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Developing a Project-Combine-Put to another Use Learning Model to Enhance Science Process Skills and Creative Thinking in Primary Science Education

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ABSTRACT

Introduction. Science education in primary schools requires instructional approaches that simultaneously develop science process skills (SPS) and creative thinking skills (CTS) as essential 21st-century competencies. However, preliminary findings in Indonesian elementary schools revealed low mastery of observation, measurement, inference, and scientific communication, alongside limited flexibility, originality, and elaboration in creative thinking. Although Project-Based Learning (PjBL) has been widely implemented, its application often encounters challenges in time management, engagement, and structured skill measurement. Therefore, an innovative syntax integrating Project, Combine, and Put to Another Use is needed to systematically enhance both SPS and CTS in primary science education.

Research methods. The design used in this research was research and development design where 50 teachers who were primary school teachers and 104 pupils in the fourth grade session of four elementary schools in Probolinggo, Indonesia were involved. The PCP model was tested with the expert judgment- teacher response questionnaires and tested with SEM-PLS with the SmartPLS 4 to test the construct validity and reliability. Pretest-posttest models were employed to determine the effectiveness of the model which was validated by the use of normality, homogeneity and paired-sample t-tests.

Results. The results indicate that the PCP learning model demonstrates strong construct validity and reliability across all evaluated dimensions, with composite reliability values ranging from 0.815 to 0.953, Cronbach's alpha coefficients between 0.858 and 0.967, and AVE values exceeding 0.50. The SPS and CTS assessment instruments also met psychometric standards (SPS $\alpha = 0.924$; CTS $\alpha = 0.787$). Descriptive analysis revealed higher mean scores in the experimental group (SPS $M = 91.24$; CTS $M = 87.92$) compared to the control group (SPS $M = 71.33$; CTS $M = 82.56$). Normality and homogeneity assumptions were satisfied ($p > 0.05$). Paired-sample t-tests showed significant differences favoring the experimental group in both SPS ($t = -7.496$, $p < 0.001$) and CTS ($t = -2.682$, $p = 0.013$), confirming the effectiveness of the PCP model in improving science process and creative thinking skills.

Conclusion. These findings prove that the PCP learning paradigm is legitimate, realistic, and useful in enhancing scientific research and innovative thinking. The paper underlines the potential of the PCP model as a new teaching strategy to improve the teaching of 21st century competencies in primary science subjects.

KEYWORDS

creative thinking skills, PCP learning model, primary science education, science process skills, project-based learning, scamper strategy, primary education

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INTRODUCTION

Learners must be instructed in how to do scientific things to understand more effectively scientific ideas, to know the SPS. SPS are the abilities required to conduct a scientific research. Such competencies include both hands-on and cognitive knowledge that can assist a person in comprehending scientific concepts in order to apply scientific processes in comprehending natural phenomena [1]. SPS has two components: basic skills and integrating skills [2]. Basic SPS among primary students include observation, classification, measurement, communication, inference, and prediction, as outlined [3], who emphasize the role of both self- and teacher-assessment in skill development. Highlight how these skills are embedded in primary science textbooks [4]. Identify integrated SPS such as hypothesis formulation and data interpretation as critical components fostered through structured experimental strategies [5]. Experimental activities enhance students' creative thinking by fostering originality and problem-solving [6], who emphasize inquiry-based experimentation [7]. As a result, both tests and non-tests analyze the basic SPS indicators observation, measurement, categorization, inference, conclusion, and communication. Other skills like CTS are also necessary in addition to SPS in the 21st century of learning Natural Sciences.

In this century, primary schools should teach creative thinking skills as one of the most essential competency skills as well because it will prepare children to think flexibly, creatively, and adaptively to change. Early creative thinking development enhances idea generation and innovation [8] identify diverse creative potential profiles, while, creative skills with improved conceptual understanding and problem-solving [9]. Creative thinking consists of several components: fluency, flexibility, originality, and elaboration. Fluency refers to the ability to generate multiple ideas in a coherent flow, while flexibility involves producing varied ideas and viewing problems from different perspectives. Originality emphasizes the generation of unique and non-stereotypical responses [10], whereas elaboration refers to the ability to expand and refine ideas in detail, as discussed in frameworks of creative thinking assessment [11]. According to PISA creative thinking is crucial as it generates original ideas, improves cognitive flexibility, clarifies the ideas, and advances collaborative creativity when it comes to solving real-world problems [12]. The creativity thinking skills can be tested using reading tests and questions that take into account the measures of creativity that were proposed by Paul Torrance [13].

A pilot study at several elementary schools in Probolinggo, Indonesia, in March-April 2025 showed that fourth-grade students had poor SPS and CTS regarding the topic of matter and its changes. It was observed that difficulties were experienced in systematic observation, measurement, classification and inference, formulation of conclusion and scientific communication. Pretest measures had shown that only 56.5% of Grade IV A and 50% of Grade IV B students had achieved adequate conceptual understanding and measurement was the weakest SPS measure in both classes. At the same time, students demonstrated poor creative thinking abilities, particularly on flexibility, elaboration, and originality. The levels of mastery of creative thinking were limited as only 34.7% of students in Grade IV A and 20% in Grade IV B met the requirement, and elaboration was named as the least efficient indicator. These observations highlight a pressing need of innovative pedagogical approaches to enhance both SPS and CTS as persistent inefficiency could hinder the effectiveness of the curriculum and an appropriate development of valuable skills to be possessed by the new generation.

Developing SPS-oriented learning syntax can be achieved through PjBL, which enhances scientific competencies via contextual inquiry activities [14], while project approaches effectively support basic process skills development, particularly through structured experimental engagement [15]. Nevertheless, the PjBL method also presents several limitations. Research on its implementation at the elementary school level indicates challenges such as poor time management, limited teacher understanding of the PjBL framework, difficulties in maintaining student engagement, issues related to group dynamics [16], and constraints in fairly assessing individual student contributions, as discussed in studies examining practical barriers in applying PjBL in primary education contexts [17].

Nevertheless, there are certain challenges of the PjBL learning approach. The gaps in the implementation of PjBL learning model at primary schools include the insufficiency of time management, the lack of knowledge about the main principles of the PjBL learning model among the instructors, the ability to keep the students engaged, the ability to manage group dynamics, and the correct evaluation of individual contributions [18]. This demands syntax that is able to enhance the PjBL model syntax to offer measurement signifiers in SPS and CTS. The syntax of Scamper method (Substitute, Combine, Adapt, Modify, Put to another use, Eliminate, Reverse) can be added to the syntax of PjBL model because Scamper can be used as a creative and intuitive method of enhancing project-based learning. It has not explored the use of the PjBL model on the Scamper technique at the university level but not at the primary school level [19].

The trends in the use of PjBL model in the period between 2016 and 2023 show that application of the research and development strategy was just at 5.88% [20]. The outcomes of Scamper bibliometric research are not properly examined in the academic community [21]. The originality of this research is the possibility to identify the difference between the project model and combinatory syntax, which have not been used in primary school science education in parallel. The strategy provides a novel combination of project-based learning experiences with approaches to enhancing SPS and CTS. This study aims at developing a realistic, practical and effective project-combine-put to another use (PCP) learning paradigm that will help in enhancing SPS and CTS in primary schools.

MATERIALS AND METHODS

Research Design

The research and development approach employed in this study was to develop a legitimate as well as practical PCP learning model that could enhance SPS and CTS in primary schools. Validity of the model was tested through teacher response surveys with strong focus on model clarity, relevance, feasibility and instructional appropriateness. N-Gain analysis would be used to measure the effectiveness of the implementation, based on the pretest and posttest results of students to measure the level of learning improvement. The development was based on the instructional design phases developed by Dick and Carey, which include model development, user validation, pilot test, feasibility test, large scale implementation, effectiveness test, and refining of the final product [22].

Sample and Data Collection

The sample included 50 teacher and 104 primary grade IV students randomly chosen in one small pilot school and three large pilot schools in Probolinggo, Indonesia and represented different academic attainments (good, middling and weak). The sampling technique was necessary to provide a variety of learning settings and student capabilities, therefore, enhancing the representativeness and generalizability of the results. Differences in schools were in terms of the level of achievement and types, quantity, and availability of resources.

Instrument and Procedures

One of the data collection tools, practical guidelines, and measures of student SPS and CTS contain the verification criteria. The primary school teachers participating in the assessment were expert users who completed the assessment questionnaire. The validity test of the model was concerned with pragmatic issues, which indicated practicability and usability of the model on realistic learning. The questionnaire instrument was compiled based on practicality indicators, including: (1) compatibility with learning content, (2) compatibility with students' characteristics, (3) ease of implementation, (4) ease of preparation, (5) ease of understanding, (6) resource efficiency, (7) time management, and (8) usefulness and sustainability [23]. The effectiveness of the model using CTS tests is compiled in a question format with indicators: (1) fluidity, (2) flexibility, (3) elaboration, and (4) uniqueness [24]. The SPS test is structured as an assessment comprising the following indicators: (1) observation, (2) measurement, (3) classification, (4) inference, (5) conclusion, and (6) communication [25].

Data Analysis

SEM-PLS was used to analyze the data validity with SmartPLS 4 to test the measurement model. Outer loadings (≥0.70) and average variance extracted (AVE ≥0.50), were used to establish convergent validity whereas composite reliability (CR ≥0.70) was used to determine construct reliability. Discriminant validity was assessed using the Fornell–Larcker criterion and cross-loadings [26]. Effectiveness analysis followed prerequisite testing, including normality (Sig. > 0.05) and homogeneity (Levene's test, Sig. > 0.05), before applying paired-sample t-tests [27]. Significant differences were determined at $p < 0.05$, indicating meaningful improvements in SPS and CTS [28]. Paired-sample t-tests were used to examine pretest–posttest differences within groups, while independent-samples t-tests were applied to compare learning gains between the experimental and control groups.

RESEARCH RESULTS

Product development should be approached as a project that integrates a combined learning model to enhance SPS and CTS. This product was created to enhance the PCP model phase outlined in Table 1.

Table 1 Phases of the PCP learning model and learning activities

No.	Phase	Learning activities	SPS indicators	CTS indicators
1.	Formulating the project	a. Students discuss and formulate investigative questions. b. The teacher facilitates the discussion through open-ended questions.	observation, inference	fluency
2.	Combine	a. Students integrate ideas from group members. b. The teacher provides support during the idea-combining process.	measurement, classification	fluency, fleksibilty, originality
3.	Designing	a. Students detail the project procedures and identify required tools and materials. b. The teacher assists in assigning tasks based on students' abilities.	classification, inference	fluency, fleksibilty
4.	Implementing the project	a. Students conduct hands-on experiments. b. The teacher monitors the process and provides feedback during practice.	measurement, inference	fluency, fleksibilty
5.	Monitoring project	a. Students present the progress of their projects. b. The teacher monitors each group's project development.	communication	flexibility
6.	Put to another use	a. Students present the final project products and analyze their effectiveness. b. The teacher conducts assessments using a rubric aligned with the evaluation criteria.	inference	elaboration, originality
7.	Evaluation	a. Students present the final project products and analyze their effectiveness. b. The teacher conducts assessments using a rubric aligned with the evaluation criteria.	conclusions	elaboration
8.	Presenting the project	a. Students present their projects using multimedia (e.g., posters, videos, demonstrations). b. The teacher reflects on the presentation outcomes of each group.	communication	originality

The results of the PCP model validity assessment by expert users focused on practical aspects that reflect the feasibility and ease of use of the model with 8 indicators presented in Figure 1 and Table 2.

The SEM-PLS analysis conducted with SmartPLS 4 reveals that the PCP learning model exhibits robust construct validity and reliability in all evaluated dimensions. Composite reliability ratings ranged from 0.815 to 0.953, while Cronbach's alpha coefficients varied from 0.858 to 0.967, both beyond the required threshold of 0.70, so affirming internal consistency. The validity was supported as a result of convergent validity through average variance extracted (AVE) scores which ranged between 0.672 and 0.907, that is, each construct had adequate explanations on an average of over 50% of the variance of its indicators. The greatest reliability and validity were observed in areas of preparation ease, usefulness, sustainability, and time management suggesting that the approach is practical, successful, and sustainable in classroom applications. At the same time, the compatibility with educational material, student characteristics and comprehensibility proved to be good in terms of dependability and AVE values which show that it meets the curricular requirements and needs of learners. These results indicate that the PCP learning model possesses the established validity and reliability criteria and can be used to determine the effectiveness of this model in improving SPS and CTS. In addition, the Figure 2 and Table 3 have validated and shown reliability of the SPS and CTS test instruments.

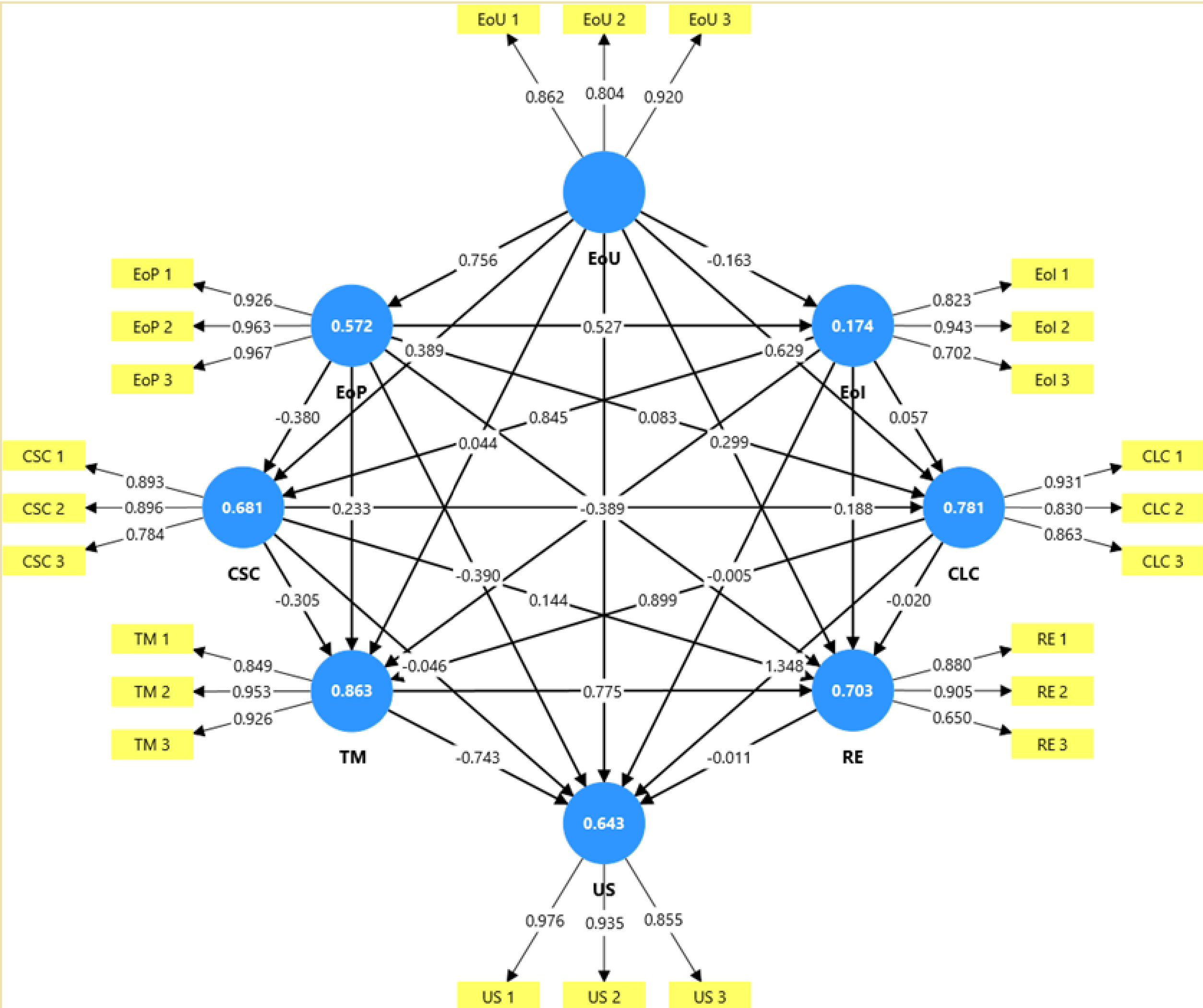

Figure 1 Graphical output of SEM-PLS of validity of the PCP model

Table 2 Validity and reliability of the PCP learning model

Aspect Assessment	Composite Reliability (rho_a)	Composite Reliability (rho_c)	Cronbach's Alpha	AVE
Compatibility with Learning Content	0.850	0.908	0.847	0.767
Compatibility with Students' Characteristics	0.819	0.894	0.82	0.738
Ease of Implementation	0.815	0.866	0.771	0.623
Ease of Preparation	0.953	0.967	0.949	0.907
Ease of Understanding	0.837	0.897	0.828	0.745
Resource Efficiency	0.759	0.858	0.743	0.672
Time Management	0.907	0.935	0.896	0.829
Usefulness and Sustainability	0.938	0.945	0.913	0.852

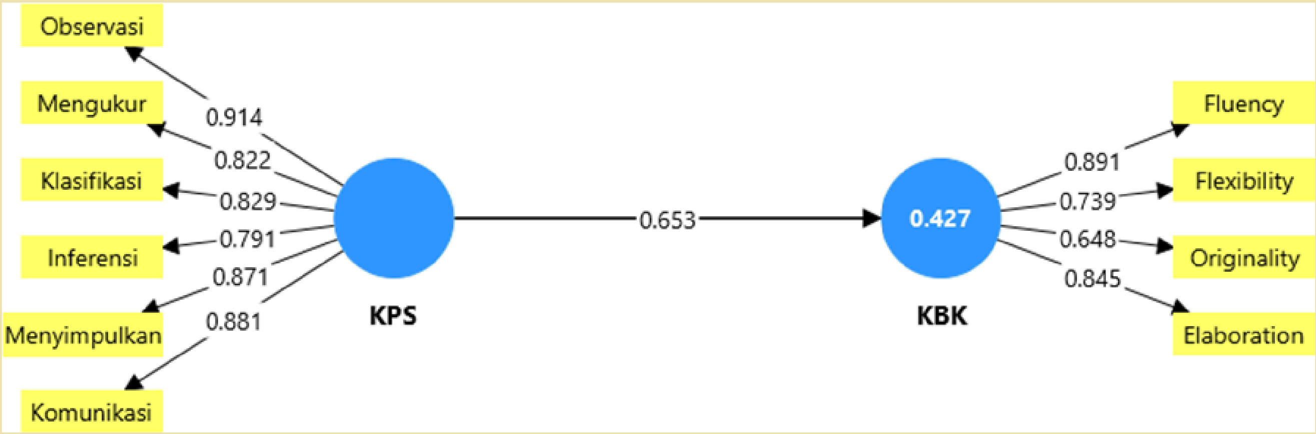

Figure 2 Graphical output of SEM-PLS of assesment instrument SPS and CTS

Table 3 Validity and reliability of SPS and CTS assessment instruments

Instrument	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	AVE
SPS	0.924	0.929	0.941	0.726
CTS	0.787	0.794	0.865	0.618

The outcome of the validity and reliability analysis of the assessment tools of SPS and CTS indicate that the two tools meet the standards of psychometric tests. The SPS instrument showed high internal consistency as indicated by a high Cronbach's alpha value of 0.924 and strong composite reliability coefficients (ρa = 0.929; ρc = 0.941). The convergent validity of the concept of SPS was also justified and the average variance extracted (AVE) was 0.726 which is above the recommended value of 0.50. The CTS measure indicated sufficient reliability, with a Cronbach alpha of 0.787 and composite reliability of 0.794 (ρa) and 0.865 (ρc) indicating reasonable internal consistency. The AVE of 0.618 also confirms enough convergent validity of the CTS construct. These results support the fact that the SPS and CTS assessment tools are valid, and reliable in assessing the learning outcomes in students and can be used in assessing the effectiveness of the PCP learning paradigm unit of primary educational settings. Following the validation, data concerning the effect of the PCP learning model in the development of SPS and CTS of the students was gathered as is seen in Table 4.

Table 4 Descriptive statistics of SPS and CTS scores

Class	Skill	N	Minimum	Maximum	Mean	Std. Deviation
Control	SPS	27	42	96	71.33	14.454
Control	CTS	27	56	100	82.56	12.522
Experiment	SPS	25	83	100	91.24	5.182
Experiment	CTS	25	69	100	87.92	9.318

The descriptive statistical results also indicate that there are significant differences between the experimental and the control groups in terms of SPS and CTS. The SPS scores in the control group ranged between 42 and 96 with a mean of 71.33 and a significant standard deviation of 14.45, which showed that there is a significant difference in the performance of the students in the control group. The control group CTS scores had mean value of 82.56, and a range of 56 to 100 and standard deviation of 12.52. On the other hand, the experimental group using PCP learning model had highly higher average scores and more consistent performance. The means of the SPS score in the experimental class was 91.24 with less range of scores of 83 to 100 and less SD of 5.18. In line with this, the experimental group scored higher on the mean of CTS (87.92) with minimal variability (SD = 9.32). The data show that PCP learning paradigm improves and stabilizes the SPS and CTS results better in contrast to the traditional training. After receiving the descriptive data, the normality test was conducted, and the results are provided in Table 5.

Table 5 Normality test result

Class	Skills	Kolmogorov-Smirnovb			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Control	SPS	.103	27	.200*	.985	27	.954
Control	CTS	.154	27	.099	.939	27	.113
Experiment	SPS	.127	25	.200*	.967	25	.569
Experiment	CTS	.121	25	.200*	.961	25	.426

Results of the normality test of SPS and CTS in both the control and experimental group show that the data were normally distributed. Kolmogorov Smirnov test showed that all the significance values were above the 0.05 threshold with a 0.099 to 0.200 range, which means that there was no significant difference in normality. These findings were further supported with the results of the ShapiroWilk test which is more suitable in small samples. The control group Shapiro Wilk significance values were 0.954 and 0.113 respectively in case of SPS and CTS but the experimental group had a significant value of 0.569 and 0.426 respectively. All the values were above 0.05, which supports the idea that the SPS and CTS scores of both groups followed the normal distribution. The fact that the normalcy assumption was satisfied indicates that the use of parametric statistics, e.g. t-tests, was appropriate in the comparison of the learning result between control and experimental groups in this research. After the normality test results were obtained, a homogeneity test was conducted and the results are given in Table 6.

Table 6 Homogenity test result

Variable		Levene Statistic	df1	df2	Sig.
SPS	Based on Mean	.001	1	50	.979
	Based on Median	.001	1	50	.981
	Based on Median and with adjusted df	.001	1	47.603	.981
	Based on trimmed mean	.002	1	50	.962
CTS	Based on Mean	.581	1	50	.450
	Based on Median	.322	1	50	.573
	Based on Median and with adjusted df	.322	1	49.997	.573
	Based on trimmed mean	.526	1	50	.472

The homogeneity test outcome of Levene shows that the variances of the scores of SPS and CTS between the control and the experimental courses are homogeneous. In the case of SPS, the value of all the criteria were significant (mean, Sig. = 0.979), median (Sig. = 0.981), adjusted median (Sig. = 0.981), and trimmed mean (Sig. = 0.962)) more than the 0.05 threshold; therefore, showing the equality of the variances of the groups. The CTS data passed the homogeneity assumption and significant values were found ranging between 0.450 and 0.573 in all the levels of Levene test. The findings show that both SPS and CTS did not have statistically significant differences in variance in the control and experimental groups. The fulfillment of the homogeneity assumption justifies the use of parametric statistical tests e.g. the independent-samples t-test to explore the difference in learning outcomes following the application of the PCP learning model. The differences in the mean scores thus cannot be considered as a result of differences in variance, thus, justifying the use of paired samples T-test to carry out further analysis, the results of which are shown in Table 7 below.

Table 7 Paired samples T-Test result

Comparison		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Control Class SPS - Experiment Class SPS	-21.560	14.382	2.876	-27.497	-15.623	-7.496	24	.000
Pair 2	Control Class CTS - Experiment Class CTS	-7.840	14.616	2.923	-13.873	-1.807	-2.682	24	.013

The results of the paired-samples t-test show that there were significant differences in both SPS and CTS in the control and experiment group. The mean difference of SPS of the control and experimental groups was -21.56 and the 95% interval was -27.50 -15.62. The t-value of 0.0226 with a level of 24 and the level of significance of 0.000 indicates that the difference between the experimental and the control group is very significant. The comparison of the CTS showed that the difference between the means is -7.84 with a 95 percent interval of -13.87 -1.81. The t-value of -2.682 and significance level of p = 0.013 shows that there is statistically significant difference between the groups. The findings show that students who participated in the PCP learning model achieved much better SPS and CTS scores compared to those who took part in the control class. The findings provide strong empirical support to the effectiveness of the PCP learning paradigm on enhancing science process skills and cognitive abilities of creative thinking in students of primary schools.

DISCUSSION

The findings of this study suggest that the PCP learning paradigm is conceptually sound, psychometrically reliable, and pedagogically effective in enhancing primary school students' SPS and CTS. The structured steps of the PCP model progressively align with learning activities as well as SPS and CTS indicators, ensuring the simultaneous development of cognitive and procedural abilities [29]. This approach is consistent with constructivist learning theory, which emphasizes active knowledge construction through inquiry, collaboration, and reflection, as discussed in foundational studies on constructivism and student-centered learning environments [30]. Furthermore, integrating project-based learning with creative thinking strategies such as idea combination and functional transformation encourages greater student engagement in authentic scientific activities [31]. This is supported by prior research demonstrating the effectiveness of project-based and inquiry-based learning models in fostering active participation and deeper conceptual understanding in science education [32].

The results of the SEM-PLS confirm that the PCP model has strong construct validity and reliability in all dimensions that are measured. High composite reliability and Cronbach's alpha indicate the existence of internal consistency, whereas values higher than 0.50 of the AVE are used to confirm the presence of convergent validity [26]. The percentage of preparation simplicity, time management among others are significantly high, which means that the PCP approach is not only theoretically correct but also practical in classrooms. These findings align with prior studies highlighting that instructional models must integrate usability and pedagogical effectiveness to ensure sustainability [33], while maintaining practical applicability and consistent learning outcomes across diverse educational contexts [34]. Furthermore, the strong alignment of the model with student characteristics suggests that it is developmentally appropriate for elementary school contexts. This supports prior studies showing learner-centered and project-based approaches increase motivation [35] and promote deeper conceptual understanding through active engagement and contextual learning experiences among primary school students [36].

The SPS and CTS evaluation tools demonstrated excellent psychometric quality. The high reliability and convergent validity of both instruments indicate that the recorded improvements reflect genuine learning gains rather than measurement errors. This finding supports previous research emphasizing the need for robust and reliable assessment tools to evaluate higher-order skills such as scientific reasoning and creativity, which are inherently complex and difficult to measure objectively. For instance, [37] study highlights the challenges of assessing scientific reasoning due to its multifaceted nature and recommends the use of validated instruments, while study [38] focuses on the measurement of creativity and underscores the importance of reliability and validity in capturing students' creative performance accurately. The validated instruments contribute to the increased validity of the reported learning outcomes and provide a strong background to the further implementation in similar learning environments.

The inferential analysis and descriptive statistics provide significant information concerning the effectiveness of the PCP model. The experimental group showed a high SPS and CTS rating, in comparison with the control group, with less variation of scores. It is a pointer that the PCP model would improve the overall performance and at the same time promote a more fair educational outcome. The normality and homogeneity tests demonstrated that the data met the conditions of the parametric tests, therefore, increasing the statistical validity of the further researches. The paired samples t-test showed a very significant difference in favor of the experimental group that the changes experienced are as a result of PCP intervention and not random fluctuation.

The results of the present research are in line with the earlier research reports that highlight the significant improvement of SPS, including observation, measurement, inference, and communication skills, through project-based and creative learning methodologies. Specifically, study [39] demonstrates how project-based learning enhances students' practical scientific skills through hands-on investigation, while study [40] highlights the role of creative learning approaches in improving students' ability to communicate and interpret scientific findings effectively. Furthermore, the "Combine" and "Put to Another Use" phases of the PCP model particularly support the development of creative thinking processes, including fluency, flexibility, originality, and elaboration. For example, study [41] explains how combining ideas fosters flexibility and originality in problem-solving, whereas study [42] emphasizes elaboration and fluency as key outcomes of instructional strategies that encourage idea transformation and adaptation. The PCP approach advocates the combination of ideas and re-packaging of scientific outputs into new situations, hence creativity must be defined as an ability that is learnable and measurable as opposed to being an inborn tendency.

The results analysis shows that PCP learning model can be successful in bridging the gaps between scientific inquiry and creative thinking within the consistent teaching framework. This model is designed to meet current educational demands that emphasize 21st-century competencies, including problem-solving, creativity, and scientific literacy. For instance, study [43] highlights the importance of integrating scientific literacy and inquiry-based skills to prepare students for real-world problem-solving, while study [44] emphasizes creativity and innovation as essential competencies in modern education frameworks. The consistency of positive outcomes in the tests of validity, reliability, and efficacy indicates that the PCP model has a high potential in its further use in the primary scientific education. Future studies can explore its long-term implications, applicability to other fields, and applicability to non-homogeneous learner populations to increase its role in the new teaching practices. Although these results were promising, this study was confined to one region of primary schools, which can lead to generalization bias.

CONCLUSION

The results suggest that PCP learning model is a valid, reliable, and effective teaching method in improving SPS and CTS among primary school students. The sequential and structured phases of the PCP model form a good mixture of project-based learning and techniques of creative thinking that enable the students to be involved in scientific inquiry as well as improve the higher-order thinking abilities. The available empirical findings based on the assessment of validity, reliability, and efficacy portray that the PCP approach significantly improves students SPS and CTS compared to standard education, as well as creates more uniform and equal learning outcomes. The great correspondence of the model with the constructivist principles of learning also confirms its high level of theoretical soundness and pedagogical importance in making learning experiences meaningful and student-centered in elementary scientific learning.

There are two implications of this study. The PCP learning paradigm offers educators an effective and sustainable education model that addresses the requirements of the curriculum and advances the key skills of the 21st century, such as creativity, problem-solving, and scientific literacy. Its outstanding level of usability, time management, and suitability to the student properties show that it can be readily implemented in most primary school institutions. The endorsed SPS and CTS assessment devices provide educators with reliable devices that will help to assess the higher-order learning outcomes in an objective way. The research theoretically contributes to the present knowledge of combined project-based and creative learning models by demonstrating how creativity can be developed and assessed in science education in a systematic way. The future research must examine the long-term consequences of the PCP model, its relevance in other fields of learning, and its effectiveness using various learner populations, therefore, making its contribution to modern and comprehensive teaching approaches.

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