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Creative Attitude in Science Learning Model to Improve Creative Thinking Skills and Positive Attitude of Students Towards Science

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ABSTRACT
The results of the literature study show that the Problem Based Learning (PBL) and Creative Problem Solving (CPS) models are proven to be able to improve students' creative thinking skills, but also have weaknesses that need to be improved. To complement the weaknesses of the application of the PBL Model and the CPS Model, it is necessary to develop an Innovative Learning Model that can improve students' creative abilities. The CASL (Creative Attitude In Science Learning) model is a learning model that integrates the CPS model with the PBL model in learning activities. The development of the CASL model is supported by the latest learning theories and the empirical foundation of the latest research. The CASL model has five phases, namely: (1) Generating positive attitudes as creative individuals, (2) Organizing creative learning, (3) Guiding creative investigations, (4) Forming positive attitudes in demonstrating scientific creativity, and (5) Attitude evaluation positive and scientific creativity.

INTRODUCTION

Physics is a branch of science that examines natural phenomena in everyday life and is based on the results of observations or experiments by measuring certain variables in it. The results of these observations or experiments are used to develop theories that can be used to predict future observations or experiments (Serway & Jewett, 2014). Learning physics is not enough to memorize physics concepts and practice questions alone, but can be used to develop student creativity in solving a problem through observation or experimentation activities according to the material being taught (Mukhopadhyay & Sen, 2013; Kier & Lee, 2017). Learning that uses scientific methods can foster a positive attitude towards student science, where students will feel optimistic in dealing with, solving problems, and finding creative ideas in problem solving to get satisfactory results (Rukavina, et al., 2012). The demands of the 21st century and the Industrial Revolution for the field of education are faced with global competition so that the demand for quality resources is demanded. To realize this, a way is needed, one of which is by improving the quality of education with various innovations carried out by the academic community in producing graduates, especially educators.

Several learning models that have been used to train creative thinking skills and positive attitudes towards science are the PBL and CPS models. The PBL model is able to increase the effectiveness of learning outcomes, but there are still some weaknesses that need to be improved, namely (1) less time for exposure and evaluation of ideas/ideas from others indeveloping scientific creativity; (2) lack of feedback in learning physics; and (3) the instruction given to students in conducting exploration is not in-depth, students are not trained in asking scientific questions and finding answers to these questions independently. PBL will be more successful if students have a positive attitude towards science so that teamwork and social interaction can be improved in solving problems more effectively and it is easier to develop students' creative thinking skills (Turiman et al., 2012; Mynbayeva, et al., 2016).

The CPS model is a learning model that focuses on student activities to think creatively in solving problems by paying attention to important facts in the surrounding environment, then generating various ideas and choosing the right solution to be implemented in real time. The CPS model also has several weaknesses, namely: (1) different levels of understanding and intelligence of students in dealing with problems; (2) students' unpreparedness, one of which is a positive attitude towards science which influences them in dealing with new problems encountered in the field, especially when the problems they face are slightly different; (3) It takes a long time to prepare students for the stages of the CPS learning model; (4) the problem to be solved is far from the environment around students (Syamsu, et al., 2016; Kurniawan, et al., 2019).

The development of the CASL model as an innovation from the recommendations of various weaknesses in the PBL and CPS models, which is deliberately designed to produce graduates who have the ability to think creatively and have a positive attitude towards science. The development of the CASL model uses a transdisciplinary approach (educational science, physics, psychology, and technology) so that it includes original and tested work in training creative thinking skills and positive attitudes towards science which are currently still low. The CASL model was developed referring to John Dewey's problem-solving path and the scientific creativity hypothesis and is supported by the latest learning theories including; constructivism theory, metacognitive skills, complex cognitive processes, interrelationship models, advanced organizers, and scaffolding. The CASL learning model emphasizes students to analyze, relate, and solve complex problems related to physics, technology, and everyday life by using creative ideas that arise in students and having a positive attitude towards science in learning.

LITERATURE REVIEW

The learning model characteristics

The learning model is a frame of mind that guides someone to design and implement learning to help students to gain information, ideas, skills, values, ways of thinking, and the meaning of their expressions. According to Arends (2012) at least four specific characteristics of the learning model that can be used to achieve the learning objectives are (1) the logical theoretical rationale of the design, (2) the learning objectives of the developed model, (3) the teaching behavior that is needed for the learning to be done, and (4) the needed learning environment to achieve the learning objectives.

PBL Model

PBL is designed for multiple disciplines (science, history, geography, and environment) with the aim of developing inquiry and problem-solving skills, self-study skills, and social skills according to adult role standards. The essence of PBL is that it involves the presentation of authentic and meaningful situations that serve as a foundation for student investigation and inquiry (Arends, 2012, Gorghiu et al., 2015). PBL syntax can be seen in Table 1.

Table 1. The syntax of the problem based learning model.

No	Phase	Teacher Behavior
1	Orient students to the problem	Teacher goes over the objectives of the lesson, describes important logistical requirements, and motivates students to engage in problem-solving activity.
2	Organize students for study	Teacher helps students define and organize study tasks related to the problem.
3	Assist independent and group investigation	Teacher encourages students to gather appropriate information, conduct experiments, and search for explanations and solutions.
4	Develop, present artifacts, and exhibits	Teacher assists students in planning and preparing appropriate artifacts such as reports, videos, and models, and helps them share their work with others.
5	Analyze and evaluate the problem-solving process	Teacher helps students to reflect on their inves problem solving process investigations and the processes they used.

(Source: Arends, 2012)

The results of Ersoy & Baser's (2014) research conclude that PBL contributes to the creativity development of students in the Department of Statistics, Faculty of Science, Dokuz Eylul University. Students can solve multidimensional problems and are able to adapt to changing situations. The quality of communication between teachers and students is very important, so that teachers can become students' partners during the learning process (Gorghiu et al., 2015). Biology and Geology science teachers at primary and secondary schools recognize the importance of PBL as an inquiry approach that helps teachers explain aspects of the nature of science (Mountinho et al., 2014). PBL also helps students understand the impact of social and cultural aspects on the development of scientific knowledge, understanding the importance of creativity and imagination in the development of scientific knowledge.

PBL researchers recommend that teachers pay attention to the importance of feedback in science learning (Gorghiu et al., 2015), increase attention to the nature of contemporary science and its applications (Mountinho et al., 2015), PBL has the potential to develop students' professional identity, the importance of depth of instruction in exploring according to the Next Generation Science Standard (Nariman & Chrispeels, 2015), observing the real effect of PBL on self-regulation (Erdogan & Senemoglu, 2014; English & Kitsantas, 2013).

The results of the research above indicate the importance of improving PBL intervention programs designed for the development of scientific creativity. Improvements in intervention programs need to pay attention to the importance of self-regulation, depth of instruction in exploration, openness of ideas, evaluation of ideas, and increased attention to the nature of contemporary science and its applications. The views of cognitivism and constructivism can also be applied in creative learning through analyzing tasks, managing step-by-step problem solving, setting goals and measuring performance based on goals, promoting a more open learning experience and varying learning outcomes for each student. The PBL model also helps students understand the importance of scientific creativity and scientific imagination in the development of scientific knowledge, as well as the social and cultural impact of scientific knowledge development (Zainuddin et al., 2020). The PBL model has advantages and disadvantages which can be seen in Table 2.

Table 2. Strengths and weaknesses of the PBL model in training students' creative thinking skills and positive attitudes towards science.

Benefit	Weakness
1. Students can solve complex and not clearly defined problems (Moreno, 2010). 2. Can be used to teach various disciplines such as science, history, geography, and the environment (Arends, 2012). 3. Can be used to develop problem solving skills, independent learning skills, and social skills according to adult role standards (Arends, 2012; Ciftci, 2015). 4. Students can solve multi-dimensional problems and are able to adapt to changing situations (Ersoy & Baser, 2014). 5. Can improve investigation and problem solving skills by understanding existing variables.	1. Lack of time for exposure and evaluation of ideas from others in developing scientific creativity (Gregory et al., 2013). 2. Lack of feedback in learning physics, so that student activities in learning are less than optimal (Gorghiu, et al., 2015). 3. Instructions given to students in conducting exploration are not in-depth, students are not trained in asking scientific questions and finding answers to these questions independently (Nariman & Chrispeels, 2015). 4. Creative thinking and imagination are emphasized on the construction of scientific knowledge, but are less related to the nature of contemporary science and its applications (Mountinho et al., 2014). 5. Students may experience stress and disinterest because they are faced with a new environment (Ocon, 2014)

CPS Model

Creative Problem Solving (CPS) learning model is a learning model that is applied to learning and problem solving skills, by increasing creativity. This learning model focuses on student activities to solve problems faced by bringing up various ideas and finding appropriate solutions that will be implemented in real life. Problems in solving require creative ideas or strategies. Creative problem-solving strategies, meaning all the ways a person does creative thinking, with the aim of solving a problem creatively he faces. This is in line with what Apino (2016) stated, that "CPS is an operational model for a specific kind of problem solving where creativity can be applied to the task at hand". This opinion explains that the CPS model is a learning model that can be used to practice problem solving, where innovation is applied in completing the tasks at hand.

Problem solving skills can be trained in learning by providing a problem that must be solved by students either through observation or investigation. Observation or investigation activities will train students to formulate a problem, design experiments, collect and analyze data, and conclude the results are in accordance with the problems being solved. These activities indirectly hone students' creative thinking by thinking about creative ideas in solving them. The syntax of the CPS learning model is presented as Table 3.

Table 3. Syntax of the CPS learning model.

No	Phase	Lecturer Activities
1.	Visionizing or Objective - Finding	Lecturers convey the vision and learning objectives, increase student awareness through imagining (imagining) the potential challenges that exist in the problem.
2.	Fact-Finding	Lecturers motivate students to gather as much information as possible regarding the problems at hand by using all their perceptions and

No	Phase	Lecturer Activities
		senses.
3.	Problem-Finding	Lecturers guide students in clarify the challenge or problem by redefining it in a new and different way.
4.	Idea-Finding	Lecturers guide students to generate as many ideas as possible that have the potential to be used to solve problems. Students try to make new connections between ideas through analogies, manipulation of ideas, or making new associations from people's ideas.
5.	Solution-Finding	Lecturers guide students in considering various selected criteria, to evaluate the advantages of the ideas put forward and get the best solution.
6.	Acceptance-Finding	Lecturers provide reinforcement by giving students time to improve the chosen solution so that it is easier to implement. The goal is to turn ideas into action through the development and implementation of an action plan. Furthermore, the results of the development and implementation of the action plan are used as conclusions.

(Source: Apino, 2016)

Based on the syntax of the CPS model above, it can be seen that the purpose of this model is to train students when faced with a problem, students can apply problem solving skills, and expand the creative thinking process. This is in accordance with constructivism learning theory, that children actively build their own knowledge through various observation and investigation activities. Rahmatin et al. (2019) recommend that the CPS learning model can be used to train creative thinking. The advantages and disadvantages of the CPS learning model can be seen in Table 4.

Table 4. Strengths and weaknesses of the CPS learning model in training students' creative thinking skills and positive attitudes towards science.

Benefit	Weakness
1. Train students to design an invention; 2. Think and act creatively; 3. Solve the problems faced realistically; 4. Identify and conduct investigations; 5. Interpret and evaluate the results of observations	1. Differences in student knowledge in dealing with problems; 2. Student unpreparedness, one of which is scientific attitude in dealing with new problems encountered in the field, especially when the problems are slightly different; 3. It takes a long time to prepare students to carry out the stages of the CPS learning model; 4. The problem to be solved is far from the environment around students (Syamsu, et al., 2016; Kurniawan, et al., 2019).

DISCUSSIONS

Characteristics of CASL Model

The CASL Model have 3 (three) major characteristics, they are: (1) The Logical Theoretical Rationale of Learning Model Design, (2) The Purpose of CASL model Development, (3) Learning Environment.

The Logical Theoretical Rationale of Learning Model Design

The CASL learning model developed by researchers has a goal to be achieved, namely to train students' creative thinking skills and positive attitudes towards science. The syntax design of the CASL learning model with theoretical and empirical support for each phase can be seen in Table 5.

Table 5. Design of CASL model model syntax.

Syntax	Theoretical and Empirical Support
Phase 1: Cultivating a positive attitude as a creative person	Theoretical support 1. Attention: Students can learn through observation by paying attention to relevant information (Moreno, 2010). 2. Individuals will be challenged if they are faced with a new experience, when compared to the experience they already have (Arends, 2012) 3. Metacognitive skills: Students will be more active in thinking about their strategies/knowledge, when what is learned is associated with new situations (Moreno, 2010). 4. Creating classroom conditions that change extrinsic motivation to intrinsic motivation, when students can control their own learning, or arouse curiosity by asking questions (Slavin, 2005; Moreno, 2010). 5. Facilitate students to learn in order to realize learning to be creative and open to new ideas Empirical support 1. Scientific attitude supports student creativity directly (Sternberg, 2012). 2. Barriers to creativity in a person will interfere with generating creative ideas (Mueller et al., 2012). 3. Creative thinking can be achieved if someone thinks beyond what is known. 4. With the motivation of students will try to produce creative ideas. 5. Attitudes towards science can affect student educational achievement and affect their performance" (Narmadha, et al., 2013). 6. The wider positive environment around students has an effect on students' positive attitudes in learning (Erdogan, 2017).
Phase 2: Organizing creative learning.	Theoretical support 1. Complex cognitive process: Students are more likely to think creatively if the learning environment stimulates and encourages independent thinking (Moreno, 2010). 2. Constructivism: Lecturers provide teaching materials and a conducive learning environment to support students in constructing their own knowledge. 3. Advanced organizers, directing students to manage new information by linking existing experiences (Slavin, 2005). 4. Attention: Students can learn through observation by paying attention to relevant information (Moreno, 2010). 5. Individuals will be challenged if they are faced with a new experience, when compared to the experience they already have (Arends, 2012) Empirical support 1. Scientific attitude supports students' creativity directly (Sternberg, 2012). 2. A free, open, democratic, and positive atmosphere are the key factors of scientific creativity (Hu et al., 2013). 3. Science process skills, inquiry, and creativity have a very close relationship to realize good learning (Charlesworth & Lind, 1995)
Phase 3: Guiding	Theoretical support

Syntax	Theoretical and Empirical Support
creative investigations.	1. Complex cognitive process: Creativity is an important component for solving problems that are not clearly defined. (Eggen & Kauchak, 2013). 2. Metacognitive skills: Students will be more active in thinking about their strategies/knowledge, when what is learned is associated with new situations (Moreno, 2010). 3. Constructivism: Students actively construct their knowledge through personal experiences with other people and the environment (Moreno, 2010). 4. A scaffolding is needed to help students solve problems that are not clearly defined (Eggen & Kauchak, 2013). 5. Production: Students need to convert mental representations created during coding to motor activities (Moreno, 2010). Empirical support 1. Scientific attitude supports student creativity directly (Sternberg, 2012) 2. Students actively exchange ideas, and build knowledge with investigation-based learning (Setiadi, 2013). 3. Emphasizing the activity of generalizing a hypothesis, designing experiments, and evaluating an idea is one of the proofs to train students' scientific creativity (Ayas & Sak, 2014). 4. To produce something meaningful in solving a problem faced requires a creative analysis of a person so that he becomes skilled and effective in solving problems (Kaufman, 2012; Rüßmann, et al., 2015). 5. Scientific creativity-based MFIs can be used to train scientific creativity.
Phase 4: Establish a positive attitude in demonstrating scientific creativity.	Theoretical support 1. Complex cognitive process: students can produce creative products when students have mastered the domain of divergent thinking (Moreno, 2010). Experiences that involve creativity and imagination can increase students' intrinsic motivation (Eggen & Kauchak, 2013). 2. Metacognitive skills: Students will be more active in thinking about their strategies/knowledge, when what is learned is associated with new situations (Moreno, 2010). 3. Constructivism: Students actively construct their knowledge through personal experiences with other people and the environment (Moreno, 2010). 4. Motivation, students must be motivated to learn from the model and reproduce what they learn (Moreno 2010). 5. Students need many opportunities to use goal setting and self-evaluation strategies to understand when, how, and why they should be independent (Moreno, 2010). Empirical support 1. Scientific attitude supports students' creativity directly (Sternberg, 2012) 2. Giving creativity assignments can expand the range of creativity by applying, generating, finding, comparing, connecting, imagining and planning creative ideas. 3. A positive attitude towards science plays a very important role in the success of learning science, and in the lives of students in the future (Blascova, 2014; Genz, 2015; Kurniawan, et al., 2019).

Syntax	Theoretical and Empirical Support
	4. Students are required to solve problems using creative ideas and their application in everyday life (Demir, 2014; Liu & Lin, 2014).
Phase 5: Evaluate positive attitudes and scientific creativity.	Theoretical support 1. Complex cognitive process: students can produce creative products when students have mastered the domain of divergent thinking (Moreno, 2010). 2. Metacognitive skills: Students will be more active in thinking about their strategies/knowledge, when what is learned is associated with new situations (Moreno, 2010). 3. Evaluation learning if involved in the assessment of the learning process and outcomes (Moreno, 2010). 4. Reflection learning occurs when engaging in the process of thinking about thinking and practice in a critical way, learning from the process, and applying what was learned to improve future actions (Moreno, 2010). Empirical support 1. Creativity requires effort, and the effort will be more smoothly if students do it casually. 2. Evaluation of ideas is needed to realize creative students in problem solving (Gregory et al., 2013). 3. A positive attitude towards science plays a very important role in the success of learning science, and in the lives of students in the future (Blascova, 2014; Genz, 2015; Kurniawan, et al., 2019). 4. Students are required to solve problems using creative ideas and their application in everyday life (Demir, 2014; Liu & Lin, 2014).

The learning model that has been developed by the researcher consists of 5 phases. The involvement of students in planning, implementing, and evaluating the learning process that has been carried out has contributed significantly to learning achievement (Yesil, 2013). Details of the explanation of the activities of lecturers and students for each phase of the syntax of the CASL learning model will be described in Table 6.

Table 6. Lecturer and student activities in the CASL learning model.

Lecturer Activities	Student Activities
Phase 1: Cultivating a positive attitude as a creative person	
1. Motivate students by asking questions for research activities 2. Organizing students for research activity problems 3. Communicating learning objectives and the importance of a positive attitude to become a creative person.	1. Provide answers to questions given by the lecturer. 2. Observing and asking questions on the phenomena given by the lecturer and being actively involved in learning 3. Listen carefully to the lecturer's explanation regarding the learning objectives, materials, and the importance of a positive attitude as a creative person.
Phase 2: Organizing creative learning.	
1. Assist students in understanding the phenomena and logistics needed to conduct investigations.	1. Trying to understand the phenomenal material given by the teacher and the logistics (tools and materials) in conducting investigations.

Lecturer Activities	Student Activities
2. Directing the formation of groups of 5-6 students and distributing logistics to each group. 3. Guiding students both individually and in groups in understanding LKM	2. Try to actively participate in the formation of groups of 5-6 students and ensure that the logistics received are in accordance with the needs of the group. 3. Work in groups in understanding the MFI that will be worked on
Phase 3: Guiding creative investigations.	
1. Develop a positive attitude towards science students in experimental activities and examine various sources of information referring to the LKM to solve science problems creatively. 2. Provide scaffolding to students in carrying out scientific investigations. 3. Facilitate interaction between students in groups in carrying out scientific investigations.	1. Trying to develop a positive attitude towards science during learning in understanding science problems, formulating as many problems as possible and choosing one to investigate, designing and conducting experiments, and solving problems creatively by reviewing various supporting information. 2. Asking the lecturer when having difficulties in conducting scientific investigations. 3. Cooperate in carrying out scientific investigations
Phase 4: Establish a positive attitude in demonstrating scientific creativity.	
Provide opportunities for students to make several assessments of scientific creativity and their solutions, then discuss the results of their group performance in front of the class.	Trying to accept and carry out the tasks given by the lecturer by having a positive attitude towards science in presenting the results of the investigation in front of the class
Phase 5: Evaluate positive attitudes and scientific creativity.	
Helping students to evaluate positive attitudes towards science and understanding students' scientific creativity, reflecting on the learning process and follow-up for the next meeting.	Participate in evaluations related to positive attitudes towards science and scientific creativity, reflect on the learning process and follow up for the next meeting

The CASL model was developed to train creative thinking skills and positive attitudes towards science for PGSD students. For further linkage of the CASL model syntax with indicators of creative thinking skills and positive attitudes towards science, for more detail, see Table 7.

Table 7. The relationship between CASL model syntax, indicators of creative thinking skills and positive attitudes towards science.

CASL Hypothetical Model	Creative Thinking Skills Indicator	Indicators of Positive Attitude towards Science
Cultivating a positive attitude as a creative person (phase 1)	fluency, flexibility, originality, elaboration	Attitude to Scientific Inquiry, Adoption of Scientific Attitudes, Enjoyment of Science Lessons
Organizing creative learning (phase 2)	fluency, flexibility, originality.	Attitude to Scientific Inquiry, Adoption of Scientific Attitudes, Enjoyment of Science Lessons

Guiding creative investigations (phase 3)	fluency, flexibility, originality.	Attitude to Scientific Inquiry, Adoption of Scientific Attitudes, Enjoyment of Science Lessons
Establish a positive attitude in demonstrating scientific creativity (phase 4)	fluency, flexibility, originality, elaboration	Attitude to Scientific Inquiry, Adoption of Scientific Attitudes, Enjoyment of Science Lessons, Leisure Interest in Science.
Evaluation of positive attitude and scientific creativity (phase 5)	fluency, flexibility, originality, elaboration	Attitude to Scientific Inquiry, Adoption of Scientific Attitudes, Enjoyment of Science Lessons, Leisure Interest in Science.

The Purpose of CASL Model Development

The CASL model is a science learning model that was developed with the main objective of training students' creative thinking and positive attitude towards science. This model bridges the gap between the competency expectations of graduates and the current actual conditions. The skills of the 21st century and the Industrial Revolution 4.0 require the competence of graduates who are creative and have a scientific attitude (Blascova, 2014), so that graduates can compete with other graduates. Graduates who have skills according to the needs in the field will find it easier to compete with graduates from other universities, both at home and abroad.

Creative thinking skills are cognitive skills possessed by a person to generate and develop new ideas, new ideas as a development of previously born ideas and skills to solve problems in a divergent manner. Creative thinking skills have four indicators, namely: (1) fluency, to measure a person's ability to generate creative ideas in solving a problem; (2) flexibility, to measure a person's ability to generate creative ideas or various ways in solving a problem; (3) originality, to measure a person's ability to generate new or previously non-existent ideas; (4) elaboration, to measure a person's ability to develop or add more specific creative ideas (Siew, et al., 2014).

Learning Environment

A creative learning environment will encourage students to find their own potential in driving the realization of creative behavior. Learning environments that support the implementation of learning with the CASL learning model include: (1) efforts to overcome barriers to creativity; (2) investigation-oriented learning to motivate students in their learning (Liu & Lin, 2013); (3) self-regulation (recommendations of Erdogan, & Senemoglu, 2014); (4) preparing a free, open, democratic, and positive atmosphere as a key factor in developing scientific creativity (Hu et al., 2013); (5) using exposure and evaluation of ideas from others (Gregory, et al., 2013); (6) opportunities for students to actively carry out investigations, exchange ideas, and build their knowledge (Setiadi, 2013); (7) involving as many scientific questions as possible, appreciating various products of imagination (students' visions for the future, new ideas, solutions provided, experiments carried out, etc.), innovating by bravely accepting suggestions and criticisms, and seeing mistakes as a learning process to create change towards success (Latuconsina, 2014); (8) Students will feel a learning atmosphere that evokes a positive attitude towards science to learn, relax, and have fun so as to make students' enthusiasm and concentration high during learning (Anggoro, et al., 2017); (9) Students are accustomed to designing, planning, and conducting creative experiments and problem solving related to everyday life (Rannikmae, 2016); and (10) to realize suitable learning to increase positive attitudes towards science, lecturers must use a joyfull learning approach, interesting hands-on activities, creating real and visible concepts, including novelty activities, and requiring projects that helped with learning to collect and analyze data were the common characteristics of the fun science experiences in the methods course (Anggoro, et al., 2017).

Component of CASL Model

The learning process in the learning model developed is contained in the components of the CASL model. According to Joyce et al, a good learning model must have 5 (five) main components in the model, namely: (1) Syntax, (2) Social system, (3) Reaction principles, (4) Support systems, (5) Instructional impact and nurture impact.

Syntax

The syntax of the learning model describes the overall sequence of steps which are generally followed by a series of learning activities that are arranged logically and systematically. The CASL model syntax begins with Phase 1: Generating a positive attitude as a creative person. This phase aims to generate positive attitudes for students to become creative individuals. In this phase, the lecturer motivates to evoke a positive attitude in himself and gives a question related to the material to be studied related to daily life. The questions given aim to motivate students to try to demonstrate their scientific knowledge, try to handle scientific tasks effectively, and overcome difficulties to solve scientific problems (Saphira & Prahani, 2022; Serevina et al., 2018). With this motivation, students will try to generate creative ideas in solving problems they face.

Phase 2: Organizing creative learning, lecturers in this phase must create a class atmosphere that is free, open, democratic, and positive to train students' creative thinking skills and positive attitudes towards science. Students will think creatively, if the learning environment created by the lecturer stimulates and encourages independent thinking (Moreno, 2010; Eishani, et al., 2014). The use of advanced organizers helps students relate new information to existing experience or knowledge (Slavin, 2005). Lecturer activity in phase 2 is to form study groups to solve problems or phenomena given by lecturers through asking questions in phase 1. In phase 2 this aims to find out students' imagination in explaining a phenomenon scientifically, namely designing an investigation with their group.

Lecturers check students' understanding in solving problems by conducting experiments and helping to understand the working principles of the tools and materials needed in conducting investigations. Lecturers also create an environment that supports cooperation through the formation of groups consisting of 5-6 students, distributing distributing Student Activity Sheets, and the logistics needed to conduct investigations. Students are expected to try to understand the material studied and its logistics, participate actively in group formation, receive worksheets, and the necessary logistics. This phase is based on several theories, namely the information processing model, cognitive constructivism, and social. The three theories state that learning emphasizes meaningful interactions between students and others, to form an understanding through the process of organizing, assimilating, and accommodating new information with existing information.

Phase 3: Guiding creative investigations, in this phase students are required to be able to solve problems with scientific principles, namely conducting an experiment using the scientific method. Positive attitudes towards science students can be instilled through the scientific method used by students in finding or conducting an experiment. Lecturers start this phase by presenting creative problems to require students to produce as much as possible related to strategies, ideas, and solutions to these problems (Moreno, 2010). Students are asked to write down as many problem formulations as possible to investigate and choose one to experiment with (Bolondi et al., 2018). Students design experiments creatively, conduct experiments to obtain accurate and accountable data. Students in carrying out experiments must consider several things including; different scientific perspectives and arguments, using factual information and rational explanations, reveal the need for a logical process in making a conclusion on the observational data obtained.

Phase 4: Strengthening positive attitudes in showing scientific creativity, in this fourth phase aims to strengthen positive attitudes towards science students in developing products in accordance with the investigations that have been carried out in the previous phase. Lecturers provide opportunities for students to discuss some examples of scientific creativity test items and present the results of their group performance in front of the class in accordance with the learning objectives to be achieved. Lecturers also guide students to re-discuss material concepts, sample questions, and competency tests in textbooks, especially those that are poorly understood. In addition, the learning carried out by lecturers must more often emphasize a positive attitude towards science, to get satisfactory results (Rukavina, et al., 2012). Phase 5: Evaluation of scientific attitudes and creativity, in this phase the lecturer evaluates the results of scientific creativity and positive attitudes towards science during the learning process carried out by lecturers in class, and determines follow-up for the next meeting.

Social System

The social system describes the roles of students and lecturers, interactions between students, interactions between lecturers and students, and the expected targets. Students are expected to have a positive attitude towards science to improve creative thinking during the learning process. Lecturers play a role in generating, facilitating, improving, and strengthening creative thinking skills and positive attitudes towards students' science during the learning process, as well as evaluating their achievements based on the determined assessment standards (Eishani, et al., 2014). Lecturer and student interactions occur in all phases, the lecturer conveys the motivation and learning objectives along with the assessment criteria, apperception of learning materials, and group formation. The lecturer guides the investigation referring to the Student Activity Sheets, makes scientific creativity assignments, divides tasks to be completed between groups, and presents the results of group performance, evaluates learning processes and outcomes, and determines activities as follow-ups at the next meeting. Interaction between students occurs in group formation and ensuring that the group has received the Student Activity Sheets along with the necessary logistics, cooperation in investigations, making scientific creativity assignments, along with their completion, presenting the results of group performance, and discussing follow-up actions for the next meeting. Creative thinking skills and positive attitudes towards science students are expected to increase after learning with the CASL model developed by the researcher.

Reaction Principles

The principle of reaction is used by lecturers as a reference in responding to the results of student performance during the learning process (Anggoro, et al., 2017; Kurniawan, et al., 2019). Lecturers appreciate and respond to student activities during the learning process by: (1) setting an example while generating, improving and strengthening positive attitudes towards science and students' creative thinking, as well as evaluating their achievements, (2) applying the principle of fairness in accommodating all suggestions/opinions. students and immediately provide feedback based on predetermined assessment criteria, (3) reward students who are active during the learning process with sentences of praise or sentences that can motivate students to do better.

Support Systems

The support system used in this study, in the form of learning tools and learning resources needed to implement the CASL learning model includes: (1) Semester Learning Plan consists of two components, namely identity and SLP table format; (2) The Lecture Program Unit consists of two components, namely the identity of the Lecture Reference Unit (includes: Title, Department, Study Program, Course, semester, subject matter, credits, meetings, time allocation), and the systematics of the Lecture Reference Unit (includes: Core Competencies, Basic Competencies, indicators, learning objectives, learning materials, approaches/models/methods, media/tools and materials, learning steps, learning resources, assessments, and bibliography); (3) Student Textbooks; (4) Student Activity Sheet; (5) Assessment Sheet; (6) Assessment instrument .

Instructional Impact and Nurture Impact

The instructional impact of the CASL learning model is a measure of the achievement of basic competencies that are determined: (1) increasing students' creative thinking including: (a) fluency, is a person's ability to generate creative ideas/ideas for solving a problem; (b) flexibility, a person's ability to generate creative ideas/ideas or various ways of solving a problem; (c) originality, a person's ability to generate new or previously non-existent ideas; (d) elaboration, one's ability to develop or add more specific creative ideas (Hu & Adey, 2010); (2) increasing positive attitudes towards science students, namely; (a) attitude towards scientific inquiry, (b) desire to develop a scientific attitude, (c) enjoyment in learning science, and (d) interest in increasing time to study science, adopted from Fraser (1981); (3) improve the mastery of the concept of electricity and magnetism, and (4) improve the character of students. The accompaniment impacts in this research include: (1) improving students' science process and problem solving skills and (2) providing opportunities for improving critical thinking skills, communication, and the use of information, media, and technology.

The Benefits of CASL Model Development

The learning model developed through theoretical and empirical studies is expected to provide several benefits, including: (1) Alternative choices of learning models that can be used to train students' creative thinking skills; (2) Availability of learning models that can train the skills needed in the 21st century; and (3) reference materials in developing other learning models.

CONCLUSION

The CASL model is a learning model that integrates the Creative Problem Solving (CPS) Model with the Problem Based Learning (PBL) Model in every learning activity to improve students' creative thinking skills. The development of the CASL model is supported by the latest learning theory (cognitive, complex cognitive processes, sociocognitive, and constructivism), the empirical foundation of current research and scientific publications of researchers. The CASL model has five phases, namely (1) Generating positive attitudes as creative individuals, (2) Organizing creative learning, (3) Guiding creative investigations, (4) Establishing positive attitudes in demonstrating scientific creativity, and (5) Evaluation of positive attitudes and scientific creativity. Further research is needed to prove that the CASL hypothetical model is feasible by fulfilling the validity, practicality, and effectiveness to improve students' creative thinking skills.

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