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Collaborative Problem Solving in Computer Programming Learning

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Abstract: The paper discuss to design an instructional syntax for the implementation of collaborative problem solving through theoretical and empirical studies related to instructional strategy of collaborative problem solving and computer programming learning. The paper results in an instructional syntax of collaborative problem solving that described the roles of teacher and student activities along with the activities conducted consisted of prepare, explain, support, assess, discussion, and report; procedures used including materials, task design, group division, assignment, group rules, guide, and evaluation; and roles played consisted of group division and tasks assignment by the teachers and identification, problem representation, algorithm accumulation, implementation in coding program, recording, and reporting by the students.

Keywords: Collaborative Problem Solving, Computer Programming Learning, Instructional Syntax

1. Introduction

In collaborative problem solving instructional strategy, problem solving is performed collaboratively involving two or more participants. Collaborative problem solving is one of the 21st Century main component skills or one of the key factors to success. Various abilities needed in computer programming learning process causes an increase in cognitive load (Castro, 2015). Difficulties in computer programming learning are one of seven challenges in computer science study. Therefore, an appropriate learning strategies should be considered to improve computer programming learning result (McGettrick et al., 2005).

2. Research Goals

The research aimed to know the influence of advance organizer-aided collaborative problem solving learning and cognitive style on the understanding and application of computer programming concept. The paper was a part of a dissertation research aimed to produce a collaborative problem solving learning syntax.

3. Significance of the Study

Collaborative problem solving approach is the most suitable approach for heuristic tasks from complex knowledge and skill system (Reigeluth, 1999). Computer programming learning requires depth of understanding, critical thinking, and other skills. It is related to the requirement in computer programming learning where students should have particular skills such as analytical skill, logic, mathematics, problem solving, and programming language syntax (Sarpong & Arthur, 2013). The thinking logic of each person is varied thus when students solve problems in computer programming tasks there are no single answer. In addition, generally, system analyst and programmer work together in team. Type of content in computer programming learning, practice to work in team, and the need of 21st century skills are among several considerations for the selection of collaborative problem solving learning strategy.

4. Theoretical Framework

During programming problem solving, problem solving learning method is an appropriate method to use. Problem solving method causes more cognitive load on learners (Sweller, Ayres, & Kalyuga, 2011). Collaborative learning will be more effective than individual learning during problem solving-based learning (Retnowati, Ayres, & Sweller, 2016). The theoretical framework can be seen on figure 1.

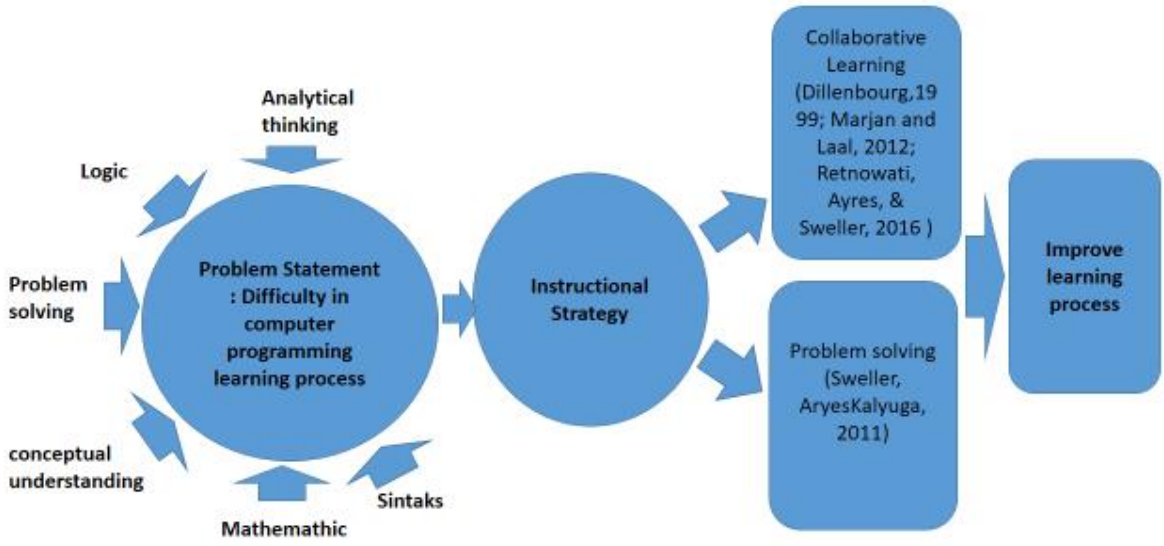

Figure 1. Theoretical Framework

5. Findings

Based on the theoretical studies and empirical studies, implementation collaborative problem solving in design of instructional syntax can be seen in table 1.

Table 1

Instructional Syntax of Collaborative Problem Solving

Roles	Activity	Procedures	Roles
Teacher Activity	Prepare	1. Materials 2.Task design	
		3. Lecturer divide groups (2 persons per group)	Lecturers divide groups (2 persons per group)
	Explain	4.Lecturer distribute materials and assigns	Lecturer assigns tasks through Practical

		group tasks through Practical Worksheet (LKP) 5.Lecturer gives introduce group rule	Worksheet (LKP)
	Support Assess	6. Guiding 7.Evaluate result of learning task	
Student Activity	Discussion	Students work on the tasks in a group	Students work on the tasks in a group through the following stages: • identify the problem • problem representation • compile the algorithm • implement it in coding program • record all cooperation processes/discussion
	Report	Report learning task	Report learning task

Tasks were given by the lecturers inside and outside the classroom. The tasks were informed one week before face to face meeting at class and the tasks were completed by each group. Discussion on task completion was facilitated through online forum media using e-learning STMIK Bumigora. Discussion topic was arranged as follows:

Day 1 : Identify the problem
Day 2 : Problem representation
Day 3 : algorithm design
Day 4 and day 5 : algorithm implement in coding program

6. Future Plans

The next research plan is to develop a collaborative problem solving learning model appropriate to the local characteristics (*local wisdom*) of Indonesian student as well as those of several developing countries. In addition, it also wants to find the most efficient learning strategy thus it will give easiness to students who have different learning style in 21st century skill-based computer programming learning.

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