Creative Thinking and Problem-solving Skills for Class X High School Students in Padangsidimpuan City on Climate Change Based on Socioscientific Issues

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Abstract. This study aims to find out how the creative thinking and problem-solving skills of high school students in the city of Padangsidimpuan in the 2021/2022 academic year. This research is descriptive. Where the research subjects were high school students of class X in the city of Padangsdimpuan with a sample of 505 students from SMA N 1 Padangsidimpuan, SMA N 4 Padangsidimpuan, and SMA N 6 Padangsidimpuan. The instrument used in this research is an essay test. The results of this study found that students' creative thinking skills were enough creative with a percentage of 84%. Problem-solving skills of students have a proportion of 79% are in enough category. The relationship between creative thinking skills and students' problem-solving skills is very strong and positive with a coefficient of 0.929. The higher the creative thinking skills, the higher the students' problem-solving skills.

Keywords: Creative Thinking, Problem Solving, SSI.

1 Introduction

The development of the times is increasingly advanced in various fields in human life. Such as education, health, economy, society, and culture. Evidence from the development of the times is marked by a balance between developing science and technology. The development of science and technology started from the first-generation industrial revolution which gave birth to a new history where human power was replaced by a steam engine in the 18th century. This revolution succeeded in raising the value of the economy dramatically.

The industrial revolution developed from the 1.0 industrial revolution to the 4.0 industrial revolution. the developmental stages of the industrial revolution changed the way we worked before. The industrial revolution 4.0 that has developed in our lives can advance economic growth and competitiveness. To deal with this, there is a need for innovation in learning and improving the competence of 21st-century graduates, namely in Learning and Innovation Skills. These skills are human resources to be skilled and master science, especially in the fields of science, technology, engineering, and mathematics. The ability to master science can

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understand life processes and the ability to participate in decision-making that affects their lives. Humans who are skilled or understand technology are very useful for the nation to facilitate it in analyzing technology and influencing society, and the State. Mastery of engineering can help humans understand and develop technology. Then mastering mathematics can be useful for human life in analyzing, communicating ideas appropriately, and finding solutions to various problems. These four fields can facilitate human life and advance a country if the education sector can influence others such as the economy, society, and culture. So, the goal of national education is directed at efforts to form the skills and attitudes of individuals in the 21st century.

21st-century skills and attitudes as ways to think (knowledge, critical and creative thinking), ways to learn (literacy and soft skills), and ways to learn with others (personal, social, and civic responsibilities). The US-based Partnership for 21st Century Skills, identifies critical thinking skills, creative thinking skills, communication skills, and collaboration skills as competencies needed in the 21st century. These competencies are known as 4C competencies. [1]

Critical thinking skills are fundamental skills in solving problems. This skill is important for students to have in finding the source of the problem and how to find and find the right solution to the problem at hand. Critical thinking skills can be instilled in various disciplines. Teachers play an important role in designing and developing learning programs that are more focused on empowering these skills. Creative thinking skills are skills related to the skills to use a new approach to solve a problem, innovation, and discovery. This skill is an act that is completely new and original, either personally (original for individuals only) or culturally. [2]

The willingness of students to think about problems or challenges, share those thoughts with others and listen to feedback, are some examples of creative thinking that can be shown by students in their learning. [3] Communication skills are skills to express thoughts, ideas, knowledge, or new information possessed both in writing and orally. These skills include listening, writing, and public speaking skills. Collaborative skills are the skills to work together effectively and show respect for diverse teams, exercising fluency and willingness to make decisions needed to achieve common goals. Group work skills; leadership, decision making, and collaboration. [4]

21st-century education in Indonesia is also developing according to the curriculum. In the character curriculum, there is an explanation of the skills that are needed by students. Therefore, participation from various parties in the world of education is very important. Namely the school and teachers/ educators and students. The school prepares students to have several 21st-century skills to play a role in their lives. The role of teachers/educators is

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[1] Patrick Griffin and Esther Care. *Assessment and Teaching of 21 st Century Skill*. (Dordreacht, Heidelberg, London, and New York: Springer, (2015) 7.

[2] Maria Abdullah and Kamisah Osman. Scientific Inventive Thinking Skills among Primary Students in Brunei. *Procedia Social and Behavioral Sciences*, (online), Vol. 9, No. 7, (https://doi.org/10.1016/j.sbspro.2010. 12.10.041, accessed on 5 September 2020). 296.

[3] Siti Zubaidah. Get to know 4C: Learning and Innovation Skills for Facing the Revolutionary Era Industry 4.01. Paper Presented at the "2nd Science Education National Conference" Seminar at (Universitas Trunojoyo Madura, 13 October 2018). 2.

[4] Ibid

required to develop student skills so teachers need to prepare all learning tools, namely curriculum, learning implementation plans, models, or methods that are integrated with 21st-century learning.

The development of 21st-century skills and attitudes in learning is expected to be owned by students as one of the keys to progress and success in life. 21st-century skills and attitudes in learning affect various areas of students' thinking. namely the cognitive, affective, and psychomotor domains. The cognitive domain emphasizes intellectual aspects such as knowledge, understanding, and thinking skills. The affective domain emphasizes aspects of feelings and emotions such as interests, attitudes, appreciation, and ways of adjustment. Then the psychomotor domain emphasizes aspects of motor skills such as handwriting, typing, and operating machines.

The cognitive domain studied in this discussion is students' thinking skills. According to Bloom's taxonomy, thinking skills are divided into two, namely low-level thinking skills and higher-order thinking skills. Low-level thinking skills are the thinking skills of students who are still in the stages of C1 (remembering), C2 (understanding), and C3 (applying). These skills are still in the early stages that must be possessed by kindergarten, and elementary school students and then gradually move into high-level skills.

According to Bloom's taxonomy, higher order thinking skills (HOTS) in the learning process are the skills to analyze, evaluate and create. Higher order thinking skills (HOTS) are sought to be applied in Senior High Schools/Madrasah Aliyah (SMA/MA) and equivalent in various fields of study, especially learning Biology. One of the four conditions of higher order thinking skills (HOTS) that students learning Biology must possess is higher order thinking skills that are more specific, namely, creative thinking skills and problem-solving.

Biology learning is a part of science and has a significant contribution to the development of technology, namely as the basic science underlying the development of technology. This is what unites the two into a unit known as Science/IPTEK. Biology learning is also related to how to find out about nature systematically, mastery of a collection of knowledge in the form of facts, concepts, or principles, and is a process of discovery.

Biology with the object of study in the form of the real world has consequences for presenting subjects that relate to everyday life. However, in reality, it is not necessarily implemented in Biology learning. The world is currently experiencing the effects of the Covid-19 pandemic. The impact on the world of education has resulted in the inhibition of teaching and learning activities in larynx schools. So that schools carry out online and offline learning. Teachers are expected to be able to design media, models, and learning strategies that are appropriate to the situation that occurs and remain within the 2013 curriculum line. And students are expected to understand Biology learning.

We know that Indonesia's PISA scores in 2018 placed Indonesian students in 6th place from the bottom (74) with an average score of 371. This value is low because it is below the average in the category (literacy, math, and science skills). PISA questions are made by following per under higher-order thinking skills so that it can be seen roughly that students do not have overall higher-order thinking skills.

In 2018 and 2019 the average UN scores of Padangsidimpuan city students in Biology learning were 43.56 and 46.94. Students are not familiar with the UN questions that are made based on higher-order thinking skills, therefore low scores are obtained. In 2020/2021 the UN

was abolished by the government. With the elimination of the National Examination, it is hoped that schools in Indonesia will familiarize students with learning and solving Higher Order Thinking Skills questions. Especially at this time of online and offline learning teachers are not maximally supervising students for real [5]

Although learning is carried out online. This does not affect the learning of Biology. Because learning Biology can be pursued by presenting real materials that occur in students' lives so that the essence of the material taught can be fully applied in everyday life. One of the Biology learning materials for SMA/MA, especially class X, which can present material in real terms is the KD. 3.10 and 4.10. About Climate Change. We can feel the phenomena of climate change in everyday life such as low rainfall intensity in some areas that should be high, for example, the Padangsidimpuan city area has a rainfall intensity of 4000 mm in 2016 which is lower than the city of Sibolga with rainfall intensity reaching 4500 mm in 2016. From this phenomenon, students can learn in real terms about climate change. [6]

The presentation of material can be done in Biology learning with the Socioscientific Issues (SSI) approach. SSI is an approach that aims to stimulate intellectual, moral and ethical development as well as awareness of the relationship between science and social life. In addition to thinking skills, students can develop moral and ethical reasoning and integration scientific concepts that have an impact on people's lives. [7]

In a structured way, it is expected that class X high school students in the city of Padangsidimpuan have high-order thinking skills (HOTS) and moral reasoning, especially on climate change material. However, it is not yet known whether higher-order thinking skills (HOTS) have developed. Therefore, this research will use the SSI approach to reveal the creative thinking and problem-solving skills of students of SMA N Class X in the city of Padangsidimpuan on climate change material based on the Socio-Scientific Issue.

Science literacy

Science learning is identical to scientific literacy. Especially with learning the field of Biology. Where this research focuses on learning Biology based on SSI (Socioscientific Issues) with Climate Change material. Therefore, it is necessary to know in advance about scientific literacy. According to Aqil (2017), literacy is a measure of the success of science education in schools, especially biology science lessons. This illustrates the true nature of science learning.[8] Meanwhile, according to Yuliati (2017), scientific literacy is the ability to use scientific knowledge, identify questions, and draw conclusions based on evidence, to understand and make decisions regarding nature and changes made to nature through human activities.

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[5] Kemendikbud. (2018). *Buku Pegangan pembelajaran Berorientasi pada Keterampilan Berpikir Tingkat tinggi: Program Peningkatan Kompetensi Pembelajaran Berbasis Zonasi. (*Bandung, Batu, Riau, Yogyakarta: Direktorat Jenderal Guru dan Tenaga Kependidikan).

[6] Budi Prasetyo, Nikita Pusparini, Irwandi Irwandi, Welly Fitria. Karakteristik Curah Hujan Berdasarkan Ragam Topografi di Sumatera Utara. *Jurnal Sains dan Teknologi Modifikasi Cuaca,* (online), Vol. 19, No. 1. (https://ejurnal.bppt.go.id, accessed on 6 September 2020). 17.

[7] Dana L. Zeidler, Troy D. Sadler, Michael L. Simmons, Elaine V. Howes. Beyond STS: A Research-Based Framework for Socioscientific Issues Education. *Science Education,* (online), Vol. 89, No. 3, (DOI: 10.1002/sce.20048, accessed on September 6, 2020). 361.

[8] Deden ibnu aqil. Literasi Sains sebagai Konsep Pembelajaran Buku Ajar Biologi di Sekolah. *Jurnal Pemikiran, Penelitian Pendidikan dan Sains,* (online), Vol. 5, No. 2, (http://journal.uim.ac.id/index.php/ wacanadidaktika, accessed on 5 September 2020). 160.

Scientific literacy can be concluded as the ability to use scientific knowledge and participate in scientific learning related to political, economic, social, cultural, state and technology issues in everyday life. Scientific literacy in this research focuses on learning Biology based on Socioscientific Issues. Social issues are a high level of scientific literacy. So high-level thinking skills are needed to achieve high-level scientific literacy and the impact of Socioscientific Issues-based Biology learning.

Creative Thinking Skills

Creative thinking skills are higher-order thinking skills that must be possessed by high school/MA students in the 2013 curriculum. Creative thinking is an ability that most of us are born with and are not natural creative thinkers. Special techniques are needed to help use our brains in different ways. The problem with creative thinking is that by definition almost any idea that has not been examined will sound strange and far-fetched and even insane. But a good solution might sound weird at first. [9]

Creative thinking can be imaginative thinking, generating many possible solutions, different, and lateral. Critical and creative thinking skills play an important role in preparing students to become good problem solvers and able to make mature decisions and conclusions and be able to be accountable academically. [10] Creative thinking ability is the ability or thought process to provide new ideas that can be applied in problem-solving. [11]

Meanwhile, Brookhart (2010) states that "creative thinking is the brainstorming or putting together of new ideas, and then critical thinking takes over and evaluates how successful the new ideas are". [12] Johnson (Suripah, 2019) states, "Creative thinking is a habit of a mind trained based on intuition, imagination, new possibilities, fresh perspectives, and unexpected ideas". [13] Then Fogarty & Mc. Tighe (King, Goodson & Spiritual, 2012) states, "Creative Thinking is generating and producing ideas through brainstorming, visualizing, associating relationships, making analogies, inventing, inferring, and generalizing". [14]

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[9] Ariyana, Yoki and Pudjiastuti, Ari and Bestary, Reisky and Zamroni, Zamroni. *Buku Pegangan Pembelajaran Berorientasi pada Keterampilan Berpikir Tingkat Tinggi Program Peningkatan Kompetensi Pembelajaran Berbasis Zonasi. (*Jakarta: Kemedikbud, 2018).

[10] ibid

[11] Maghfiroh Nuril, Susilo, Herawati Gofur and Abdul Kemampuan Berpikir Kreatif Siswa Kelas X SMA Negeri 4 Sidoarjo pada Mata Pelajaran Biologi. *Seminar Nasional Pendidikan dan Saintek,* (online), (https://publikasiilmiah.ums.ac.id/bitstream/handle/11617/7981/92.pdf?sequence=1&isAllowed=y, accessed on 17 September 2021). 635.

[12] Susan M. Brookhart. *How to Assess Higher-Order Thinking Skills in Your Classroom. (* ASCD: Virginia USA, 2010). 125.

[13] Suripah and Heri R. (2019). Investigating Students' Mathematical Creative Thinking Skill Based on Academic Level and Gender. International Journal of Scientific and Technology Research, (online), Vol. 8, No. 8, (https://www.ijstr.org/final-print/aug2019/Investigating-Students-Mathematical-Creative-Thinking-Skill-Based-On-Academic-Level-And-Gender.pdf, accessed 23 September 2020). 227.

[14] FJ. King, Goodson, L., and Rohani, F. *Assessment and Evaluation of Higher Order Thinking Skills*. (Florida: Educational Service Program, 2012). 32.

The opinion of the experts above can be concluded that creative thinking skills are the ability to train the mind by exchanging thoughts, intuition, and imagination and summing it up to get new ideas, fresh ideas, and solutions to solving problems. The components of creative thinking skills have each indicator listed in table 1 made by Torrence (1969) from http://repository.fkip.unja.ac.id and Setiawan (2016).[15]

Table 1. Indicators of Creative Thinking Skills

No.	Aspect	Indicator
1.	Fluency	• Fast see faults and weaknesses from something object or situation
2.	Flexibility	• Give Miscellaneous interpretation to something pictures, stories, or problems. • Apply something draft or different principles. • Thinking Miscellaneous different ways to complete problem
3.	Originality	• Thinking about problems or things that don't once other people think. • Give new ideas in complete problem
4.	Elaboration	• Tends to give a broad and satisfactory answer. • Able to build linkages between concept

The four indicators of creative thinking skills relate to students' creativity. Student creativity can be explored more deeply. Through instruction and practice, all students can develop and improve their ability to think in this so-called higher-order thinking. Creativity involves finding and solving problems. An innovative approach is used to evaluate deficiencies accurately and actions are taken to correct the problem. Creativity involves the relevant aspects of a problem and integrating the parts into a suitable system that integrates new information with what students have already learned.

Treffinger, Young, Selby, and Shepardson. (2002) stated that a person's creativity must have the openness and courage to explore categories of ideas. It includes several personality traits related to a person's interests, experiences, attitudes, and self-confidence. Characteristics in this category that we refer to as openness and courage to explore ideas include; problem sensitivity, aesthetic sensitivity, curiosity, sense of humor, excitement, fantasy and imagination, risk-taking, tolerance for ambiguity, tenacity, openness to experience, emotional sensitivity, adaptability, intuition, willingness to grow, unwilling to accept authoritarian statements without critical examination, and dichotomous or opposite integration. Creative people are naturally curious and open to new experiences and ideas. They usually identify problem areas before others notice them. As a result, they are not afraid of the unknown and can tolerate ambiguity. [16]

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[15] Windi Setiawan. Profil Berpikir Metaforis (Metaphorical Thinking) Siswa SMP dalam Pemecahan Masalah Pengukuran Ditinjau dari Gaya Kognitif. *Jurnal Matematika Kreatif-Inovatif*, (online), Vol. 7, No. 2, (http://repository.fkip.unja.ac.id, accessed on 18 September 2021). 211.

[16] Treffinger, DJ, Young, GJ, Selby, EC, and Shepardson, C. (2002). *Assessing Creativity: A Guide for Educators*. (Sarasota, Florida: NRCG/T, 2002). 20.

The conclusion that can be drawn from the statements above is that creativity is a creative thinking skill that is growing with the support of the environment to get a positive response from oneself such as self-confidence, courage, tenacity, imagination, tolerance, and joy.

Problem-Solving Skills

Higher-order thinking skills such as problem-solving are needed in the learning process because learning designed with a learning approach is oriented towards high-level skills that cannot be separated from a combination of thinking skills and creativity skills for problem-solving. Then problem-solving skills are needed in the science learning process because science learning cannot be separated from a combination of thinking skills and creative skills to create new products.

Problem-solving skills are skills that have a strong desire to be able to solve problems that arise in everyday life. According to Picus, Saches, and Smith (1983) problem solving is a process or set of mental operations used in acting from the current situation to the desired goal. [17] Meanwhile, George Polya (Picus, Saches, and Smith, 1983) states that problem-solving is finding an unknown way to a clearly understood ending. [18]

Meanwhile, according to Rahmawati, Sajidan, and Ashadi (2018), problem-solving skills are a kind of expert thinking who has a strong desire to solve problems in life. [19] Krulik and Rudnick (Carson, 2007) also define problem-solving as a method used by individuals who previously gained knowledge, skills, and understanding to meet the demands of unfamiliar situations. The student must synthesize what he has learned, and apply it to new and different situations. [20]

Based on previous statements about problem-solving skills, it can be concluded that problem-solving skills are students' skills in finding solutions by gathering information, knowledge, and understanding to be applied and synthesized in solving problems in everyday life. The steps in problem-solving skills (problem-solving skills) according to Polya (1957) are taken from sources Novitasari, Murni, and Maridi, (2015) in table 2. [21]

Table 2. Indicator Problem solving Skills

No.	Component	Indicator

[17] Larry Picus, Saches, TP, and Smith, RM *Teaching Problem Solving.* (Portland, Oregon: Educational Resources Information Center (ERIC), 1983). 6.

[18] Ibid

[19] Rahmawati, D., Sajidan and Ashadi . (2014). Analysis of Problem Solving Skill in Learning Biology at Senior Higher School of Surakarta. *Journal of Physics: Conference Series*, (online), Vol, 10, No. 6, (https://iopscience.iop.org/article/10.1088/1742-6596/1006/1/012014/ pdf, accessed on 20 September 2021).

[20] Jamin Carson. (2007). A Problem with Problem Solving: Teaching Thinking Without Teaching Knowledge. *The Mathematics Educators.* (online), Vol. 17, No. 2, (https://files.eric.ed.gov/fulltext/EJ841561.pdf , accessed on 20 September 2020). 11.

[21] Naintyn novitasari. Murni R. dan Maridi. (2015). Mengukur *Problem Solving Skills* Siswa SMA pada Mata Pelajaran Biologi. *Jurnal Biologi Edukasi* (Ed: 14), (online), Vol. 7, No. 1, (http://www.jurnal.unsyiah.ac.id/ JBE/article/download/5480/4701, accessed on 23 September 2020). 3.

No.	Component	Indicator
1.	Defining the problem	• State the facts regarding the problem. • Define a concept or category. • Determine the information/data related to the given problem. • Determine the details of the problem (time, place, perpetrator).
2.	Checking the problem	• Identify root causes. • Examine the interrelationships (cause and effect) of a given problem. • Check the severity of the problem. • Checking the solutions that have been done to solve the related problem.
3.	Planning a solution	• Develop a problem-solving plan based on the root of the problem. • Mapping sub-problems and sub-solutions. • Choose theories, principles, and approaches to solving related problems.
4.	Carry out the plans that have been made	• Make a list of problems to be solved. • Sequencing work steps related to solutions that have been made. • Determine who needs to be contacted for information on implementing the solution.
5.	Evaluate	• Check the feasibility of the solution made. • Make assumptions regarding the solutions made. • Estimating the results that will be obtained through the solutions that have been made. • Choose the right media to convey and communicate the solutions that have been made.

Furthermore, according to Winarso, problem-solving is a level that must be solved by an understanding amount of knowledge and work skills and is the result achieved by students after the students concerned experience a problem-solving learning process taught by certain knowledge.

According to Rahmat (Winarso, 2014), 4 factors influence the process of problem-solving, namely motivation, wrong beliefs and attitudes, habits, and emotions. [22]

Problem-solving skills encourage thinkers to fully understand the practical nature of complex problems and identify approaches to problem-solving. Learning involves self-regulation. Good students can think to monitor themselves, develop their learning strategies, and learn from experience and mistakes. Higher-order thinking is effort. Motivation allows the thinker to initiate creative activities beyond rote memorization and emulation. [23]

The relationship between creative thinking skills in problem-solving activities is shown by several findings according to Hwang et al, (2007) in Yuliani, Dharmono, Naparin, and Zaini, (2018) defining creativity as the ability to solve problems or produce something useful and new. [24] Then, Krutetski (Park, (2004) in Yuliani, Dharmono, Naparin, and Zaini, (2018)

[22] Wang Winarso. (2014). Problem Solving, Creativity and Decision Making dalam Pembelajaran Matematika. *EduMa*, (online), Vol. 3, No. 1, (https://www.researchgate.net/publication/317182912, accessed on 20 September 2020). 7.

[23] Wang, S. and Hai W. (2014). Teaching and learning Higher-order Thinking. *International Journal of Arts & Sciences*, (online), Vol. 7, No. 2, (http://universitypublications.net/ijas/0702/pdf/H4V240.pdf, accessed on 23 September 2020). 180.

[24] Yuliani, A., Dharmono, Naparin, A., and Zaini, M. (2018). Kemampuan Berpikir Kreatif Mahasiswa Pendidikan Biologi dalam Penyelesaian Masalah Ekologi Tumbuhan. *BIOEDUKASI: Jurnal*

views creativity as the ability to find solutions to problem flexibility. [25] The important role of creativity in problem-solving is also explicitly stated by Nakin (2003) in Yuliani, Dharmono, Naparin, and Zaini, (2018) who view creativity as a problem-solving process. [26]

Problem-solving skills and generating something new are complex activities and are closely related to one another. A problem generally cannot be solved without thinking, and many problems require new solutions for students or study groups. On the other hand, producing something new (objects, ideas) for students, and creating something, includes problem-solving. This means that factual information and concepts are not important. As we have seen, mastery of information is necessary to acquire concepts; both of which must be remembered and considered in problem solving and creativity. [27]

In conclusion, problem-solving skills with creative thinking skills are not related to creative thinking skills to generate new ideas and ideas that can solve a problem. Problems that can be solved are problem-solving skills.

A good problem solver identifies exactly what the problem is with facts and information, what might be a barrier to solving it, and what solutions are expected to work. Then look for creative solutions or strategies and plan them. A good troubleshooter then tries at least one of the solutions. For more complex problems, good problem solvers can prioritize and evaluate the relative effectiveness of different solution strategies. After planning, it is implemented in solving the problem.

Socioscientific Issue (SSI) in Biology Learning

Biology learning in SMA/MA equivalent in class X about environmental change is discussed in chapter 10 environmental/climate change and waste recycling. Climate change occurs in both natural and artificial ways. Climate change naturally occurs in time with nature. However, artificial climate change occurs due to human actions in a short time and destroys nature. Climate change due to human actions are caused by science and technology used by humans. The increasingly sophisticated science and technology have a negative side in the globalization of civilization on this earth. The negative effect that penetrates various fields such as social, economic, and others are called the Sosisintifik Issue.

According to Janasoff, advances in science and technology are constantly creating new intersections between science and society which result in complex and often controversial issues. One of the problems discussed above is climate change. According to research by the National Research Research Council and the NGSS Lead States, SSI instructional instruction has emerged as effective instruction for students to contextualize their science learning in complex social and political contexts. [28]

Pendidikan Biologi, (online), Vol. 11, No. 1, (DOI: http://dx.doi.org/10.20961/bioedukasi-uns.v11i1.19736, accessed on 20 September 2020). 30.

[25] ibid

[26] ibid

[27] ibid

[28] Tamara S. Hancock, Friedrishen, P. J., Kinslow, A. T., and Sadler, T. D. (2019). Selecting Socio-scientific Issues for Teaching a Grounded Theory Study of How Science Teachers Collaboratively Design SSI-Based Curricula. *Science and Education*, (online), Vol. 7, No. 28, (https://doi.org/10.1007/s11191-019-00065-x, accessed on 22 September 2020). 640.

According to Putriana, Suryawati, Suzanti, and Zulfarina (2020), SSI learning has several benefits, namely, (1) growing awareness or science literacy in students so that they can apply evidence-based scientific knowledge in everyday life, (2) the formation of social awareness where students can reflect on the results of their reasoning, (3) encourage argumentation skills in the process of thinking and reasoning scientifically on a phenomenon that exists in society, and (4) improve critical thinking skills which include analyzing, making conclusions, providing explanations, evaluating, interpret, and perform self-regulation. Therefore, learning Biology based on Socioscientific issues (SSI) is following the development of technology and science in this era. [29]

According to Evagorou et al., (Espeja and Digna, 2015), Socio-scientific Issues (SSI) are socially controversial (or socially living) topics or issues that have a scientific component but also include other disciplines and interests (politics, economics, ethics), etc.) and which involves the evaluation of moral and ethical aspects.[30] Meanwhile, Anagüna and Muhammet (2010) stated that the features of the socioscientific issue are current events, having a scientific basis, and effects on the lives of individuals and society. The socioscientific issue in science and technology education is to inform individuals in society through education and create awareness about the effects of scientific and technological developments on human life or health. [31]

Ratcliffe (2003) states that this problem lies within scientific knowledge. According to him, socioscientific issues consist of everyday issues and affect the lives of individuals and society negatively or positively. [32] Bossér (2018), in his book on Socoiscietific issues (SSI), implies that utilizing issues that have a basis in science and have an impact on society addresses personal, local, national, and global dimensions. Typically, dealing with SSI involves evaluating sometimes incomplete, conflicting information, and considering values, both one's own and that of others, regarding the issue under consideration. [33]

Based on the statements of the researchers about the Socioscientific issue (SSI) is an educational approach with the topic of discussing issues of technology and science that have an impact on society, which aims to stimulate students' cognitive, affective and psychomotor

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[29] Astrid Riauda Putriana, Suryawati, E., Suzanti, F. dan Zulfarina. (2020). Socio Scientific Issue (SSI) Based LKPD Development in Learning Natural Science SMP Class VII. *Jurnal PAJAR (Pendidikan dan Pengajaran),* (online), Vol. 4, No. 1, (DOI: http://dx.doi.org/10.33578/pjr.v4i1.7919 , accessed on 22 September 2020). 81.

[30] Anna Garido Espeja,, and Digna C. L. (2015). Socio-scientific Issues (SSI) in Initial Training of Primary School Teachers: Pre-service Teachers' Conceptualization of SSI and Appreciation of The Value of Teaching SSI. International Conference on University Teaching and Innovation, CIDUI 2014, 2-4 July 2014, Tarragona, Spain. *Procedia-Social and Behavioral Sciences,* (online), 196 (http://creativecommons.org/licenses/by-nc-nd/4.0/, accessed 22 September 2020). 81.

[31] Sengul S. Anagüna , and Muhammet . (2010). Teacher Candidates' Perceptions Regarding Socio-Scientific Issues and Their Competencies in Using Socio-Scientific Issues in Science and Technology Instruction. *Procedia Social and Behavioral Sciences,* (online), Vol. 10, No. 16, (https://earsiv.anadolu.edu.tr/xmlui/bitstream/handle/11421/14400/14400.pdf?sequence=1&isAllowed=y, accessed on 22 September 2020). 981.

[32] Mary Ratcliffe, and Marcus G. *Science Education for Citizenship Teaching Socio-Scientific Issues.* (Philadelphia: Open University Press, 2003). 109.

[33] Ulrika Bossér. *Exploring the complexities of integrating socioscientific issues in science teaching*. (Kalmar: Department of Chemistry and Biomedical Sciences, Linnaeus University, 2003). 13.

abilities. The component of the Socioscientific issue (SSI) taken from Ziedler et al. (2005) can be seen in table 3.

Table 3. Socioscientific issue (SSI) Components in Biology Learning

No.	Component	Indicator
1.	Scientific content	Climate change
2.	Life experience	Surrounding environment
3.	Cognitive and Moral development	1. Creative thinking skills 2. Problem-solving skills

The socioscientific issue (SSI) in this study is focused on showing students' creative thinking skills and problem-solving skills which are discussed on the topic of climate change in class X SMA/MA or equivalent. So that the material is adjusted to the 2013 Curriculum with an analysis of KD material on environmental/climate change and waste recycling in table 4. [34]

Table 4 . Basic Competency Analysis for class X SMA/MA Materials on Environmental/Climate Change and Waste Recycling with Potential Socioscientific Issues (SSI)

Code	Basic Competence	*Climate Change Socioscientific Issue* (SSI)
3.10.	Analyze data on environmental changes and the impact of these changes on life.	1. Environmental damage/ environmental pollution
4.10.	Solving environmental problems by designing waste recycling products and environmental conservation efforts.	2. Solutions and efforts for environmental preservation.

Materials on environmental/climate change and waste recycling with potential Socioscientific issues (SSI) are associated with environmental problems that occur in the area. focuses on the province of North Sumatra and specifically in South Tapanuli.

2 Method

Study descriptive done in the city Padangsidimpuan with subject study students of SMA N 1 Padangsidimpuan, SMA N 4 Descriptive research was conducted in the city of Padangsidimpuan with the research subjects of 505 students of SMA N 1 Padangsidimpuan, SMA N 4 Padangsidimpuan and SMA N 6 Padangsidimpuan. The instrument used is an essay test on creative thinking skills with as many as 5 questions and problem-solving skills with as many as 5 questions. The essay questions are adapted and modified from PISA questions and Biology olympiad questions where the material is adapted to the issues of everyday life. This is supported by the statement of Ratclife (2003), which states that Socioscientific Issues consist of everyday issues and affect the lives of individuals and society negatively or positively. Then the essay questions were validated by three expert lecturers and declared

[34] Dana Zeidler, L., Sadler, TD, Simmons, ML, and Howes, EV (2005). Beyond STS: A Research-Based Framework for Socioscientific Issues Education. *Science Education*, (online), Vol. 89, No. 3, (DOI: 10.1002/sce.20048, accessed on September 6, 2020). 361.

valid. Then the students answered the essay questions in 75 minutes. After the students answered the researcher assessed the students' essay questions. On creative thinking skills, students' answers are assessed based on each indicator. Can be seen in table 5.[35]

Table 5. Category Each Indicator of Creative Thinking Skills

Category	*Fluency*	*Flexibility*	*Originality*	*Elaboration*
High	Writing down the answer correctly with a total score of >5	Writing answers from various aspects with 3 answers	Having original information with a score of 3	Having an elaboration with a score of 3
Moderate	Writing the answer correctly with a total score of 3-5	Writing down answers from different aspects with 2 answers.	Having the original answer with a score of 2	Having the original answer with a score of 2
Low	Having the original answer with a score of 3	Writing answers from different aspects with 2 answers.	Having an original answer with a score < 2	Having an elaboration with a score of < 2

After the assessment is based on table 5, the student scores are categorized based on table 6 below.

Table 6. Category Creative Thinking Skills Score

No.	Creativity Value Interval Student	Percentage(%)	Category Ability Think Creative Student
1.	66-75	88-100	Creative
2.	56 – 65	74-87	Enough creative
3.	46 – 55	61-73	Less creative
4.	35-45	47-60	Not creative

Students' answers on problem-solving skills were scored based on each indicator. The indicator for defining the problem is given a value of 4, the indicator for examining the problem is given a value of 4, the indicator of planning a solution is given a value of 3, and the indicator of implementing the plan that has been made is given a value of 3 and the indicator of evaluating is given a value of 4.

Table 7. Category Problem Solving Skills Score

No.	Student Problem Solving Skills Score Interval	Percentage (%)	Category Student Problem Solving Skills Score
1.	15-18	83-100	High
2.	10-14	56-82	enough
3.	5-9	28-55	Low

[35] S. A. Handayani, Y. S, Rahayu and R. Agustini, (2021). Students' Creative Thinking Skills in Biology Learning: Flexibility, Originality, and Elaboration. *Journal of Physics: Conference Series*, (online), Vol. 1747, No. 1, (DOI: https://iopscience.iop.org/article/10.1088/1742-6596/1747/1/012040/pdf, accessed on March 23, 2022). 5.

Then, the correlation test was carried out. This test was conducted to determine the degree of relationship between the variables in the study. Is the relationship between variables closely related and unidirectional or not related at all? This is done by using a non-parametric correlation test using SPSS 25. The correlation test on the variable creative thinking skills with problem-solving skills using the Spearman Rho correlation test.

3 Results and Discussion

The creative thinking skills of class X IPA students of SMA N Padangsidimpuan for the 2021/2022 academic year for more details can be seen in table 8 below:

Table 8. Creative Thinking Skills of Class X Science Students at SMA N Padangsidimpuan on Climate Change

No.	Indicator	Score	
		Percentage (%)	Category
1.	**Fluency**	84	Enough
2.	**Flexibility**	95	High
3.	**Originality**	80	Enough
4.	**Elaboration**	76	Enough
Average		**84%**	**Enough**

Based on table 8 which has been shown, it shows that the students of class X IPA SMA N in the city of Padangsidimpuan have enough creative thinking skills which are shown in an average percentage of 84%. Of the five indicators of students' creative thinking skills on climate change material, the highest indicator of flexibility is obtained with an acquisition of 95%. The percentage of students who have not achieved creative thinking skills is around 16%. More details can be seen in the image below.

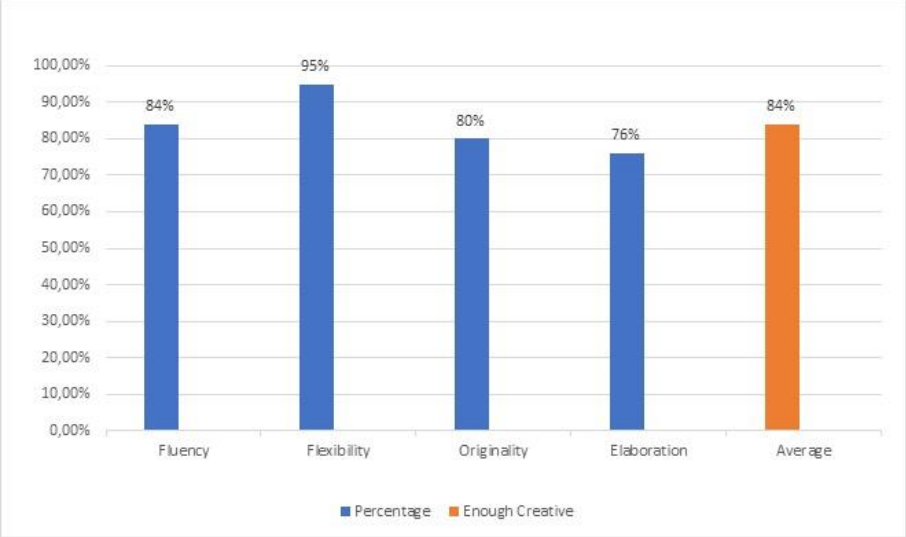

Fig. 1. Creative Thinking Skills of Class X Science Students at SMA N Padangsidimpuan on Climate Change Based on the Indicators of Creative Thinking Skills from Torrence (1969)

Table 9. Profile of Creative Thinking Skills of Class X Science Students at SMA N Padangsidimpuan on Climate Change

Category	interval	Frequency	Percentage (%)
Creative	66-75	96	19.01%
Enough Creative	56-65	13	2.57%
Less Creative	46-55	167	33.07%
Not Creative	34-45	229	45.35%
Sum		**505**	**100 %**

Table 9 shows that students have creative thinking skills with a very high category as many as 96 students with an overall percentage of 19.01%. Then the high category has 13 students with an overall percentage of 2.57%. Furthermore, in the category of less creative as many as 167 students with an overall percentage of 33.07%. And the not creative category has 229 students with an overall percentage of 45.35%. So, the students of class X IPA SMA N Padangsidimpuan from the number of subjects 505 students obtained different categories according to their ability to answer and analyze questions. The following can be seen in the general description of the level of creative thinking skills of students in class X IPA SMA N Padangsidimpuan:

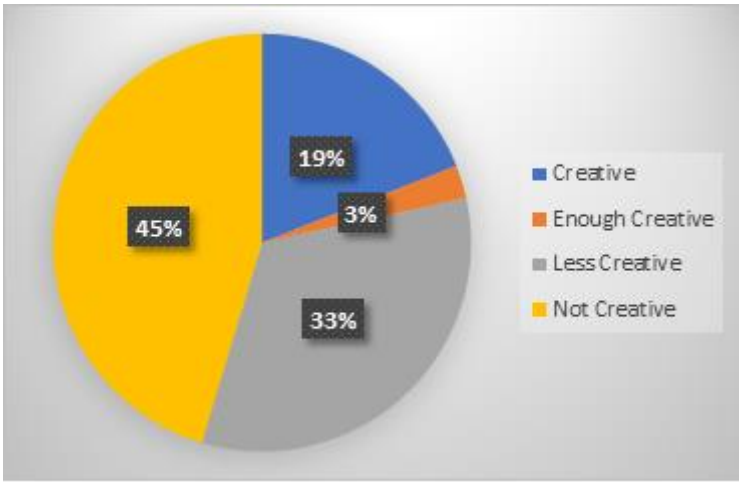

Fig. 2. Profile of Creative Thinking Skills of Class X IPA SMA N Padangsimpan on Climate Change

Creative thinking skills possessed by students on climate change material are based on students' ability to come up with answers with the indicators being in enough creative category with a percentage of 84%. We look at the average indicators that often appear are indicators of fluency and flexibility. Students can display 2 indicators of the four indicators of creative thinking skills categorized as enough creative. While the indicators of originality and elaboration are still not shown in the students' answers. Then the students in the low category were 45% with a total of 229 students. Then the second highest category is less creative with a

total of 167 students and a percentage of 33%. In the next category, namely the creative category as many as 96 students with a percentage of 19% and the last category is quite creative as many as 13 students with a percentage of 13%. This shows that students have low creative levels. So that after totaling it can be concluded that all students have creative thinking skills, students are in the category of enough creative.

The level of creative thinking skills of students is enough creative, which means that students' creativity needs to be improved to enter the high category. The times are getting higher and the quality of education must be improved. students' creative thinking skills are in the sufficient category because other indicators are still in the sufficient and low categories.

The creative thinking skills possessed by students are still in the sufficient category because the learning process has not been handled properly. And the need to encourage students' motivation to learn actively and improve students' creative thinking skills. In the Biology learning process in the city of Padangsidimpuan, much online learning is carried out. In this learning, many students do not fully focus on the teacher's direction in learning. When the teacher gives the exercise there are still many students who do not understand the steps to completing it.

Students do not fully carry out the tasks given by the teacher. There are still many parents or other people who do the student's practice assignments. so that students do not get an adequate learning experience. The learning method given by the teacher is still boring for students. so that the need for teachers to teach with a learning method approach that attracts students' interest and makes students experience firsthand such as the socioscientific issues learning approach. Students also need to be stimulated so that they can develop their creative thinking skills by carrying out mini projects and reading information on surrounding phenomena. So that students remember and stimulate different ideas. Next, Problem-solving skills student of class X IPA SMA N Padangsidimpuan Year The teaching of 2021/2022 is in the following table 10:

Table 10. Problem Solving Skills of Class X IPA SMA N Padangsidimpuan on Climate Change

No.	Indicator	Score	
		Percentage (%)	Category
1.	Defining the problem	82%	Enough
2.	Checking the problem	75%	Enough
3.	Planning a solution	75%	Enough
4.	Carry out the plans that have been made	79%	Enough
5.	Evaluate	85%	High
	Average	79%	**Enough**

Based on table 10 which has been shown, it shows that the students of class X IPA SMA N in the city of Padangsidimpuan on climate change have problem-solving skills in the good category which are shown in the average percentage of the overall indicators of 79%. The percentage of problem-solving skills that have not been achieved is 21% of the total 100%. For clearer data acquisition of each indicator of student problem-solving skills can be seen in Figure 3 below:

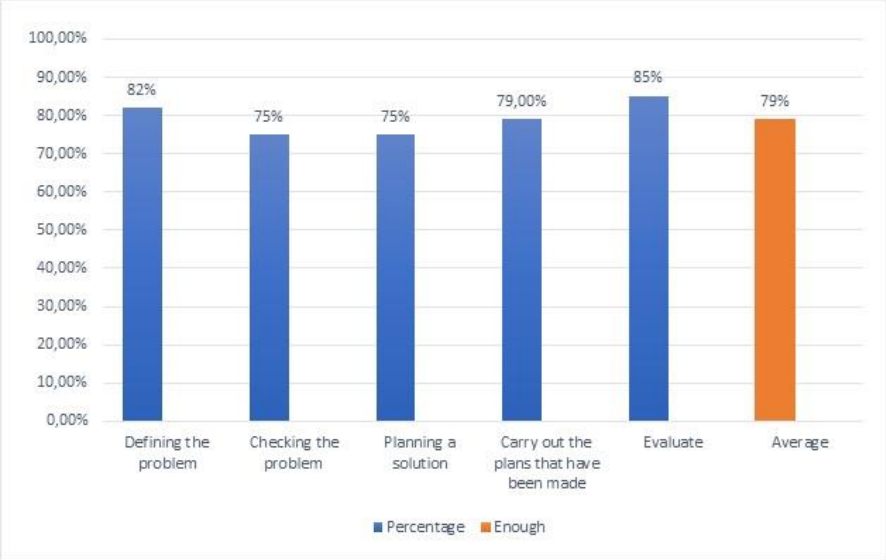

Fig. 3. Problem Solving Skills of Class X IPA SMAN Padangsidimpuan on Climate Change Based on Problem Solving Indicators by Polya (1957)

Problem-solving skills of students have a percentage of 79% which is in the high category. What can be explained by the data on the number of students who answered the questions? Students who answered each question were assessed and categorized by their percentage and on a pie chart. The category of problem-solving Skills for students of class X IPA SMA N Padangsidimpuan in Biology learning for the 2021/2022 academic year is presented in table 11 as follows:

Table 11. Profile of Problem-Solving Skills of Class X IPA SMA N Padangsidimpuan on Climate Change

Category	interval	Frequency	Percentage (%)
High	15-18	308	60.99%
Enough	10-14	124	24.55%
Low	5-9	73	14.46%
Sum		**505**	**100%**

Table 11 shows that students have problem-solving skills with a very high category as many as 308 students with a percentage of 60.99%. Then the high category has 124 students with a percentage of 24.55%. Furthermore, in enough category, there were 73 students with an overall percentage of 26.14%. And in the low category, there are no students who answer. So, the students of class X IPA SMA N Padangsidimpuan from the number of subjects 505 students obtained different categories according to their ability to answer and analyze questions. The following can be seen in the general description of the level of problem-solving Skills of students of class X IPA SMA N Padangsidimpuan:

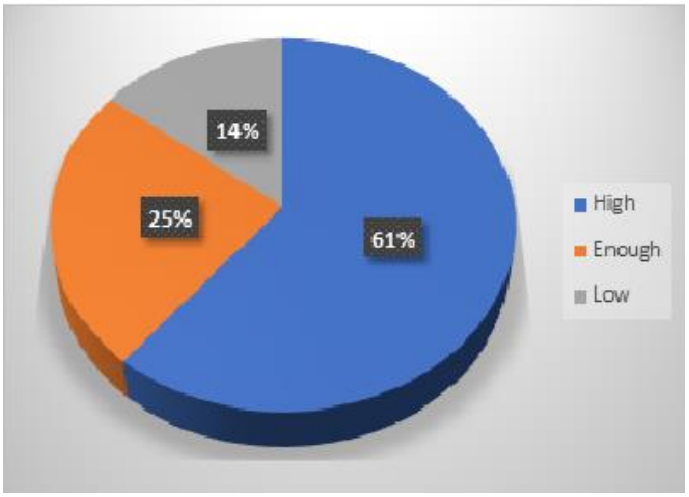

Fig. 4. Profile of Problem-Solving Skills of Class X IPA SMA N Padangsidimpuan on Climate Change

The level of problem-solving skills of students is in the sufficient category, which means that students are quite capable of solving problems related to climate change material. Problem-solving skills are a kind of thinking that has a strong desire to solve problems in life. Problem-solving skills in evaluating indicators have a percentage of 85% in the high category. This indicator shows that students are declared to have been able to evaluate the solutions to be used and can estimate the results. Other indicators are in the sufficient category where students are quite able to solve problems. With an unsatisfactory solution.

The basic knowledge of students who are still lacking causes students to give inadequate answers. Less motivation to learn and less interactive learning methods cause students to feel burdened in finding knowledge information from books, the internet, and other social media. The problem of natural disasters, namely COVID-19 that occurred in Indonesia is one of the reasons students are less motivated in learning. Because the learning process is adapted to environmental conditions, students carry out online learning with insufficient time.

Lack of student creativity causes students' problem-solving skills to be lacking. This statement can be seen from the correlation test on students' creative thinking skills with students' problem-solving skills. The results were obtained by the coefficient of 0.929**. This means that the level of relationship (correlation) between creative thinking skills and problem-solving is very strong. The sign (**) means that the correlation is significant at 0.01. The coefficient of 0.929 is positive so the relationship between the two variables is unidirectional. This means that the higher the students' creative thinking skills, the higher the students' problem-solving skills.

So, the need to improve creative thinking skills so that students' problem-solving skills also increase. Student creativity is not obtained from birth but through effort and hard work. Students need to learn and get adequate information. Then the teacher becomes a facilitator by facilitating student learning. So, teachers need to improve students' teaching abilities, either directly or indirectly. Such as teaching with an interesting learning method approach, conducting experimental activities, and directing students to explore and adapt to developing

technology. Teachers should also try to understand students to know the Steps for learning that can motivate and improve students' creative thinking skills and problem-solving skills.

4 Conclusion

Based on this research, the profile of creative thinking skills of SMA N Padangsidimpuan class X IPA students were in enough creative category with an average score of 84%. Then the problem-solving skills of SMA N Padangsidimpuan class X IPA students are in the good category with an average value of 79%. between creative thinking skills and problem-solving skills are very close. So, it is necessary to increase students' creativity to improve their problem-solving skills. teacher intervention is needed to train and help students improve students creative thinking skills and problem-solving skills.

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