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Implementation of Inquiry Learning Based on Creativity and Science Process Skills

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Abstract: After inquiry learning research is carried out, it is necessary to investigate problems and find problems based on clear concepts based on observations. Creativity is the ability to create something new. The proposed activities are based on physical phenomena through experiments. Prior knowledge of a problem may detract from an investigation, as it may prefer to retain known evidence rather than devise new alternatives. Creativity is the ability to think to come up with solutions, ideas, ways, products as solutions to existing problems. Innovative is the process of doing something in a new way. The process skills of discovering and developing concepts, theories, legal principles and facts are science process skills (KPS). Based on investigations and problem findings, creative inquiry learning with a process skills approach is used. The method in this research is analysis of indicators of inquiry learning syntax (problem formulation, hypothesis formulation, data collection, hypothesis testing and conclusions), creativity (KE experimental group and KK control group) and science process skills (KE and KK). The concepts developed mutually support inquiry, creativity and process skills. Students' ability to investigate and find problems can be realized.

Keywords: Creativity; Indicator analysis; Inquiry learning; PPP

Introduction

Inquiry is student-centered learning, which encourages students to investigate problems and discover information (Mariegaard et al., 2022; Navy et al., 2021; Tornee et al., 2019).The student's ability to work from multiple perspectives on a problem, and the uncertainty that arises when choosing the right or correct solution. Alternative or appropriate answers are a prerequisite for meaningful inquiry learning for students (De Jong et al., 2023; Pedaste et al., 2015; Wale et al., 2020). The proposed activities are based on physical phenomena through experiments. Prior knowledge of a problem may detract from an investigation, as it may prefer to retain known evidence rather than devise new alternatives. There are six steps in inquiry learning, namely problem orientation, formulating the problem, making a hypothesis, exploration (gathering information or data), testing the hypothesis and making conclusions (Eristya et al., 2019; Kuang et al., 2022; Kwangmuang et al., 2021; Solé-Llussà et al., 2020).

The learning material topics are Newton's law 1, Newton's law 2 and Newton's law 3. Each learning material topic is carried out according to six steps in the inquiry learning syntax. First, analyze Newton's 1st law problems in everyday life, such as HVS paper being jerked when an object is on the surface of the paper. Find concepts according to structure, parts and relationships to obtain the problem (Anam et al., 2023; Daniel et al., 2023). Pull means force, which is applied in the direction of the plane of the paper even though the object remains in its position where Newton's 1st law applies, the direction of the paper pull or perpendicular to the direction of the paper pull. Based on experimental

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observations, the problem is the pull in the direction or perpendicular to the pull of the paper.

The force perpendicular to the pull indicates that the object is stationary, while the perpendicular force of the pull only the paper moves. The problem lies in the relationship between the object and the paper, of course in the direction perpendicular to the pull of the paper or the vertical force of a stationary object. This means that the force in the vertical direction is zero, silence indicates maintaining the state (inertia). So, Newton's 1st law is called the law of inertia. Thus, the problem is that the vertical force is zero. In fact, when we are going to analyze, we first find the concepts seen in experimental observations according to structure, parts and relationships, if we find them, then continue with the second syntax. Formulating a problem can be done after we find the problem.

The procedure for formulating the problem begins with a question sentence (in science (science) what and how) connected to the problem statement. What to explore early and how to solve the problem. One of the problem formulations is what influences the vertical force is zero; how the vertical force is zero. Third, test the hypothesis. The hypothesis is to answer the problem formulation that there is a relationship between vertical force and silence. Fourth, exploration or investigation (data collection). Data is a statement according to observations. The investigation is the vertical force on an object on the surface of the paper and at rest. Any force that acts on an object in the vertical plane. Of course, the weight of the object is directed towards the earth and the normal is perpendicular to the plane of the paper. In other words, the vertical force is a vector sum or resultant and remaining stationary means zero. The fifth hypothesis test is that there is a relationship between the resultant force and silence. Sixth conclusion, the resultant force acting on the object is zero. According to the same reasoning, inquiry learning syntax is also carried out on the topics of Newton's 2nd law and Newton's 3rd law.

This research aims to develop experiments in creativity and inquiry process skills. Creativity is the ability to create something new by connecting several existing things and making something new (Kauley et al., 2024). Science process skills are the ability to carry out actions in learning science so as to produce information (Aulia et al., 2023; Ekici et al., 2020; Wiratman et al., 2019), concepts, theories, principles and facts or evidence. indicators of students' science process abilities which include skills in using tools and materials, observation skills, classification skills, description skills, and communication skills (Tan et al., 2018). Components of science process skills according to Hunegnaw et al. (2023), Hodosyová et al. (2015), and Hikmah et al. (2018) includes: observing, proposing hypotheses, interpreting data, planning experiments, conducting experiments, drawing conclusions, communicating results. After the experiment participants contextualize researchable questions that enable them to design appropriate conceptual designs in the experiment. Inquiry learning through experiments means students are creative in carrying out science process skills in inquiry learning (Siantuba et al., 2023; Syahgiah et al., 2023) on Newton's laws 1, 2 and 3.

Method

This research was formed into two groups, namely the experimental group (KE) and the control group (KK), with treatment KE (creativity-based inquiry learning) and KK (conventional learning). The number of students in each class is 30 people. The research instrument consisted of teacher questionnaires, student questionnaires and questionnaires, assisted by observers in collecting KE and KK data.

Result and Discussion

After the inquiry learning was carried out by the researcher, the teacher's questionnaire data was analyzed to obtain inquiry learning syntax data consisting of: problem orientation, formulating RM problems, making RH hypotheses, exploration (gathering information or data) PD, testing UH hypotheses and making SP conclusions. It can be seen in Figure 1 that there are changes in the treatment of RM, RH, PD, UH and SP, with the average of each indicator RM 3, RH 3.2, PD 3, UH 2.8 and SP 2.9 seen in Table 1, using a Likert scale questionnaire (Harrell et al., 2023; Nieminen et al., 2021; Reith et al., 2020).

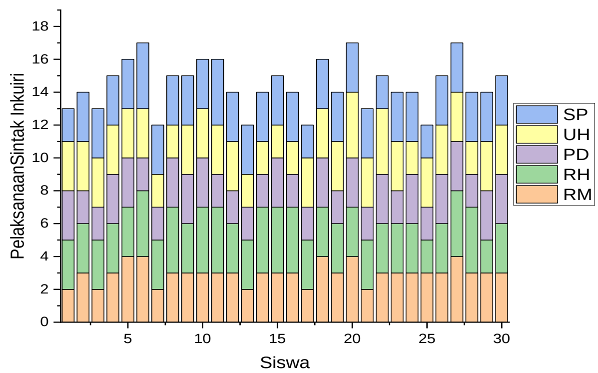

Figure 1. Results of implementing inquiry syntax

Table 1. Average Indicators RM, RH PD, UH

RM	RH	PD	UH	SP
3	3.20	3	2.80	2.90

Creativity has the power to solve problems and can help children achieve their goals. The purpose of the indicator mirror, the embodiment of the indicator is a questionnaire (García-Carmona et al., 2023; Guy et al., 2023; Romano et al., 2021). Creativity is a process that can give birth to innovation (new ideas) in all fields (Khessina et al., 2018; Neto et al., 2019; Zhou et al., 2020). The development of imagination is necessary to generate unique ideas that go beyond knowledge and skills (Ho et al., 2013). Creativity is not something new but rather a synthesis, namely a combination of existing knowledge and skills (Dou et al., 2021; Larraz-Rábanos, 2021). They must combine or connect the essential elements of unique and useful ideas (Darling-Hammond et al., 2020; Kim, 2019).

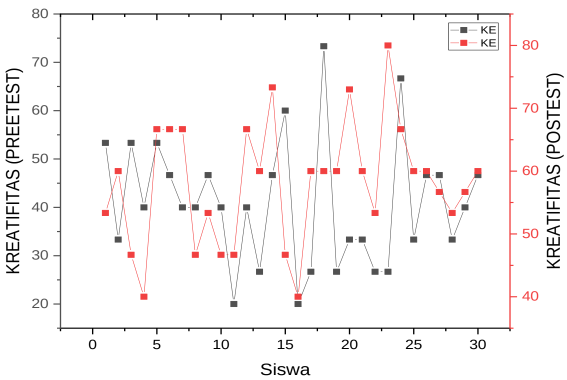

Figure 2. Creativity results after pretest/posttest (experimental group)

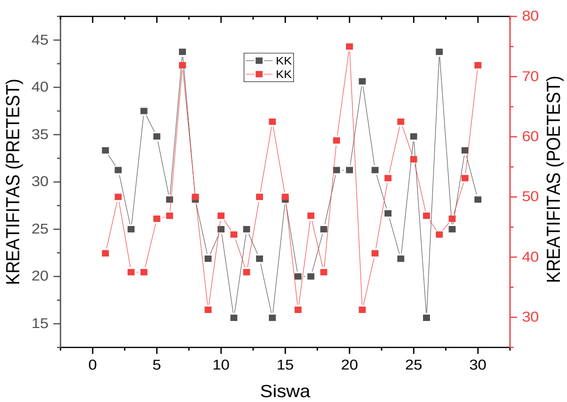

Figure 3. Creativity results after Pretest/Posttest KK (control group)

Table 2. Student Creativity

Creativity			
	Pretest		Posttest
KE	KK	KE	KK
29.87	28.12	55.77	48.61

The creativity of KE and KK students is shown in the results of the pretest and posttest KE questionnaires, which can be seen in Figure 2. The results of the pretest and posttest KK questionnaires can be seen in Figure 3. The analysis in Figure 2 and Figure 3 is connected to Table 2. According to the graph in Figure 2, black marks are for Pretest and red mark for Posttest. Creativity which lies above the range of the Pretest mean score of 29.87 KE to the Posttest mean of 55.77 KE totaled 11 Pretest students, totaling 19 Posttest students, there was an increase in creativity through the Pretest and Posttest questionnaires (Hetherington et al., 2018).

Based on the same reasoning, creativity lies above the range of the Pretest mean score of 28.12 KK to the Posttest mean of 48.61 KK totaling 12 Pretest students, totaling 9 Posttest students, there is a decrease in creativity through the Pretest and Posttest questionnaires. The procedure for making ranges (Idul et al., 2022), is to take a horizontal line from the black scale for pretest creativity and a horizontal line from the red scale for posttest creativity for both KE and KK. KPS analysis is carried out as in creativity, by making a mean range for each KE and KK. The average range is taken from table 3 for KPS analysis of increasing or decreasing KE and KK.

Table 3. Science Process Skills

Creativity			
	Pretest		Posttest
KE	KK	KE	KK
40.67	42.89	57.99	52

KPS which is located above the range of the Preetest average score of 40.67 KE to the Posttest average of 57.99 KE amounted to 12 Pretest students, totaling 17 Posttest students there was an increase in KPS. KPS which is located above the range of the average Pretest score of 42.89 KK to the average Posttest 52.00 KK amounted to 14 Pretest students, totaling 11 Posttest students there was a decrease in KPS.

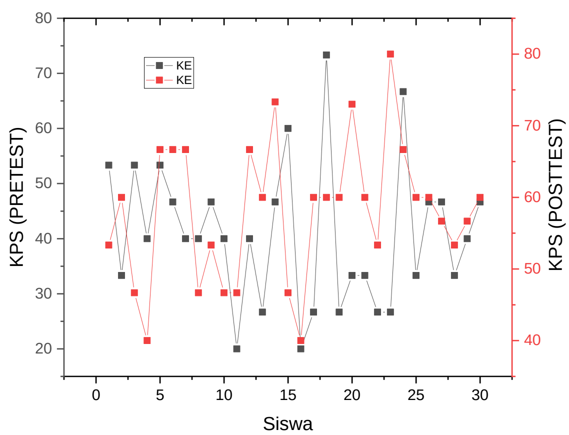

Figure 4. KPPS results after pretest/posttest (experimental group)

The analysis of creativity is related to KPS, both of which increase for KE, both decrease for KK (Marsh et al., 2024; Peguera-Carré et al., 2024).

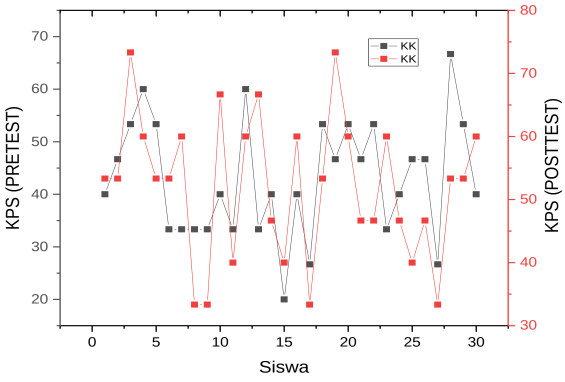

Figure 5. KPPS results after KKN pretest/posttest (experimental group)

Conclusion

The implementation of inquiry learning supported by creativity and science process skills (KPS) both increased for KE, shown by the average increase from RM to UH.

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Author Contributions
Conceptualization; J. S.; methodology.; M.; validation; S. M.; formal analysis; A. H. S.; investigation.; J. S; resources; M.; data curation: S. M.; writing—original draft preparation. A. H. S.; writing—review and editing: J. S.; visualization: M. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest
The authors declare no conflict of interest.

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