Human Behavior, Development and Society
ISSN 2651-1762, Vol 21 No 3, September 2020

Formative and Summative Evaluations in Learning Physics: Do They Complement Each Other?

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Date Received: 21 May 2020 Revised: 19 June 2020 Accepted: 23 June 2020

Abstract

A correlational study was conducted to analyse the relationship between students' performance in problem-based learning (PBL) and final exam scores with two student cohorts. This study focused on PBL as a teaching strategy and how it related to the students' achievement in the final exam of a physics course. Exam reliability was assessed by Cronbach's alpha, and values were obtained ranging from .71 to .83. Correlation between students' scores in PBL and the final exam was analysed using Pearson's correlation coefficient. Statistical significant was shown only for semester 2 in Cohort A. For Cohort A semester 1 and both semesters for Cohort B, the correlations were not significant. The corresponding highest Pearson correlation coefficient was .19, which was only for Cohort A semester 2. Coefficients of determination showed that PBL accounted for about 0 to 3.7% of the variance in students' final exam scores. In all semesters for both cohorts, the difference between final exam scores and PBL scores was significantly higher in the upper quartile of students' scores, and lower in the lower quartile of students' scores. Thus, this study showed that PBL can be implemented as one of the teaching strategies to improve some students' academic achievement.

Keywords: *Physics, teaching strategy, problem-based learning, assessment, achievement*

Introduction

Teaching science effectively in schools, especially physics, is a challenge for educators, and has been of great concern in Malaysian educational institutes for a long period of time (Halim et al., 2012). Several researchers have identified the weaknesses in Malaysia's teaching and learning methods. The main problem with traditional methods of teaching is that students tend to memorize problem-solving strategies without understanding the concept. This is a consequence of the method of teaching that emphasizes problem-solving rather than conceptual understanding (Mazur, 1999). Since Malaysia's education system has a tendency to be examination-oriented (Kirkpatrick & Zang, 2011), it leads to a poor mastery of core and generic skills in students' learning (Goh & Ali, 2014). The goal of learning science in the 21st century, as noted by the South Africans, is to educate students to understand concepts, develop process skills, and develop thinking skills for knowledge transfer (Department of Education, 2011). Pang (2011) stated that one of the key strategies for building an integrated human workforce is to restructure the education system to enhance students' performance. Hence, educators need more effective teaching methods to provide motivation for courses, help students with difficulties, (EL-Shaer & Gaber, 2014), and be relevant for learners in a Science, Technology, Engineering and Math (STEM) community. According to Pedaste et al. (2015), students can engage with real-world applications of science and mathematical principles, by integrating technology into mathematics and science courses. Learning activities should focus on activating students' creativity and critical thinking skills, rather than be restricted to rote learning (Goh & Ali, 2014).

Several researchers have explored the benefits of problem-based learning (PBL) and how it affects the performance of students in learning science. As an educational method, PBL assists learners in applying scientific knowledge to real-life situations using an open inquiry technique (Ketpichainarong et al., 2010). This is unlike the conventional passive teaching method, which does not encourage problem-solving and the development of cognitive skills (Ronis, 2008). Students who are exposed to PBL can transfer their skills and knowledge into real-life situations (Hoffman & Ritchie, 1997). Sungur

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