility. Students have not been able to give answers from various points of view, and novelty is also not achieved. This answer is because students can still not provide new answers or answers that are different from other students. According to Prasetiyo (2014), creative thinking is when someone can think of more than one idea to solve a problem. In addition, it will be easier to bring up creative abilities if you use various issues. According to (Hidayani et al., 2020), for individuals who understand the problem well, finding solutions and describing and testing hypotheses related to the problem will be easier. In this case, students with poor categories are still unable to understand the issues and have difficulties solving ecological problems.

Table 4 Results of creative category student worksheets (S4 and S9)

Problem Solving Stages	Creative Thinking Indicator	Explanation			Reason
		I	II	III	
Understanding the problem	Fluency	√	√	√	S4 and S9 are able to present problems according to the discourse.
	Flexibility	√	√	√	S4 and S9 are able to present problems from multiple points of view.
	Novelty	√	√	√	S4 and S9 are not able to raise problems that are new or different from other students.
Develop a problem solving plan	Fluency	-	-	-	S4 and S9 were unable to draw up a problem-solving plan according to the problem he raised.
	Flexibility	√	√	√	S4 and S9 are able to develop problem-solving plans from various points of view.
	Novelty	-	-	-	S4 and S9 are not able to develop problem solving plans that are new or different from other students.
Implement a problem solving plan	Fluency	√	√	√	S4 and S9 are able to describe the steps for solving the problem according to the plan he put forward.
	Flexibility	√	√	√	S4 and S9 are able to describe the steps for solving problems from various points of view.
	Novelty	-	-	-	S4 is not able to describe the steps for solving problems that are new or different from other students.
Re-checking the results of problem solving	Fluency	√	√	√	S4 and S9 are able to express the impact and solutions of solving problems according to the plan he put forward.
	Flexibility	√	√	√	S4 and S9 are able to present impacts and solutions to problem solving from various points of view.
	Novelty	√	√	√	S4 and S9 are able to express the impact and solutions of solving problems that are new or different from other students.

Based on Table 3, the answers S1, S2, and S8 for written tests I, II, and III can meet 15 of the 36 indicators so that they are categorized as quite creative following the hypothesis theory that has been made previously, namely if 14-21 of the 36 indicators are achieved, then categorized as quite creative. This category can be seen from the results of the answers S1, S2, and S8 on the written tests I, II, and III.

The results of the answers on the written test I for the stages of understanding the problem and formulating a problem-solving plan, namely "the

explosion of the water hyacinth population and the causes of the explosion of the water hyacinth population." The answers submitted by S1 can meet the indicators of fluency and flexibility because the answers can understand the problem and review it from various points of view. Still, the novelty indicator has not been achieved because the answers are not new or the same as other students. Furthermore, all indicators of creative thinking skills have not been fulfilled at the stage of implementing the problem-solving plan. However, in the stage of re-examining the results of problem-solving, all indicators are met.

The answers for the written tests II and III have the same pattern as the answers in the written test I, so from these findings. Its answer can be concluded that S1, S2, and S8 are in the quite creative category. This category shows that students can express their answers smoothly and precisely according to the problems faced through their thoughts and have not been thought of by others, in line with the opinion of Antika (2019), which states that individuals who have sufficient or low levels of creativity mean that the individual has not achieved the ideal level of creativity. This statement means that the individual still tends to be passive in the learning process. The ability to think creatively needs the power to provide a solution to the problem it finds and solve the problem by thinking creatively.

Table 4 explained that the answers S4 and S9 for the written tests I, II, and III can meet 28 of the 36 indicators so that they are categorized as creative, according to the hypothetical theory that has been made previously, that is, if 22 – 28 of the 36 indicators are achieved, they are categorized as creative. This can be proven from answers S4 and S9 on written tests I, II, and III following the stages of problem-solving ecological concepts.

The results of the answers on the written tests I, II, and III at the problem-solving stage show that all indicators of creative thinking are met, both indicators of fluency, flexibility, and novelty, it can be proven from the results of students' answers, namely "The water hyacinth population exploded, and the cause of the water hyacinth population exploded was." Furthermore, at the stage of compiling a problem-solving plan, only the flexibility indicator was achieved, while the fluency and novelty indicators were not met. Then, the fluency and flexibility indicators were achieved at the stage of implementing the problem-solving plan while the novelty had not been achieved. Therefore, the final stage in problem-solving is re-examining the results of problem-solving. Students can meet all indicators of creative thinking in solving problems at this stage.

The creative category has fulfilled the ability to think creatively in solving problems for S5 and S9. This shows that students have high imagination power and creative thinking so that they can solve problems according to the issues at hand, in line with the opinion conveyed by Antika (2019), which states that individuals who have high creativity or are very creative are individuals who can express his opinion smoothly and precisely, can express opinions that come from his thoughts or can be in the form of new things that have not been thought of by others, have high imagination power. This is also following the results of research conducted by Simangunsong et al. (2018), which states that students' creative thinking abilities fall into the creative category. The achievement of indicators of creative thinking ability in solving problems can be seen in the following Table 5.

Table 5 Creative thinking indicators achievement

Indicator	Percentage (%)	Category
Fluency	77	High
Flexibility	29.6	Low
Novelty	15.7	Very Low

Table 5 explained that students' creative thinking skills in solving problems on the fluency indicator are in the high category. This category is evidenced by the results of students' answers who can solve problems with various solutions according to the discourse provided. This statement follows research (Santoso et al., 2014) which states that subjects representing creative thinking ability level 1 can bring up fluency indicators, and subjects can fluently solve questions with varied answers. Furthermore, the flexibility indicator is in a low category, as evidenced by the results of the answers during the research. The answers given by students have not shown the ability to solve problems in one way but can provide other ways. Meanwhile, the novelty indicator is in the very low category, evidenced by the answers of students who did not pose a problem that was different from the previously proposed problem.

D. Conclusion

Based on the results of research on the analysis of high school creative thinking skills in solving ecological problems to several students of SMA Negeri 4 Banjarmasin who have studied the concept of ecology, it can be concluded that there are four levels of creative thinking, namely not

creative, less creative, quite creative and creative, for students highly creative are not found in this study. Meanwhile, the level of creative thinking ability of the students of SMA Negeri 4 Banjarmasin is dominant in the quite creative category. Characteristics of the level of creative thinking ability, namely the achievement of high fluency indicators, low flexibility, and very low novelty. This research still has many shortcomings, especially in applying and measuring, which is relatively new for students. These results prove that creative thinking skills still need to be optimized at the high school level.

E. References

Antika, C. R. (2019). Tingkat kreativitas siswa dan implikasinya terhadap program pengembangan kreativitas. In *Prosiding Seminar Nasional & Call Paper, Fakultas Pendidikan Psikologi, Universitas Surabaya*.

Ariyana, Y., Pudjiastuti, A., Bestary, R., & Zamromi, Z. (2018). Buku pegangan pembelajaran keterampilan berpikir tingkat tinggi berbasis zonasi. *Direktorat Jendral Guru dan Tenaga Kependidikan*, 1–87.

Chan, D. W. (2007). Creative teaching in Hong Kong Schools : Constraints and challenges. *Educational Research Journal*, *22*(1), 1–12.

Heriyanto, D. (2020). Analisis kemampuan berpikir kreatif siswa Sekolah Menegah Pertama. In *PRISMA, Prosiding Seminar Nasional Matematika*, (Vol. 3, pp. 587–590).

Hidayani, S., Amelia, T., & Muhartati, E. (2020). Analisis kemampuan berpikir kreatif siswa SMP di Tanjungpinang dalam merespon isu pencemaran lingkungan. *Jurnal Pedagogi Hayati, 4*(1), 30-37.

Hidayat, W., & Yuliani, A. (2011). Meningkatkan kemampuan berpikir kritis matematik siswa sekolah menengah atas melalui pembelajaran kooperatif Think-Talk-Write (TTW). *Matematika dan Pendidikan Karakter dalam Pembelajaran*, 535–546.

Meika, I. (2017). Kemampuan berpikir kreatif dan pemecahan masalah matematis siswa SMA. *Jurnal Penelitian dan Pembelajaran Matematika*, *10*(2), 8–13.

Munandar, U. (2009). *Pengembangan kreativitas anak berbakat*. Jakarta: PT. Rineka Cipta.

Prasetiyo, A. D. (2014). Berpikir kreatif siswa dalam penerapan model pembelajaran berdasar masalah matematika. *Jurnal Pendidikan Matematika STKIP PGRI Sidoarjo, 2*(1), 9–18.

Santoso, H. R. W., Ratu, N., & Yunianta, T. N. H. (2014). Deskripsi tingkat kemampuan berpikir kreatif (TKBK) pada materi segiempat siswa kelas VII SMP Negeri 1 Pabelan Kabupaten Semarang. *Satya Widya*, *30*(2), 82-95. https://doi.org/10.24246/j.sw.2014.v30.i2.p82-95

Silver, E. A. (1997). Fostering creativity through instruction rich in mathematical problem solving and problem posing. *Zentralblatt Für Didaktik Der Mathematik*, *29*(3), 75–80. https://doi.org/10.1007/s11858-997-0003-x

Simangunsong, P. G., Lumban Gaol, A. Y. D., & Sahnan, M. (2018). Efektivitas model pembelajaran treffinger terhadap hasil belajar dan kemampuan berpikir kreatif siswa pada materi ekologi. *Jurnal Pelita Pendidikan*, *6*(4), 211–217. https://doi.org/10.24114/jpp.v6i4.10583

Siswono, T. Y. E. (2010). Level student's creative thinking in classroom. *Academic Journal*, *6*(7), 548-553.

Sugiyono. (2014). *Metode penelitian pendidikan pendekatan kuantitatif, kualitatif, dan R&D*. Alfabeta.

Suyidno, S., M, A. S., Arifuddin, M., Misbah, M., & Siswanto, J. (2020). Menyiapkan peserta didik untuk masyarakat 5.0 melalui creative responsibility based learning. *Jurnal Pendidikan Fisika Dan Keilmuan*, *6*(1), 25. https://doi.org/10.25273/jpfk.v6i1.6041