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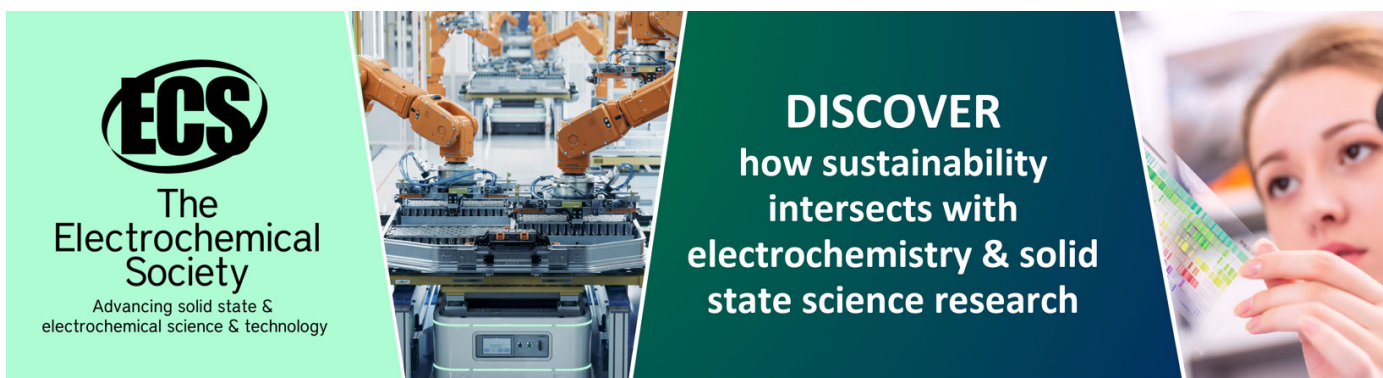
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The effectiveness of collaborative problem based physics learning (CPBPL) model to improve student's self-confidence on physics learning

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Abstract. In the previous research, Collaborative Problem Based Physic Learning (CPBPL) model has been developed to improve student's science process skills, collaborative problem solving, and self-confidence on physics learning. This research is aimed to analyze the effectiveness of CPBPL model towards the improvement of student's self-confidence on physics learning. This research implemented quasi experimental design on 140 senior high school students who were divided into 4 groups. Data collection was conducted through questionnaire, observation, and interview. Self-confidence measurement was conducted through Self-Confidence Evaluation Sheet (SCES). The data was analyzed using Wilcoxon test, n-gain, and Kruskal Wallis test. Result shows that: (1) There is a significant score improvement on student's self-confidence on physics learning ($\alpha=5\%$), (2) n-gain value student's self-confidence on physics learning is high, and (3) n-gain average student's self-confidence on physics learning was consistent throughout all groups. It can be concluded that CPBPL model is effective to improve student's self-confidence on physics learning.

1. Introduction

Self-confidence is one of the most important aspects of student learning and motivation [6,7]. Self-confidence refers to the expectations and beliefs for success in one's life [6, 8] and influences the success of student learning processes and outcomes [9-13]. Self-confidence that learners have the belief that there is a chance to succeed and make them motivated [13]. Self-confidence is explicitly contained in Permendikbud No. 20 of 2016 on the competency standards of secondary education graduates that students are required to have self-confidence in interacting effectively with the surrounding social and natural environment in placing itself as a reflection of the nation in the association of the world [14]. It shows the learning of physics in senior high school as a medium to increase self-confidence.

The expectation of the importance of self-confidence is contrary to the reality in Indonesian education. The results of preliminary studies show that self-confidence in senior high school students in Indonesia is generally low in the process of physics solving problems [15, 16]. Supported by TIMSS study results, Indonesia has the lowest level for student's self-confidence in subject physics, chemistry, biology, and earth science [17]. The results of previous research indicate a serious problem related to the self-confidence of senior high school students. Therefore the need to increase student's self-confidence in physics solving problems, especially in senior high school physics level.

In the previous research, Collaborative Problem Based Physic Learning (CPBPL) has been developed to improve student's self-confidence on senior high school [16]. The CPBPL model has been specially designed to increase the self-confidence of senior high school students in physics problems solving. CPBPL model has 5 phases, namely: (1) motivation and problem orientation; (2)



collaborative problem solving activities; (3) presents; (4) non-routine problem solving; and (5) evaluation. The previous research developed a device of learning physics as an operational form of CPBPL model developed. CPBPL model learning tool is a novelty based on the need for current and future. This is in accordance with the novelty of [18] that "there is a need for the intervention and its design is based on state-of-the-art knowledge." Before developing the learning tool, analysis, and literature review to obtain features as an improvement of needs, difficulties and weaknesses in the field [19]. The learning tools developed have key features in CPBPL model, namely (1) integrating teacher books and warp student books, (2) basic and integrated science process skills, (3) student cantered learning, (4) collaborative problem solving skills and self-confidence is emphasized in physics learning. The CPBPL model and learning tools developed by researchers have fill the needs and demands of the curriculum in Indonesia and 21st Century skills. Therefore, it is hoped that the implementation of the CPBPL model that have been developed are expected to contribute to improving student's quality in Indonesia.

A model is said to be of high quality when it meets the criteria of validity, practicality, and effectiveness [20]. In previous research has been developed CPBPL model that proved valid to increase self-confidence of high school students in physics learning [21]. The purpose of this research is to analyze the effectiveness of CPBPL model to increase the self-confidence confidence of senior high school students in physics learning. The focus of the problem in this study included: (1) whether there was a significant increase (statistically) of student's self-confidence before and after the CPBPL model was applied, (2) how much level of confidence increased before and after applied CPBPL model there is an average difference in the level of student's self-confidence after learning with CPBPL model in all four groups.

2. Methodology of Research

2.1. General Background of Research

This research was conducted at Senior High School State 19 Surabaya and Senior High School State 1 Tegaldlimo, Indonesia from October to December 2016. The scope of this research is on X Class senior high school students taking physics learning in academic year 2016/2017. Basic physics materials used in physics learning in class include (1) Heat: Effect of heat on changes in temperature of objects; the influence of heat on the change of being, and Black's principle. (2) Elasticity material: (a) material elasticity, (b) Hooke's law, and (c) spring series. This research is emphasized on the analysis of the fulfilment of the effectiveness of CPBPL model by analysing the improvement of student's self-confidence before and after following the process of problem solving on physics learning with CPBPL model. The effectiveness of the CPBPL model was determined based on a significant increase in scores (statistically) between pre-test and post-test of student's self-confidence, as well as the mean of n-gain determined by criteria: low, medium and high.

2.2 Sample of Research

The sample in this study were 140 students of Senior High School State 19 Surabaya and Senior High School State 1 Tegaldlimo, Indonesia; which is in the four groups, namely: group-1 (students of class X1 Senior High School State 19 Surabaya), group-2 (students class X2 Senior High School State 19 Surabaya), group-3 (students of class X1 Senior High School State 1 Tegaldlimo) 4 (students of class X2 Senior High School State 1 Tegaldlimo). Each group consists of 30 students who take physics learning in academic year 2016/2017.

2.3 Instrument and Procedures

Self-Confidence Evaluation Sheet (SCES) is an instrument used to measure student's self-confidence in the process of physics problems solving adapted from Problem Solving Confidence Questionnaire [22]. Self-Confidence Evaluation Sheet (SCES) includes self-confidence indicators in this research, namely motivation, ability, and perseverance [23]. Basic Physics materials used in physics learning include: (1) Heat: Effect of heat on changes in temperature of objects; the influence of heat on the

change of object, and Black principle. (2) Elasticity material: a) Material elasticity, b) Hooke's Law, and c) spring series. This research uses one group pretest-posttest design that is O1 X O2 [24]. The learning process begins by giving pre-test (O1). Each student is required to complete the Self-Confidence Evaluation Sheet (SCES). After the pre-test, the teacher applies CPBPL model and learning tool in each group (X). Learning tools are specifically designed to be integrated with self-confidence indicators consisting of: motivation, ability, and perseverance at each learning phase. The process of physics learning ends with post-test (O2). Every student is required to post-test of self-confidence by filling Self-Confidence Evaluation Sheet (SCES).

2.4 Data Analysis

Student's self-confidence is analysed based on the assessments obtained by students before and after learning using the CPBPL model. The pre-test, post-test, and n-gain data of student's self-confidence were further analysed using inferential statistical tests with the help of SPSS and reinforced by qualitative descriptive analysis. The score level for self-confidence is based on indicators of motivation, ability, and perseverance [22, 23]. The criteria for achieving the score for self-confidence are as follows. $0 \leq x \leq .2$: Very Low; $.2 < x \leq .4$: Low; $.4 < x \leq .6$: Moderate; $.6 < x \leq .8$: Height; $.8 < x \leq 1$: Very High. The effectiveness of the CPBPL model is determined by: (1) there is a statistically significant increase in the level of significance, $\alpha = 5\%$, (2) the level of increase determined by the normalized gain value (n-gain) at least moderate, and (3) the increase in the four groups statistically did not differ significantly. The n-gain value is determined by the equation: $n\text{-gain} = (\text{score post-test} - \text{score pre-test}) / (\text{maximum score} - \text{pre-test score})$ [25]. According to the following criteria: (1) if $n\text{-gain} \geq .7$ (high), (2) if $.3 < n\text{-gain} < .7$ (moderate), and (3) if $n\text{-gain} \leq .3$ (low).

3. Result of Research

The learning outcomes of all groups related to the self-confidence are presented in Figures 1 and Table 1. Black bars represent the mean of pre-test, shape bar scores represent the mean post-test scores, and vertical bar scores represent the n-gain scores. Figure 1 shows the average post-test scores of self-confidence in the Physics learning for all groups is greater than the pre-test score. The average pre-test, post-test, and n-gain scores associated with self-confidence indicators for all groups are presented in detail in Table 1. Figure 1 shows the average n-gain value of self-confidence for group-1, group-2, group-3, and group-4 are respectively .72; .74; .71; and .71. The average n-gain value of self-confidence for all groups is in the high category.

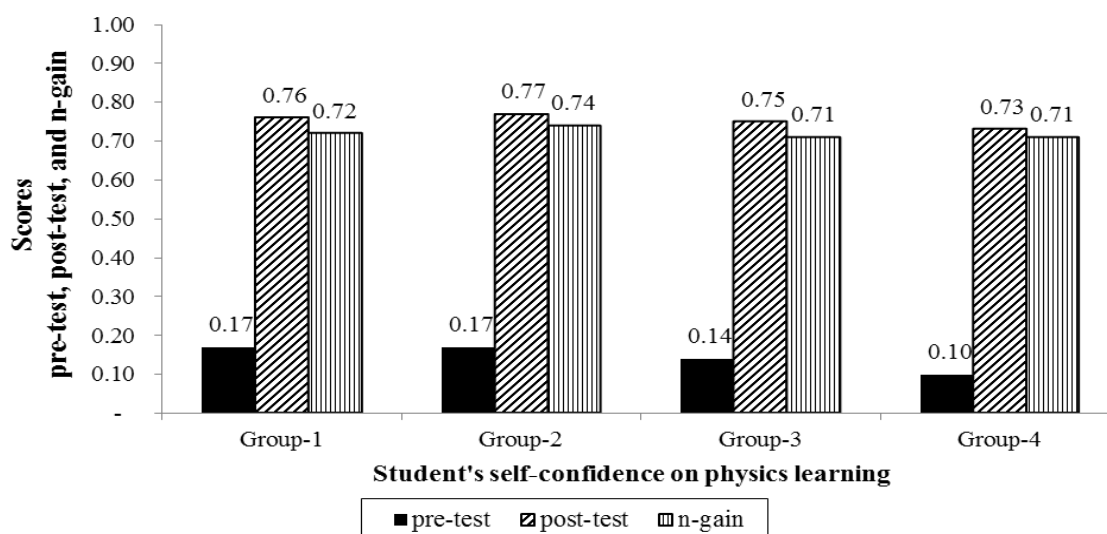


Figure 1. The average pre-test, post-test, and n-gain scores of self-confidence in all groups.

Table 1. The average score of pre-test, post-test and n-gain of self-confidence in all groups.

School	Groups	Scores	Self-confidence Indicator		
			Motivation	Ability	Perseverance
Senior High School State 19 Surabaya	1	Pre-test	.13	.14	.25
		Post-test	.70	.76	.83
		n-gain	.66	.72	.77
	2	Pre-test	.12	.13	.25
		Post-test	.77	.75	.80
		n-gain	.74	.71	.73
Senior High School State 1 Tegaldlimo	3	Pre-test	.13	.12	.17
		Post-test	.75	.71	.80
		n-gain	.71	.67	.76
	4	Pre-test	.11	.11	.09
		Post-test	.73	.70	.77
		n-gain	.70	.66	.74

Table 1 shows that the self-confidence test scores of each indicator include: motivation, ability, perseverance are low for all groups and the post-test score of self-confidence in each indicator is high for all groups. The n-gain of self-confidence score of each indicator includes: motivation, ability, and perseverance in all groups are moderate/high.

Table 2. Wilcoxon test Result of self-confidence for all groups.

School	Group	Data	N	Z	p
Senior High School State 19 Surabaya	1	<i>Pretest-Posttest</i>	35	-4.11	< .01
	2	<i>Pretest-Posttest</i>	35	-4.11	< .01
Senior High School State 1 Tegaldlimo	3	<i>Pretest-Posttest</i>	35	-4.11	< .01
	4	<i>Pretest-Posttest</i>	35	-4.11	< .01

p < .05 (2-tailed)

Table 2 shows the improving in pre-test and post-test self-confidence tested using Wilcoxon test. The Z score gives a value of -4.11; -4.11; -4.11; -4.11 for group-1; group 2; group 3; group 4. Each score is considered significant, because $p < .05$. Because Z the result of the calculation is negative so it shows that there is an increase of high school students after applied learning with CPPBL model for all groups. Furthermore, the consistency of the impact of the implementation of the CPPBL model on improving self-confidence was analyzed using the Kruskal-Wallis test shown in Table 3.

Table 3. Kruskal-Wallis test Result of self-confidence for all groups.

	N	Chi square	df	p
Group 1, group 2, group 3, group 4	140	2.17	3	.54

Table 3 shows the significance value $p = .54 > .05$. This clearly indicates that there is no difference in the increase the self confidence after using the CPPBL model for all groups. This indicates a consistent increase in self confidence in all groups after using the CPPBL model.

4. Discussions

A more complete explanation concerning the effectiveness of the CPPBL model for enhancing student's self-confidence is described as follows. The effectiveness of the CPPBL model on improving student's self-confidence in physics learning can be seen from: (1) an increase in pre-test and post-test scores, (2) n-gain self-confidence value, and (3) (consistent), as shown in Figure 1, Table 1, and Table 2. Before the CPPBL model is applied; students less master the self-confidence, average score of students is under the standard score (minimum score .20 in score range 0-1), that is the average score of self-confidence for group-1, group-2, group-3, and group-4 respectively are .17; .17; .14; and .14. All this time, students are not used to motivation, ability, and perseverance. This is supported by [15, 16] that the self-confidence of high school students in Indonesia is generally still low in the process of physics problems solving. Supported with TIMSS study result, Indonesia has lowest level for student's self-confidence in subject physics, chemistry, biology, and earth science [17].

Conversely, after the CPPBL model was applied to the Physics learning, the mastery of student's self-confidence rises above average and becomes high; the average score of scientific self-confidence for groups-1, group-2, group-3, and group-4 respectively to .76; .77; .75; .73 (well beyond the minimum score of .70 in the 0-1 score range). The increase in self-confidence is allegedly influenced by the role of the student's self-confidence as the scenario in phase of the CPPBL. Each phase emphasizes self confidence in collaborative physics problem solving activities. Self-confidence refers to the expectations and beliefs for success in one's life [6, 7] and influences the success of student learning processes and outcomes [9-12]. Supported with other research results by [26] that problem-solving group has the highest learning outcomes compared to individual and competition learning.

The increase of self-confidence score in all groups was significant and did not differ (consistent) at the 5% significance level with n-gain of .72 for group-1; .74 for group-2; .71 for group-3; and .71 for group-4. This means that there is an increase in student's self-confidence after the application of physics learning with CPPBL model. Increased self-confidence is supported by the availability of self-confidence learning needs as suggested in phase of the CPPBL model. Students must work collaborative and are interdependent positive to optimize all their knowledge in designing and implementing problem-solving strategies. It supported with theory self-regulated learning [27]. Self-confidence is explicitly contained in Permendikbud Article 20 of 2016 on the competency standards of primary and secondary education graduates that students are required to have self confidence in interacting effectively with the surrounding social and natural environment in placing itself as a reflection of the nation in the association of the world [14]. Based on the above description, the implementation of CPPBL model is able to develop the role of student's self confidence in collaborative problem based physics learning.

The level of self-confidence improvement for all groups due to the application of learning with the CPPBL model is significant at 5% real level and consistent in the high category. It is suspected because a teacher device that has been valid supports it. In addition, the increase in self-confidence is strongly influenced by the success of phase of CPPBL model. Teachers should be able to increase student's self-confidence by providing many varied and challenging experiences that can improve learning success. The importance of collaborative investigation according to the John Dewey flow of problem solving [28] that the class should be a laboratory for solving real-life problems [29-30]. It is based on cognitive constructivist theory by Piaget (1954, 1963), any student of any age actively involved in the process of obtaining information and constructing their own knowledge [28]. Students should be actively involved in individual problem solving before contributing in collaborative problem solving. Based on the above description, the implementation of CPPBL model is able to develop the role of student's self confidence in physics learning.

5. Conclusions

Conclusion of this research shows that: (1) There is a significant score improvement on student's self-confidence on physics learning ($\alpha=5\%$), (2) n-gain value student's self-confidence on physics learning is high, and (3) n-gain average student's self-confidence on physics learning was consistent throughout all groups. It can be concluded that CPBPL model is effective to improve student's self-confidence on

physics learning. The implication of this research is that CPPBL model can be used as an alternative to overcome the low of student's self-confidence on physics learning. To strengthen the result of this research, it is necessary to do further research in various education levels and countries.

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