Chapter 10
Improving Logical Thinking Skills Through Jigsaw-Based Cooperative Learning Approach

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ABSTRACT

Many opportunities for success are given to computer science students in their modules with minimum guidance from their instructors. Mainly, students from this field have to complete tasks on an open-ended problem that requires higher-order thinking skills. Since the students need to derive their unique answer from a given task in a group setting, cooperative learning helps them to compare with and discuss the solutions together. Hence, the individual's foundational skills of problem-solving and logical thinking skills are critical in the process of software development. However, to install such skills is usually a challenging task for academics. This study believes jigsaw-based cooperative learning approach helps the computer science students to grasp and build their logical thinking skills. The familiarity with software analysis tools as part of the online cooperative learning helps accelerate and firm-up the process of sequential logical skills. The results of pre- and post-experiment showed significant improvement (61.6%) in logical thinking and problem-solving skills among students.

INTRODUCTION

In Taylor's University, flexibility is given to academics to introduce innovative teaching and learning methods to ensure that the learning process is enjoyable, effective, and efficient (Wong, 2018). Moving from a teacher-centred to a student-centred approach institution, Taylor's University encourages its academics to improve the learning experience of students with student-centred focus. Part of the goal of the university is to promote Teach Less Learn More (TLLM) pedagogies. From the students' feedback, student centric learning has gained its popularity in the institution. This learning method has given opportunities for students to attain relevant knowledge and skills to be future leaders in their field of study.

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For example, students of the field of Computer Science are given many opportunities to excel in their modules with minimum guidance from their instructors. Mainly, the students were required to work in groups to complete tasks in their modules – i.e. from producing an algorithm that shows the sequence of steps, to producing the right solution to the problem. The techniques and processes involved are analyzing, developing, debugging and testing. However, it is always a challenge for many Computer Science academics, particularly those that teach programming modules. Vital foundational skills of problem-solving and logical thinking skills are critical in the process of software development (Wazlawick & Mariani, 2003). To introduce these two foundational skills at open-ended programming problems is usually a challenging task for academics. This is because learning how to program is not a skill that you could attain by reading from textbooks. The students need to go through a set of rigorous processes of the experiment (i.e. trial and error) – from producing an algorithm to code writing using a compiler(s) or an interpreter(s), to debugging and testing, to deploying the software applications. Since these skills are not easy to attain from textbooks, many students find the learning process difficult, leading to high failure rates and dropout in most of the Computer Science Studies (Lahtinen, Ala-Mutka, & Järvinen, 2005, Loksa et al., 2016, Othman, Hussain, & Nikman, 2010).

In this book chapter, the steps of the project that focuses on cooperative learning are disclosed, in hope to enlighten and help the learning process to be more enjoyable, effective, and efficient for both instructors and students in the field of Computer Science. Besides, through this chapter, it is hoped that the cooperative learning approach could be applied in other areas of studies.

PEDAGOGICAL APPROACHES TO COMPUTER SCIENCE EDUCATION

Computing is interconnected in almost all facets of managing and running a business, either via online or offline settings. In order for the companies to run smoothly, trained computer scientists are needed to maintain the efficiency of the system. Besides, the growing use of technology in daily lives has increased the demand for technology courses offered by education institutions. The learning outcome of the courses should prepare and equip the learners with essential computer science skill, so that they can effectively link the business nature of a company, people and technologies. In other words, leading and preparing the learners to comprehend Information and Communication Technologies solutions for businesses (Stensaker, Maassen, Borgan, Oftebro, & Karseth, 2007). However, learners face many challenges in comprehending the conceptual understanding and logical reasoning of the courses. For instance, linking the classroom topics of Computer Science courses in hardware, programming, databases or networks with real-world applications are complex.

Many instructors from institutions come out with many innovative ways to help learners to relate the Computer Science course contents to real-world examples. For instance, Xie, Li and Geng (2008) used four techniques to make the learning relevant. First, Xie and colleagues applied their classroom learning together with a website for self-paced learning. Then, the learning takes place with the actual lab with experiments and a virtual lab for visualization or animation techniques. Such techniques are known as a blended learning approach, which involves mixing the teaching delivery with online learning and group learning. These learning techniques create an environment that could motive the learners to increase their confidence levels to continue their learning. However, these learning processes are generally considered hard for Computer Science course (Lahtinen et al., 2005). The main reason is that the core modules of Computer Science consist of learning programming. This learning requires the ability