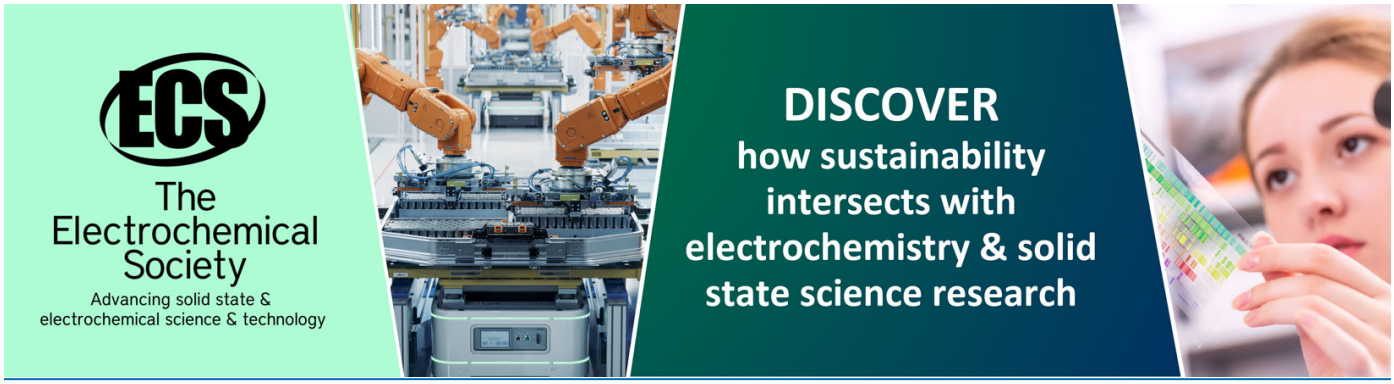
The effectiveness of CCDSR learning model to improve skills of creating lesson plan and worksheet science process skill (SPS) for pre-service physics teacher



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The effectiveness of CCDSR learning model to improve skills of creating lesson plan and worksheet science process skill (SPS) for pre-service physics teacher

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Abstract. In the previous research, CCDSR (Condition, Construction, Development, Simulation, and Reflection) learning model has been developed to improve science process skills for pre-service physics teacher. This research is aimed to analyze the effectiveness of CCDSR learning model towards the improvement skills of creating lesson plan and worksheet of Science Process Skill (SPS) for pre-service physics teacher in academic year 2016/2017. This research used one group pre-test and post-test design on 12 pre-service physics teacher at Physics Education, University of Khairun. Data collection was conducted through test and observation. Creating lesson plan and worksheet SPS skills of pre-service physics teacher measurement were conducted through Science Process Skill Evaluation Sheet (SPSES). The data analysis technique was done by Wilcoxon t-test and n-gain. The CCDSR learning model consists of 5 phases, including (1) Condition, (2) Construction, (3) Development, (4) Simulation, and (5) Reflection. The results showed that there was a significant increase in creating lesson plan and worksheet SPS skills of pre-service physics teacher at $\alpha = 5\%$ and n-gain average of moderate category. Thus, the CCDSR learning model is effective for improving skills of creating lesson plan and worksheet SPS for pre-service physics teacher.

1. Introduction

The learning model is a plan or a form which can be used to help students getting information, ideas, skills, values, ways of thinking, and the meaning of their expressions [1]. The role of teachers in the learning process is considered very important [2], because teachers play an important role in planning [3]. Teachers are obliged to plan lessons and implement quality learning process. Lesson planning is very important as the main guide or determinant of activities that teachers will do in the classroom during the learning process [4,5]. Teachers are the determinants of what is taught in the classroom and how to teach it [3].

Findings from previous studies on study literature studies were reinforced by preliminary studies. The results of the preliminary study by [6] in the Physics Education Study Program, FKIP University of Khairun showed that physics learning planning by physics teacher candidate is still low. The results

of interviews and observations on some students, teachers and lecturers in the city of Ternate found that (1) Limited time teachers and lecturers develop learning models and tools that emphasize learning planning; (2) Students are not well trained in making learning tools that trains the science process skill indicators including formulating problems, formulating hypotheses, identifying variables, formulating operational definitions of variables, conducting experiments, designing tables, graphs, analyzing data, and formulating conclusions; (3) Physics teachers in the city of Ternate have not yet optimal ability in preparing learning tools; (4) There is no standard guidance on learning tools that will be used by lecturers to teach on pre-service physics teacher, then they will teach to students on the Senior High School. This phenomenon should be handled by a lecturer or lecturer. As the essence of the function of a lecturer are a professional educator and scientist with the main task of transforming, developing, and disseminating science, technology through education, research, and community service. In general, students must gain and be able to learn science process skills that will be useful in real life. The perspective of John Dewey (1916), schools should be the laboratories for solving real-life problems [4].

In the previous research, CCDSR learning model has been developed to improve science process skills for pre-service physics teacher for pre-service physics teacher. The CCDSR model has been specially designed to increase the skills of science process skills for pre-service physics teacher. The CCDSR learning model consists of 5 phases, including (1) Condition, (2) Construction, 3) Development, (4) Simulation, and (5) Reflection. The previous research developed a device of learning physics as an operational form of CCDSR model developed. In this research, CCDSR model designed to improve the skills of creating lesson plan and worksheet SPS for pre-service physics teacher. Actually, the implementation of the CCDSR model that has been developed quality of pre-service physics teacher.

The purpose of this research is to analyse the effectiveness of CCDSR model to improve the skills of creating lesson plan and worksheet SPS for pre-service physics teacher. The focus of the problem in this study included: (1) whether there was a significant increase (statistically) of skills of creating lesson plan SPS for pre-service physics teacher before and after the CCDSR model was applied, (2) whether there was a significant increase (statistically) of skills of creating worksheet SPS for pre-service physics teacher before and after the CCDSR model was applied, (3) how much level of skills of creating lesson plan SPS for pre-service physics teacher increased before and after applied CCDSR model, (4) how much level of skills of creating worksheet SPS for pre-service physics teacher increased before and after applied CCDSR model.

2. Methodology of Research

2.1. *General Background of Research*

This research was conducted at Khairun University (Indonesia). The scope of this research is on pre-service physics teacher in academic year 2016/2017. This research is emphasized on the analysis of the fulfillment of the effectiveness of CCDSR model by analyzing the improvement of skills of creating lesson plan and worksheet SPS for pre-service physics teacher before and after following the CCDSR model. The effectiveness of the CCDSR model was determined based on indicator: a significant increase in scores (statistically) between pre-test and post-test of skills of creating lesson plan and worksheet SPS for pre-service physics teacher, as well as the mean of n-gain determined by criteria: low, medium, and high.

2.2 Sample of Research

The samples in this study were 12 pre-service physics teacher at University of Khairun, Indonesia. Pre-service physics teacher in academic year 2016/2017 take the Study and Field Practice course in physics education.

2.3 Instrument and Procedures

Creating lesson plan and worksheet SPS for pre-service physics teacher measurement were conducted through Science Process Skills Evaluation Sheet (SPSES) [7-14]. SPSES of lesson plan SPS includes: formulation of learning objectives; organizing the material; learning resources/learning media; learning scenarios; assessment; and grammar [7-14]. SPSES of worksheet SPS includes formulate the problem, formulate the hypothesis, identify experiment variables, defines operational definition of experiment variables, designing an experiment, collecting data, create an observation table, data analysis, and formulate conclusions [7-14]. In this study, the indicators of creating lesson plan SPS skills include: formulation of learning objectives; organizing the material; learning resources / learning media; learning scenarios; assessment; and grammar [7-14]. The indicators of creating worksheet SPS skills include: formulate the problem, formulate the hypothesis, identify experiment variables, defines operational definition of experiment variables, designing an experiment, collecting data, create an observation table, data analysis, and formulate conclusions [7-14]. Implementation CCDSR model used Study and Field Practice course used in physics learning. This research uses one group pretest-posttest design, which is O1 X O2 [15]. The learning process begins by giving pre-test (O1). Each pre-service physics teacher is required to complete the SPSES. After the pre-test, the lecturer applies the CCDSR model and learning tool in each group (X). Physics learning is consisting of creating lesson plan and worksheet SPS skills. The process of physics learning ends with post-test (O2). Every pre-service physics teacher is required to post-test of creating lesson plan and worksheet SPS skills by SPSES.

2.4 Data Analysis

Creating lesson plan and worksheet SPS skills of pre-service physics teacher is analyzed based on the assessments obtained by pre-service physics teacher before and after learning using the CCDSR model. The pre-test, post-test, and n-gain data of creating lesson plan and worksheet SPS skills of pre-service physics teacher were further analyzed using inferential statistical tests with the help of SPSS and supported by qualitative descriptive analysis. The n-gain value is determined by the equation: n-gain = (score post-test - score pre-test) / (maximum score - pre-test score) [16]. According to the following criteria: (1) if n-gain $\geq$ .7 (high), (2) if .3 <n-gain <.7 (moderate), and (3) if n-gain $\leq$ .3 (low).

3. Result and Discussions of Research

The learning outcomes of all groups related to the creating lesson plan and worksheet SPS skills of pre-service physics teacher are presented in Figures 1 and Table 1. Vertical bar represent the mean of pre-test, Shape bar scores represent the mean post-test scores, and Black bar scores represent the n-gain scores. Figure 1 shows the average post-test scores of creating lesson plan and worksheet SPS skills of pre-service physics teacher is greater than the pre-test score. The average pre-test, post-test, and n-gain scores associated with creating lesson plan and worksheet SPS skills of pre-service physics teacher indicators are presented in detail in Table 1. Figure 1 show the average n-gain value of creating lesson plan and worksheet SPS skills is respectively .49 and .57. The average n-gain value of creating lesson plan and worksheet SPS skills of pre-service physics teacher for all groups is in the moderate category. Table 1 shows that the creating lesson plan SPS skills of pre-service physics teacher scores of each indicator include: formulation of learning objectives, organizing the material, learning resources or learning media, learning scenarios, assessment, and grammar are low and the post-test score is high for all indicators. The n-gain of creating lesson plan SPS skills of pre-service physics teacher score of each indicator includes: formulation of learning objectives; organizing the material; learning resources or learning media; learning scenarios; assessment; and grammar in all groups are moderate or high.

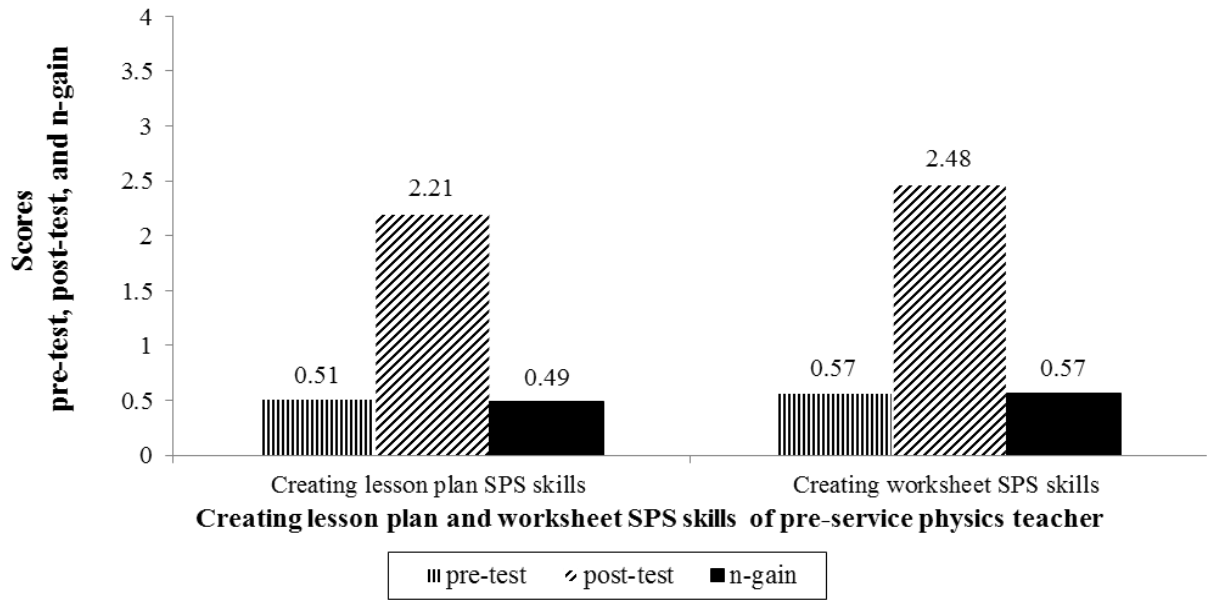

Figure 1. The average pre-test, post-test, and n-gain scores of creating lesson plan and worksheet SPS skills of pre-service physics teacher.

Table 1. The average score of pre-test, post-test and n-gain of creating lesson plan and worksheet SPS skills of pre-service physics teacher.

Indicator of creating lesson plan SPS skills	Pre-test		Post-test		N-gain	
Formulation of learning objectives	.92	Low	3.00	High	.68	Moderate
Organizing the material	1.00	Low	3.08	High	.69	Moderate
Learning resources / learning media	.67	Low	2.67	High	.60	Moderate
Learning scenarios	.33	Low	2.92	High	.70	Moderate
Assessment	.75	Low	2.92	High	.67	Moderate
Grammar	.42	Low	3.08	High	.74	High
Indicator of creating worksheet SPS skills						
Formulate the problem	.75	Low	2.50	Moderate	.54	Moderate
Formulate the hypothesis	.75	Low	2.58	Moderate	.56	Moderate
Identify experiment variables	.58	Low	2.25	Moderate	.49	Moderate
Defines operational definition of experiment variables	.33	Low	2.08	Moderate	.48	Moderate
Designing an experiment	1.00	Low	3.08	High	.69	Moderate
Collecting data	.33	Low	2.67	High	.64	Moderate
Create an observation table	.33	Low	2.33	Moderate	.55	Moderate
Data analysis	.33	Low	2.25	Moderate	.52	Moderate
Formulate conclusions	.50	Low	2.33	Moderate	.52	Moderate

Table 1 shows that the creating worksheet SPS skills of pre-service physics teacher scores of each indicator include: formulate the problem, formulate the hypothesis, identify experiment variables, defines operational definition of experiment variables, designing an experiment, collecting data, create an observation table, data analysis, and formulate conclusions are low and the post-test score is moderate or high for all indicators. The n-gain of creating worksheet SPS skills of pre-service physics teacher score of each indicator includes: formulate the problem, formulate the hypothesis, identify

experiment variables, defines operational definition of experiment variables, designing an experiment, collecting data, create an observation table, data analysis, and formulate conclusions are moderate.

Physical learning cannot be separated from the process of systematic scientific investigation. Along with its development, the process contained in scientific inquiry is packed more systematically in the form of skills that must be possessed by a person to conduct a scientific investigation, this skill is referred to as Sciences Process Skills (SPS). Skills of the process of science are procedural, experimental, and investigate systematic science as the basis of scientific science literacy [17-19] so it is important for teachers to have a good understanding of SPS [20]. The effectiveness of the CCDSR model on increasing creating lesson plan and worksheet SPS skills of pre-service physics teacher included (1) an increase in pre-test and post-test scores and (2) n-gain CPLP skills value, as shown in Figure 1 and Table 1. Before the CCDSR model is applied; pre-service physics teacher low mastery the creating lesson plan SPS skills, average score of pre-service physics teacher is under the standard score (minimum score 2.00 in score range 1-4), that is the average score indicator of creating lesson plan SPS skills respectively are .92; 1.00; .67; .33; .75; and .42. All this time, pre-service physics teacher are not used to formulation of learning objectives, organizing the material, learning resources / learning media, learning scenarios, assessment, and grammar. And then, before the CCDSR model is applied; pre-service physics teacher low mastery the creating worksheet SPS skills, average score of pre-service physics teacher is under the standard score (minimum score 2.00 in score range 1-4), that is the average score indicator of creating worksheet SPS skills respectively are .75; .58; .33; 1.00; .33; .33; .33; and .5. All this time, pre-service physics teacher are not used to formulate the problem, formulate the hypothesis, identify experiment variables, defines operational definition of experiment variables, designing an experiment, collecting data, create an observation table, data analysis, and formulate conclusions. These results are reinforced by the results of the preliminary study [6] in the Physics Education Study Program, Khairun University; Ternate shows that the science process skills of physics teacher candidates are still low. The results of interviews and observations on some students and lecturers in the city of Ternate reveal 1) Limited time teachers and lecturers develop learning models and tools that emphasize the skills of the science process; 2) Students are still having difficulty using science process skills in physics learning; 3) Limited time teachers and lecturers develop learning models and tools that emphasize learning planning; 4) Students are not well trained in making learning tools that trains the science process skill indicators including formulating problems, formulating hypotheses, identifying variables, formulating operational definitions of variables, conducting experiments, designing tables, graphs, analyzing data, and formulating conclusions; 5) Physics teachers in the city of Ternate have not yet optimal ability in preparing learning tools; 6) There is no standard guidance on learning tools that will be used by lecturers to teach on pre-service physics teacher, then they will teach to students on the Senior High School.

After the CCDSR model was applied to the pre-service physics teacher, the mastery of creating lesson plan SPS skills rises above average and becomes high; the average score indicator of creating lesson plan SPS skills respectively to 3.08; 2.67; 2.92; 2.92; and 3.08 (well beyond the minimum score of 2.67 in the 1-4 score range). The mastery of creating worksheet SPS skills rises above average and becomes moderate or high; the average score indicator of creating worksheet SPS skills respectively to 2.50; 2.58; 2.25; 2.08; 3.08; 2.67; 2.33; 2.25; 2.33 (well beyond the minimum score of 2.08 in the 1-4 score range). N-gain score creating lesson plan and worksheet SPS skills respectively to .49 and .57 (in the 0-1 score range). The increase in creating lesson plan and worksheet SPS skills is allegedly influenced by design of scenario in phase of the CCDSR model. Each phase emphasizes creating lesson plan and worksheet SPS skills of the CCDSR model.

Table 2. Wilcoxon t-test result of creating lesson plan and worksheet SPS skills of pre-service physics teacher.

Inferential Statistics Test	Data	Asymp. Sig. (p)
Wilcoxon t-test	*Pretest Posttest*	.01

$p < .05$ (2-tailed)

Table 2 shows the improving in pre-test and post-test of CPLP skills tested using Wilcoxon t-test. The p score gives a value of .01 for creating lesson plan and worksheet SPS skills of pre-service physics teacher. 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 creating lesson plan and worksheet SPS skills of pre-service physics teacher after applied learning with CCDSR model. Implementation of the CCDSR learning model has an impact on the significant increase of creating lesson plans and worksheet SPS skills as shown in Table 2. The increase of creating lesson plans and worksheets SPS skills cannot be separated from the role of learning tools that have been valid. The process of creating lesson plans and worksheets SPS skills in physics learning by design has been developed in the CCDSR learning model, Phase 3: Developing a Tool oriented science process skills (Development). Students create learning tools to develop learning planning skills on SPS (focus on learning to practice SPS). Students are guided by lecturers to see the skills of creating lesson plan and worksheet SPS skills that students have. Students are proactive in learning activities by contributing to the skills of the science process in their working groups. Lecturers act as mentors, moderators, facilitators, consultants and mediators in the learning process in an effort to improve the skills of the science process. This process is systematically in which trained: (1) the indicators of creating lesson plan SPS skills include: formulation of learning objectives; organizing the material; learning resources or learning media; learning scenarios; assessment; and grammar; (2) the indicators of creating worksheet SPS skills include: formulate the problem, formulate the hypothesis, identify experiment variables, define operational definition of experiment variables, design an experiment, collecting data, create an observation table, data analysis, and formulate conclusions. The SPS skills lesson plan and worksheet activities are relevant to the results of [7-11] research that physics teachers should have and be able to develop a student response data strategy that the majority of students feel the lesson plan and their SPS skills are improved after the implementation of the CCDSR learning model. Reinforced theory Production, the learner needs to convert mental representations created during encoding to motor activity [21-23]. As well as social constructivist theory by Vygotsky, that learners share the perspective of individuals with others to build a common understanding that is impossible to build individually [21-23], SPS improved by physics learning [24,25]. The above description shows that the implemented CCDSR learning model has been proven to be effective in increasing the students' writing lesson plan and worksheet SPS skills with moderate or high criteria.

4. Conclusions

The CCDSR learning model consists of 5 phases, including (1) Condition, (2) Construction, (3) Development, (4) Simulation, and (5) Reflection. The results showed that there was a significant increase in creating lesson plan and worksheet SPS skills of pre-service physics teacher at $\alpha = 5\%$ and n-gain average of moderate category. Thus, the CCDSR learning model is effective for improving skills of creating lesson plan and worksheet SPS for pre-service physics teacher. The implication of this research is that CCDSR model can be used as an alternative to overcome the low of creating lesson plan and worksheet SPS for pre-service physics teacher. To improve the result of this research, it is necessary to do further generalizations in various education levels and countries.

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