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The Effect of Scientific Reading Based Project Model in Empowering Creative Thinking Skills of Preservice Teacher in Elementary School

Kartika Chrysti Suryandari* 
Universitas Sebelas Maret, INDONESIA

Rokhmaniyah 
Universitas Sebelas Maret, INDONESIA

Wahyudi 
Universitas Sebelas Maret, INDONESIA

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Abstract: Creative thinking skills are 21st century learning needs that can be applied through the Scientific Reading Based Project (SRBP) model. The purpose of this study is to empower creative thinking skills through SRBP models in science learning in elementary school teachers' education students. This research is mixed research with qualitative and quantitative approaches. Qualitative research is used to explore students' creative thinking abilities. Quantitative research uses a quasi-experimental approach carried out for six months on the candidates of elementary school teachers' education. Participants in this study were the candidate of elementary school teachers' education of 75 people who took the Basic Concept of Science subject. Data collection in this study was through observation, documentation, pre-test, and post-test with essay questions to measure creative thinking skills. The final result of the project is the final product to measure creativity. The data analysis used was an ANOVA test to measure every aspect of creative thinking skill. Qualitative analysis was used to describe the learning process and the final project of creativity. The results showed that there was an increase in creative thinking skills from aspects of flexibility, elaboration, fluency and originality. The SRBP model has a positive effect on improving the ability to think creatively.

Keywords: *Creative thinking, empowering, SRBP model.*

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Introduction

The need for creative thinking empowerment emphasized on students can compete in the era of disruption. More challenging and quality soft skill skills are needed in the era of globalization (Kind, 2015; Parikh et al., 2020). Education plays an important role in educating students to have 21st century skills namely critical thinking, creative, collaborative, communicative, problem solving, data literacy, technology literacy and human literacy character (Kennedy et al., 2016; Pattanapichet & Wichadee, 2015; Talat & Chaudhry, 2014). Creative thinking skills that are original, flexible, elaborate and fluency need to be accustomed in learning. Essential 21st century skills must be mastered by everyone in order succeed in facing challenges, problems, life, and career in 21st century include critical thinking, creativity, communication and collaboration (Greenstein, 2012).

The Indonesian government supports 21st century learning implemented in the 2013 Curriculum known as 4C skills, namely 1) critical thinking and problem solving, 2) creativity and innovation, 3) communication, and 4) collaboration. Mastery of soft skills and 4C skills is an aspect of High Order Thinking Skills (HOTS) that are very important because they are needed in everyday life. Therefore, the development of HOTS is very important as the goal of education at all ages (Nachiappan et al., 2018). For students, creative thinking skills are very important as a provision in supporting daily life. Creative thinking is a process that combines mental skills to imagine and experience to produce products in the form of ideas or unique objects (Syarifah & Emiliyasi, 2019).

Activities in science involve students having high curiosity, investigating, and expressing ideas about observed events (Kind, 2015; Kwan & Wong, 2015; Ülger, 2016). Each science content has unique characteristics, so the way to teach is also different (Koehler & Mishra, 2009; Schneider & Plasman, 2011). The way to study each science content is in accordance with the expected standards related to the cognitive, affective and skill domains (Johnson, 2010). According to the National Research Council (2010), teaching science includes content standards, nature of science, inquiry, issues,

* **Corresponding author:**

Kartika Chrysti Suryandari, Universitas Sebelas Maret, Surakarta, Jawa Tengah, Indonesia. ✉ kartika@fkip.uns.ac.id

general skills of teaching, curriculum, science in the community, assessment, safety and welfare, and professional growth.

Literature Review

Based on observations on elementary school teachers' education students at Sebelas Maret University Surakarta of Indonesia showed students' creative thinking skills were low. When conducting class discussions, the quality of student answers is only reviewed from one aspect of biology or physics, and not yet holistic. The explanation isn't detailed and knowledge of science is just memorizing concepts. This shows that the ability to think creatively has not been empowered. The unfamiliarity of critical and creative thinking has an impact on the learning outcomes of graduates, that is; the compilation of most pedagogic-specific subjects only copied the syllabus compiled from the government. Students are less daring to write elementary school science teaching materials independently based on the results of creativity. The lecture assignments given by the lecturer have not emphasized the project to produce creative products. Elementary school teachers' education students who are making a thesis and conducting research at elementary school have never applied project-based learning. Project learning by emphasizing the activity of reading scientific articles or scientific reading is appropriately applied to enhance creativity. In this study, the learning model that supports the needs of the 21st century is the model of the Scientific Reading Based Project (SRBP). The SRBP model is an innovative learning model that emphasizes project learning activities and reading comprehension from scientific articles. The SRBP model consists of six syntaxes, that are; 1) orientation, 2) scientific reading, 3) design and creation, 4) progress of the project, 5) analysis, and 6) Discussion and Communication (Suryandari et al., 2019).

Project-shaped learning requires participation between lecturers and students (Kai et al., 2017; Hoorn & Whitty, 2017; Raamkumar et al., 2017). Activities that emphasize the project and read tread understanding in constructivism, inquiry, authentic, problem solving, contextual (hands-on and mind-on). Students are empowered to think creatively, critically, analytically in order to evaluate problems and find solutions (Ahrari et al., 2016). New knowledge is built by students from direct and indirect experience. Quality learning processes integrate research and reading activities that are oriented to the student cealmenter learning (SCL), referring to various learning models and methods. SRBP models in the form of projects in learning outcomes that produce products in the form of innovative objects or creative ideas. The ability to produce innovative creative products can be obtained from designing and completing projects.

Project activities, research, and read of understanding in the SRBP model can be carried out by students outside of learning and or during learning. By reading and looking for information, students are actively involved in shaping their initial knowledge and increasing self-confidence (Alghafri & Ismail, 2014). The habit of reading impacts creative thinking skills (Isabekov & Sadyrova, 2018; Syarifah & Emiliasari, 2019). The more reading material, the more knowledge that is owned and affects the ability to think critically and creatively. The reading comprehension activity emphasized in this research is the ability to understand the contents of the reading sourced from scientific articles or research journals. Reading scientific articles is a language skill that needs to be trained continuously so that it becomes a habit for students to have creative thinking skills (Alghafri & Ismail, 2014). Based on the background, the researchers took the initiative to develop a science learning model that synergized the ability to apply the science concept in a project that was collaboratively done based on scientific reading to empower creative thinking skills (Ahrari et al., 2016).

Creative thinking is one of the 21st-century skills that must be possessed. Creative thinking is a process when someone shows new ideas that are logical and rational. The ideas conveyed have novelties and certain characteristics (Aloqaili, 2012; An et al., 2016). The new ideas are then evaluated critically, rationally, and logically. Creative thinking is part of the divergent thinking process that stimulates curiosity which includes aspects of fluently, flexibility, elaboration, and originality skills (Torrance, 1990). Creative thinking is the process of getting alternative solutions or new solutions to problems (Alghafri & Ismail, 2014; Kashani-Vahid et al., 2017). To obtain alternative solutions, the right identification and analysis of problems are needed (Mumford, 2003). Creative thinking accepts the knowledge associated with divergent forms for everything new. State that if a creative person has a sensitivity to the situation and conditions around him and has several solutions to problems that are not normal (Cho, 2017).

If viewed from the perspective of neuroscience, creative thinking is a mental process that raises creativity. Creativity is the ability to generate ideas, work methods, and products from creativity to make something new. Creativity is multifaceted to produce high creativity and right when applied to obtain solutions (Lemon, 2011; Ülger, 2016). Creativity requires imagination, intuition, openness, curiosity, innovation, not bound by something or independent. Components of creativity include creative products, creative human and creative processes. A creative person has full characteristics of ideas, divergent thinking, spontaneous, energetic, can integrate initial knowledge and the situation it faces so that it produces something new (Kennedy et al., 2016). Creative process is a process of thinking metacognitively through four stages, namely (1) preparation (defining problems), (2) incubation / reflection (analyzing problems in some time), (3) illumination (stage of getting new ideas / thoughts), and (4) verification (the stage of applying the ideas found). Creative products mean everything or new inventions such as songs, items, books and so on.

Creativity is divided into scientific creativity and artistic creativity (Dietrich's, 2004). Scientific creativity focuses on the idea of solving problems with organized stages with cognitive functions that take place precisely in the prefrontal

cortex while artistic creativity relies on emotions and spontaneously. This research emphasizes scientific creativity. Creativity listed in Torrance Thinking Creative Test (TTCT) is the ability to detect problems, submit solutions to problems, generate new ideas, and combine ideas into new theories (Torrance, 1990). Based on expert opinion it can be concluded that creative thinking is the ability to produce products in the form of ideas or products that are different from usual. The creativity of science learning is a scientific theory of creative products made by scientists. Scientists always work while contributing to building knowledge. The creativity of science is always rational that can be implemented in the field (Kind, 2015).

Creativity is the process of thinking divergently to form new products, new ideas, original discoveries, and the development of ideas (Almeida et al., 2008). Creativity is a capacity to detect gaps, get new ideas, and solutions in solving problems (Torrance, 1990). The dimensions of creativity can be measured verbally and the images consist of fluently, flexibility, originality, and elaboration. Fluency is in the form of fluency to produce various ideas, questions, careful answers to see the weaknesses and strengths of an object from a situation. Flexibility means the ability to produce different ideas in a variety of viewpoints. Originality is the ability to produce new, unusual, and unique thoughts, thinking of alternative ways to solve specific problems. Elaboration is the ability to think of generating ideas in detail so that it is more interesting to develop an idea or novelty of a product in detail.

The learning model of the Scientific Reading Based Project (SRBP) is learning that involves project activities and research from students on learning. Project activities are activity-based reading comprehension and information that can be done anytime or anywhere and are not limited only when learning takes place in the classroom. Students are required to actively seek information through the internet, reference books, or ask informants about assignments from lecturers related to concepts of science. Project activities and scientific reading are carried out as long as students are involved in learning activities (Suryandari et al., 2019).

Reading activities are related to skills for expressing ideas and thoughts from reading texts. Reading is an activity of seeing and understanding the contents of the reading orally or in the heart (Royanto, 2012). Reading competence is the ability to understand the information transferred by other parties through written forms. Reading activities involve cognitive processes (Aloqaili, 2012; Johnson, 2010). Reading is a part of learning and is very important for students to understand the concept. The reading activity emphasized in this study was comprehensive reading. Reading comprehension is not just understanding each letter but building opinions from each sentence that is read to produce an accurate understanding of the contents of the reading. Cognitive aspects play a role during reading comprehension to shape prior knowledge. The reader is responsible for delivering information from the reading text (Amolochitis et al., 2013).

The SRBP model is constructivism, authentic learning, inquiry, hands-on and minds on and problem-solving. The SRBP model is implemented with the syntax as follows: 1) orientation, 2) scientific reading, 3) design and create, 4) progress of the project, 5) analysis, 6) discussion and communication (Suryandari et al., 2019). Scientific activities can be carried out before or during science learning takes place, in other words, can be done without any limitations of space and time. The SRBP model helps students as better problem solvers.

Research Goal

The purpose of this study is to empower creative thinking skills through SRBP models in science learning in elementary school teachers' education students.

Methodology

The research used in this study uses a mixed-method (a combination of quantitative and qualitative data) (Creswell, 2012; Merriam, 2002). The experimental class applies the SRBP model and the control class uses the inquiry model as is usually done by lecturers. Before learning, both the experimental class and the control were performed a pretest to find out the initial ability (Creswell & Clark, 2011).

Sample and Data Collection

Participants consisted of 75 elementary school teachers education students Sebelas Maret University in Indonesia, 2017/2018 batch students divided into 2 groups, 38 students entered the experimental class using SRBP models and 37 students in the control class. Elementary school teachers' education students are included in the social science family so students come from a variety of scientific and non-scientific backgrounds. In the experimental class with the SRBP model working on the project to make teaching aids for elementary school science learning that was tested so that it obtained data for the practicum activities in the laboratory, followed by making a lab report. In the control class using the inquiry model without a project, only carrying out simple practices. During the collaborative classroom learning activities, students form groups of 5 or 6 members. Before learning, both the experimental and control classes were pre-test to determine their initial abilities. Then learning is done and after with a post-test with the theme Wave and the Sensory System. The results of the scoring pretest-posttest used the rubric and were statistically analyzed with the help of SPSS 22.0 for Windows. Effect size test according to Hedges formula with the help of Rstat Effect Size

Calculator. Quantitative data collection was obtained through questionnaire, pre test and post test. Qualitative data collection techniques are obtained by means of interviews, observation, and documentation (Cohen, 1988; Glass, 1976; Hedges, 1981).

Instruments in the form of tests of creative thinking skills in the form of essay questions with four indicators. Indicators of creative thinking skills namely fluently, elaboration, flexibility, and originality (Torrance, 1990). The number of test instruments was 8 questions. Each test item was assessed with a scale of 100 using the assessment rubric guide. The instrument was construct validated and analyzed with Pearson Product Moment. The indicators in the questionnaire can be said to be valid if the calculated r-value is greater than the r table. The results of the analysis show that the r score is 0.75 which means valid. Project assessment instruments use rubrics adapted to science concepts. Cronbach's alpha value for measuring reliability. The value that Cronbach's Alpha in the Reliability Statistics test is 0.820. The research data is in the form of a test of creative thinking skills with essay question forms and assessment of project portfolio results in the form of ideas, posters, and science learning media development.

Analyzing of Data

Each cycle begins with a pre-test and at the last meeting, a post-test is conducted. Data were analyzed using SPSS 22.0 for Windows in statistical descriptive analysis. Normality test with Kolmogorov-Smirnov, homogeneity test with Levene test, and further test with ANOVA, N-gain calculation with formula. Effect size was checked according to the interpretation of Hedges formula with the help of Rstat Effect Size Calculator (Cohen, 1988; Glass, 1976; Hedges, 1981). Normality test was used for seeing how far data have collected from the field is normally distributed. How to determine whether your data is normally distributed using the Kolmogorov-Smirnov with a significance value of 0.250 more than 0.05, it can be said that the data is normally distributed. The homogeneity test was used for checking how far the experiment group and control group is homogeneous or have the same variance. The homogeneity significance of 0.156 (≥ 0.05) indicates that the Initial Test variable in the treatment and control groups is homogeneous, with a Levene Statistic of 2.185. Analysis of Variance (ANOVA) is a comparative test used to test the difference in the mean (average) of data for more than two groups. With ANOVA information will be analyzed which one the best between experiment class with a control class. Qualitative data is analyzed by collecting data, reducing data, presenting data, and conclusions or verification. Qualitative data consists of descriptions of the quality of the science learning media, practicum reports, and project completion performance including the design of the science learning media, logbooks, and science learning media. The validity of qualitative data was obtained through triangulation of sources, triangulation of data collection techniques, and triangulation of time (Miles & Huberman, 1994).

Findings / Results

The results of preliminary observations showed that more than 80% of lecturers and students agreed on innovative teaching methods such as inquiry, investigation, discussion, case studies, discoveries, scientific, and project learning. Teaching materials in the subject of Basic Concepts of Science are integrated, thematic, and holistic. Thematic teaching materials are cultivated because elementary school teachers' education students will teach elementary school subjects that are holistic thematic. Learning activities that center on student activities in the form of project design, project presentations, and research. These activities can stimulate critical and creative thinking skills. Learning activities by emphasizing project-based reading scientific articles or research journals are approved by more than 80% of lecturers and students because these activities can improve thinking skills. By reading the ideas conveyed by students are based on scientific concepts and not their own assumptions. Reading scientific articles is reading comprehension that requires the ability to study the reading. Based on the results of the interview, learning-oriented to HOTS is the need for lecturers to convey knowledge, but still have difficulties in its application. Achievement of Graduates' Learning (AGL) The Basic Concepts of Science teaches that students are able to master the Basic Materials and Methodologies of Science, critical thinking, inquiry, problem solving, and science process skills. Competency standards graduates elementary school teachers' education students are expected to be at level 7 according to the Indonesian National Qualification Framework (INQF) guidelines. Criteria for minimum ability to pass in attitudes, knowledge, and skills with the level of INQF are regulated in the Achievement of Graduates' Learning (AGL). On the attitude, aspect shows students are responsible for work in their field of expertise independently in learning. The experimental class is divided into 6 groups, namely Red, Green, Yellow, Blue, Black, and White. Before entering the syntax stage of the SRBP model, a pre-test is conducted to measure the initial ability in creative thinking.

The first step of the SRBP model is orientation, with the aim of stimulating students' curiosity, according to the agreed theme, namely the Wave and the Sensory System, the sub-theme of harmonic motion, sound waves, and the sense of hearing. Students observe videos or images about the oscillation motion that is associated in everyday life. The activity continued with brainstorming and classical question and answer. Design of the project is the third step of the SRBP learning model. Based on the knowledge studied from scientific articles then students make a design of the project with scientific paper products, scientific posters, and elementary school science learning aids. The project design aspects are in the form of titles, project objectives, tools, materials and methods of work, costs planning, time, and product

innovation. The reported aspects are in the form of student activities or logbooks in completing projects, time agreements, group work division and documentation of activities.

In the experimental class as collaborative classroom learning activities, students form groups of 5 or 6 members. The project completion time agreement is determined by lecturers and students for 2 weeks. The project is carried out by making scientific papers based on reading from research articles or journals. The objectives of the science learning teaching aids project are: (1) students are able to analyze the influence of electromagnetic waves on health based on scientific literature, (2) students are able to study various scientific journals presented in scientific papers, (3) students are able to make scientific papers with creations. The project consists of: (a) project design, (b) logbook in the form of group work paper, (c) final product, (d) lab report. Project performance targets for group assessment in the form of project design, logbook, and final products, while lab reports are done individually.

Based on the inspiration of scientific articles, students can make different titles from each group. The final product assessment criteria are scientific papers in the form of idea originality, text content, creativity, the purpose of delivering messages, and bibliography. The results of making the project is a basis for working on the pre-test and post-test. The test results in the form of essay questions in creative thinking skills are listed in Table 1. Creative thinking skills are indicated by N-gain and average values which can be seen in Table 1.

Table 1. Average scores of creative thinking aspects in the SRBP class and controls

Aspect	SRBP			Control			N-gain	F	Sig.
	Pretest	Post test	N-gain	Pretest	Post test	N-gain			
Elaboration	64.21	85.20	0.74	46.40	58.11	0.19	14.08	.001	
Fluently	62.63	83.77	0.78	40.92	58.55	0.19			
Flexibiliy	63.88	87.44	0.72	52.89	65.21	0.18			
Originaly	58.27	83.88	0.70	45.52	57.89	0.19			

Creative thinking skills using the SRBP model on elaboration aspects scored 0.74 and fluently 0.78, flexibility, originality 0.70 including the high category. In the control class with N-gain 0.19 in the weak category. There were significant differences in creative thinking skills between the experimental classes using the SRBP learning model and the control class with F values of 14.08 and a significance of 0.001. To find out how much the effectiveness of the SRBP learning model in creative thinking skills can be calculated with the effect size that can be observed in Table 2.

Table 2. Effect size model SRBP

Group	Mean	Std. Dev.	Cohen's d	Hedges' g	Glass' s	Category
SRBP	84,58	42,83	0,989	0,979	1,159	High
Control	47,24	32,23				

Based on Table 2, a score of each effect size was obtained that compared the effectiveness test of the SRBP and control models with the Cohen's formula of 0.989, Hedges' 0.979, and Glass 1,159 included in the high category. The Accompaniment impact on learning with the SRBP model is a side learning outcome that results are aspects of attitude, ability to speak, group work, and communication skills. Accompaniment impacts were observed in performance assessment Table 3.

Table 3. Descriptive statistics of performance assessment using SRBP models and controls

No	Aspect	N	Minimum statistics	Maximum statistics	Mean SRBP	Mean Control	SD
1	Attitude	38	2.00	3,57	3.25	2.10	.59
2	Argumentation	38	1.00	4,85	3.05	1.90	.42
3	Group Work	38	1.00	4,83	3.40	2.83	.46
4	Communication Ability	38	1.00	4,81	3.51	2.76	.41

Descriptive statistics of performance assessment using SRBP models and controls consist of attitude, argumentation, group work, and communication ability. The attitude indicators observed by curiosity, confidence, and scientific attitude gained an average of 3.25 while those in the control class scored 2.10. The argumentation aspect in the experimental class with the SRBP model scored 3.05 and the control class 1.90. Group work on the class using SRBP models and controls obtained scores of 3.14 and 2.83, respectively. Group work gets the highest score because with the SRBP model all groups must complete the project performance targets. Group work indicators are observed, namely; face-to-face interaction with group members, division of group tasks fairly, responsibility, not easily discouraged in completing projects, evaluating projects to be better, and positive dependence. Communication skills use a higher SRBP

model with a score of 3.48 than control 3.76. Ability to communicate with indicators of understanding on topics, organizing, presentation styles, use of statistical data and activeness in getting online information.

The project completion time agreement is determined by lecturers and students for 2 weeks to make elementary school science teaching aids from secondhand goods. The project starts on October 9 - November 13, 2019. The theme of the effects of light waves on the eye system and optical devices. The project aims: (1) so that students are able to apply the principle of light waves in the form of science learning aids in elementary schools, (2) study the principles of light waves in everyday life, (3) create creativity in elementary school science learning tools. Lecturers randomize each group to make props projects from secondhand goods. Teaching aids from secondhand goods for science learning in elementary schools are in the form of miniature telescopes, periscopes, simple projectors, kaleidoscopes, holograms, and field binoculars.

Project bills consist of: (a) project design, (b) log book in the form of group work paper, (c) final product, (d) lab report. Project performance targets for group assessment in the form of project design, logbook, and final product, while the lab report is done individually. Lecturers monitor the progress of each group through a logbook. The average score assessment of group performance in completing the project can be seen in Table 4.

Table 4. Average score assessment of group performance

Groups	Project Bill			
	Project Design	Log book	Final Product	Final Project in form Learning Props
1.Red	2,66	2,75	3,00	field binoculars
2.Green	3,16	3,00	3,16	Kaleidoscopes
3.Yellow	3,33	2,75	3,66	Holograms
4.Blue	3,50	3,25	3,66	telescopes
5.Black	2,66	3,00	3,33	periscopes
6.White	3,66	3,00	3,83	kaleidoscopes

Project design aspects were (1) title, (2) objectives, (3) tools and materials, (4) work methods, (5) cost efficiency, and (6) product description. There are three project design groups with very good categories namely, Yellow 3.33, Blue 3.50, and White 3.66. The Green Group with a good category is 3.16, while the Red and the Black score of 2.66 with enough categories. Some group weaknesses are found, namely determining the title, purpose, and detailing the workings. The title has not yet linked the independent variables and the dependent variable. The objectives achieved are still using abstract words, for example, knowing not yet with the operational verb. The method of work is not systematic and does not specify a standard unit of measurement that must be used in detail, for example in the length or weight (Kg or G). All groups collect projects on time.

The logbook is used to record group activities in completing projects within a certain period of time. Lecturers monitor the progress of the project through a logbook. Students can submit project progress face to face or via WhatsApp groups. The logbook aspect includes the purpose, completeness of data, time of activity, and documentation. The Red and Yellow Group of 2.75 in the sufficient category, the Green, Black, White Group of 3.00 in good categories, and the Blue of 3.25 group in the very good category. The final product of the project was an elementary school science learning tool for the Red group made field binoculars, the Green group made a simple projector display, the Yellow group made a hologram, Blue group made a telescope, Black and White groups made periscopes and kaleidoscopes respectively. The elementary school science learning aids are made of used items such as cardboard, plastic bottles, wood, paper, and others. Assessment aspects of Primary School Science learning aids are originality, function, quality, creativity, beauty, and product description. There are 4 groups with very good criteria with scores between 3.33 - 3.83 and 2 groups with good criteria. The weakness of the final product is that it has not yet created unique elementary school science learning aids. All groups make science learning aids with good creativity. Students work in the form of final products.

All groups collect the final product on time as planned. The time to complete the project is 2 weeks. After the product is collected, each group presents the results of their work, followed by classical questions and answers. Innovations are given for the final product, for example, the white group makes the kaleidoscopes that have given buffer. The green group makes a simple projector with the adding innovation of a flat mirror on the inside so that the monitor can be reflected clearly.

Individual project performance is compiling a practicum report. Data is obtained from each practicum in the project undertaken. The mean score of Elementary School Basic Science. Performance Assessment of Science report scores in the class using the SRBP model and controls can be seen in Table 5.

Table 5. Performance Assessment Practicum Report with SRBP Model and Control

Grup	N	Mean	Std. Dev.	Std. Error Mean	F	Sig.
Practicum Report of SRBP	36	75.58	2.52	.418	7.96	.006
Practicum Report of Control	38	70.76	1.45	.233		

In the experimental class using the SRBP model, it obtained a mean of 75.58 and the control obtained an average of 70.76. There is a significant difference between the experimental class using the SRBP model and control with a calculated F value of 7.96 and a significance of 0.006. Aspects of assessment of lab reports include (1) title, (2) objectives, (3) background, (4) problem formulation, (5) tools, materials and methods of work, (6) practicum results, (7) discussion, (8) conclusions, (9) list of references, (10) documentation attachments. Described the difference in lab reports in the experimental class using the SRBP model and the control class in terms of various aspects can be seen in Table 6.

Table 6. Description of Practicum Report Quality from SRBP and Control Class

Aspect	SRBP Class	Control Class
Title	Already connecting independent variables and dependent variables	The relationship between independent and dependent variables is unclear
Objective	a. Able to write 1 to 2 practicum objectives b. Writing objectives already uses operational verbs	a. Writing down 1 practicum objective b. Writing objectives have not used operational verbs but with abstract words such as "knowing, understanding"
Background	a. Already outlined the independent and dependent variables b. References taken from relevant literature of the latest year research journal	a. The description doesn't explain the independent and independent variables b. Literature taken from source books is not a research journal
Problem Formulation	a. Formulation of problems with question sentences and connecting variables b. Writing out 1 or 2 problem statements with only 1 type of question sentence varies for example "how and what". c. Write with variations in the question "what, why, when, what" etc. Write with variations in the question "what, why, when, what".	a. Formulation of the problem with question sentences but doesn't connect between variables b. Formulation of the problem with only one type of question sentence such as "how and what". c. Less writing variations on the question "what, why, when, how much." d. Problem formulation such as making evaluation questions
Hypothesis	Answer Problem Formulation	Answer the problem statement but it isn't related to variables
Tools, Materials, ways of working	Some special objects in units of length or weight	Not yet specified in units of length or weight
Practicum Result	a. Data is represented in tables or graphs b. Data are processed in descriptive statistics	a. Data are represented in a table b. Raw data hasn't processed using statistical descriptive yet
Discussion	a. Able to interpret data on tables or graphs, but not yet related to the science concept b. Less discussing the objective completely c. Use the relevant bibliography	a. Able to interpret data on tables or graphs but has not associated with the science concept yet b. Discussion based on student assumptions c. include a bibliography on some the discussion aspects
Conclusion	Answer the objective	Not synchronous with the objective
References/ Bibliography	Relevant and <i>up to date from research journal and Book</i>	Only from book
Documentation attachment	Most of them have photo captions	There is no photo captions

Based on Table 6, there are several differences in the quality of reports between the control class and the SRBP model class. The difference is in the aspects of the title, purpose, background, hypothesis problem formulation, material tools, and work methods, conclusions, bibliography and attachments. Some obstacles to learning activities need to be reflected and get intervention from lecturers. Learning obstacles that occur in the lecturer model are: (1) not yet memorized the syntactic sequences in the SRBP model, (2) difficulties in brainstorming in learning the Basic Concepts of Science, (3) in the orientation syntax, there are difficulties to motivate students to make questions, (4) in scientific

reading activities, students forget to provide the key words of scientific articles that will be cited by students, (5) the delivery of science concepts only at a glance, so that many don't understand the concept. Solutions to overcome these obstacles (1) give more guidance to the model lecturers, (2) be given input to brainstorm with science teaching aids, (3) be given additional understanding of the concept in order to stimulate students to make questions, (4) remind to explore modules learning, (5) the deepening of the science concept is more emphasized in order to establish a common perception.

The obstacles on students are (1) not yet accustomed to being independent in searching the scientific articles, (2) not yet accustomed to conducting research independently to search data, (3) there is no awareness of the importance of reading research journals, (4) some of the students feel pressured to work in groups. The solutions include, (1) giving additional assignments through Student Work Sheets (SWS) to read research articles and be discussed in learning, (2) motivating students to be more independent in taking data, (3) giving rewards to students who diligently read research journals, (4) motivating students to get to know their groups so that the collaboration will run smoothly.

Discussion

Creative thinking is the ability to generate many ideas as mental challenges. When generating many ideas, the process of associative thinking takes place (Kashani-Vahid et al., 2017; Kwan & Wong, 2015). N-gain flexible thinking ability of 0.72 which shows the difference between experimental and control classes. This can also be seen from the answers to questions that vary from the point of view of physics, biology, or chemistry. The ability to think flexibly can be interpreted as a person's ability to generate many ideas and know the relationship between ideas, and obtain many alternatives to solve each problem (Murphy et al., 2013). Flexible thinking skills can also be interpreted to see a problem from a different perspective. These are indicators of Moore's creative thinking ability (Moore et al., 2009). People with creative skill is able to give a lot of ideas, answers or questions can see different points of view, by providing many alternative answers (Almeida et al., 2008; Amolochitis et al., 2013).

In the treatment class, the elaboration ability with N-gain was 0.74. These results indicate a tendency to increase even though thinking of elaboration is still difficult for students to do. Students need to practice continuously to detail qualitative and quantitative answers. The ability to think elaboration is the ability to develop an idea in detail (Parikh et al., 2020). If students have elaborate thinking skills, they are able to store knowledge into long-term memory. Indicators of students have elaborate thinking skills including being able to develop ideas or products and be able to specify an object or idea so that it is more interesting. The ability to think fluently with N-gain is 0.78. This can be seen from student answers when tested verbally and in writing. Students express their opinions based on the concepts of science smoothly. Fluency, namely students are able to solve problems with various solutions and answers. Fluency is the ability to build lots of ideas. The more opportunities are obtained, the more opportunities to get good ideas. This ability is one of the most powerful indicators of creative thinking because the more ideas are, the greater it is to get a variety of ideas.

The ability to think unique and original from students' own thinking. The ability to think original is still relatively low, as evidenced by the N-gain of 0.70. Originality is the ability to produce extraordinary ideas that are not common. The category of originality refers to the uniqueness of any response has given originality is indicated by an unusual response, unique and rare happen. Thinking about the future can also stimulate original ideas. Thinking about the future can also stimulate original ideas. The types of questions used to test this ability are in the form of interesting things from general objects. Original ideas can be stimulated through activities or questions. The idea can be: (1) designing science learning props as a future dream; (2) think of an effort to improve the product quality of the project. However, students' answers are still classified as standard and normative but haven't created a unique idea yet.

Based on the results of the study, it shows that the SRBP model is more effective than control as evidenced by calculations using the Cohen formula of 0.989, Hedges '0.979, and Glass 1.159 are included in the high category. Mastery of technology synergizes to produce learning (Magnusson et al., 2006). In the SRBP model there is a scientific reading syntax with the activities of students being obliged to read scientific references, as a theoretical basis for carrying out projects. The habit of reading the ability to think creatively. Creative knowledge is knowledge about the relationship of knowledge between one part of the other. The ability to think creatively is wrong that comes from reading material, the more reading material you have. One of the most important language skills and one that needs attention in writing scientific papers is the mastery of syntactic structures. Mastering structuralism helps someone pour their ideas into scientific work (Parikh et al., 2020; Wang, 2016)

The results of the performance assessment include attitude, argumentation, group work and communication abilities which are the result of students' abilities in creative thinking as shown in Table 3 and Table 6. Creating different ideas in each learning activity is a cognitively challenging task. This activity requires divergent thinking and new things, in the school climate (Benavides et al., 2008; Mierdel, & Bogner., 2019). Creative performance, creative thinking, psychomotor skills, have more to do with thought, knowledge, and professional skills. In previous studies, creative thinking and correlation were stronger for creative thinking and creative performance (Chang et al., 2016, 2019; Liu et al., 2017). making creative ideas and making creative products are clearly inseparable skills (Arpan et al., 2016).

Creative thinking skills produce creativity. According to Rhodes the creativity in terms of personal, process, press and product is known as 4P as an essential component (Mumford, 2003; Murphy et al., 2013). The characteristics of a creative personality are capable of convergent and divergent thinking, high curiosity, confidence, independence, conceptual flexibility, generating unique ideas/originality, preferring complexity over simplicity, and having many interests and skills in various fields (multiple skills). The family environment is very influential in the development of creative thinking. The involvement and openness of parents' attitudes and the freedom given by families to carry out exploration. The campus environment also influences the development of creative thinking, especially the application of learning models. Learning approaches and models that form creative environments, active learning, collaborative and innovating (Cho, 2017). Learning approaches can increase the creative and higher-order thinking of students (Royanto., 2012). The interaction between lecturers and students, between students, facilities, and infrastructure has an influence on developing creativity. Forms of social interaction such as competition, cooperation, opposition, and power stimulate creative thinking skills.

Creative thinking skills require psychological support. Freedom and psychological security can be done by giving individuals the opportunity to express their feelings and thoughts (Alghafri & Ismail, 2014; Paul & Elder, 2007; Slavin, 2012). Psychological conditions (Kostromina & Gnedikh, 2016) are obtained if (1) students accept what happens because each person is basically capable and good, (2) the atmosphere of learning is calm and there is no threat, (3) mutual understanding and tolerance. Likewise, a healthy and prosperous society will foster creativity. Individual abilities cannot be separated from the influence of culture and society (Arpan et al., 2016; Schunk, 2009). Creative thinking is divergent, involves finding opportunities to change things for the better. Creative thinking doesn't explicitly organize processes, such as critical thinking. Creative thinking is a habit of sharp thinking with intuition, moving images, revealing new possibilities, opening amazing ideas, and inspiring unexpected ideas (Alghafri & Ismail, 2014).

Conclusion

The SRBP model is effective in empowering creative thinking skills based on the effect size score of 0.92 in the experimental class compared to the control class. Empowerment of creative thinking skills can be seen in the test scores, the quality of the project design, the logbook, the final results of the project will be in the form of an elementary science learning tool, and the quality of the lab report. Learning that applies the SRBP model causes students to have the ability to think creatively to develop an idea in detail, unique, express their opinions based on the concepts of science smoothly and able to solve problems with various solutions and answers.

Performance assessment which includes aspects of attitude, argumentation, group work, and communication skills in completing projects significantly leads to an increase in creative thinking and divergent creativity.

Recommendations

Recommendations from the research on the influence of the SRBP model for future research development are the SRBP model can be applied to basic to tertiary education, which is adjusted to the level of development of students. For practitioners, application of the SRBP model at the basic level by modifying reading material from encyclopedias or children's magazines. The performance assessment for completing the project can be varies more according to the level of development of the student. Investigating the effect of the SRBP model on empowering critical and creative thinking skills in elementary school students. Applying the SRBP model to improve critical and creative thinking skills at the school level through classroom action research. Suggestions for further research to enlarge the sample so that the research results can be generalized. Research subjects can be chosen from elementary school students.

Limitations

This research is limited to the aspects of empowering creative thinking skills. Research participants were only prospective elementary school teacher students at the Sebelas Maret University.

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Authorship Contribution Statement

Suryandari: Conceptualization, writing, design, data collection and analysis. Rokhmaniyah: Editing/reviewing, data analysis. Wahyudi: Editing/reviewing, supervision.

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