

## **Integrated science, technology, engineering, and mathematics project-based learning for physics learning from neuroscience perspectives**

### **ABSTRACT**

For many students, learning physics is difficult because of its abstractness. To help students to learn physics, we have developed the Integrated Science, Technology, Engineering, and Mathematics Projects Based Learning (STEM-PjBL) method based on principles from neuroscience. We believe that incorporating principles from educational neuroscience would help students learn better. This paper describes our experiments of implementing the integrated STEM-PjBL Module in physics, i.e., classical mechanics, to secondary school students in Malaysia and South Korea. The study consists of two groups of students: the experiment group, 77 in total, comprising those who have undergone the integrated STEM-PjBL, and the control group, again 77 in total, who experienced the traditional approach. The Colorado Learning Attitudes Science Survey (CLASS) was conducted for the two groups on students' beliefs about physics and learning physics before and after the implementation. The paired sample t-test from the pre-survey and post-survey shows that the integrated STEM-PjBL group has a more positive shift in belief about physics and learning physics than the traditional group. The results of the independent samples t-test for students' beliefs about physics and learning physics, compared with the postsurvey between the experimental group and the traditional group for both Malaysian and Korean perspectives, show that the experimental group has a higher mean compared to the traditional group. This paper explains why the integrated STEMPjBL has improved students' beliefs about physics and learning physics, from the neuroscience education perspective. Finally, the paper concludes with guidelines for teachers who wish to implement the integrated STEM-PjBL in the classroom.