

**The integration of problembased and collaborative learning Assisted by
geometer's sketch Pad: its effects on students' Higher-order thinking skills and
Collaborative skills**

ABSTRACT

Students showed poor performance in applying higher-order thinking skills (HOTS) in solving Additional Mathematics problems. Therefore, this study examined the effects of Problem-Based Learning (PBL) and Collaborative Learning (CL) assisted by Geometer's Sketch Pad on the four levels of HOTS of Form Four students, namely Applying, Analysing, Evaluating and Creating. In addition, the effects of PBL-CL on the four collaborative skills (CS) constructs, namely Academic Benefits, Social Benefits, Generic Skills, and Negative Aspects, were also examined. A PBL-CL module was developed as a guide for teachers. A HOTS test and CS questionnaire were developed to assess the level of HOTS and collaborative skills of students, respectively. This study used a quasi-experimental pre-test and post-test control group research design involving 270 Form Four students in Sabah, Malaysia. The assessment of HOTS involved three intervention groups, namely PBL-CL, PBL and Conventional Learning (Conv) group, while the assessment of CS involves two intervention groups, namely PBL-CL and PBL groups. The results showed that the PBL-CL group produced significantly higher post-test mean scores compared to the PBL and Conv groups in all four levels of HOTS and also produced a significantly higher post-test mean score than the PBL group in all four CS constructs. This shows that the PBL-CL method has a positive effect in helping the development of HOTS and CS of Form Four students. Therefore, Additional Mathematics teachers are strongly recommended to integrate PBL-CL in their classroom to increase the level of HOTS and CS among students