IMPROVING STUDENT LEARNING AND ENGAGEMENT IN STEM DISCIPLINES USING TEAM-BASED LEARNING

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BACKGROUND

There have been numerous innovations in higher education which employ student centered teaching strategies to improve student engagement and learning outcomes. A study conducted by the Australian Council of Learned Academies for PMSEIC (Marginson et.al, 2013) recommends curriculum reform to engage students in STEM through active learning approaches. Team-Based Learning (TBL) can be regarded as one form of active learning. TBL consists of strategically-formed permanent teams, a Readiness Assurance Process (RAP) and Application activities (Paramelee et.al, 2012). While TBL has not been implemented widely in STEM disciplines, several studies have shown that TBL has been effective in improving student learning outcomes, examination scores and graduate attribute skills (Koles 2010; Haberyan 2007; Thompson2007, Levine 2004) in medicine and health education. This well-defined teaching strategy promotes higher level cognitive skills among students and develops their problem solving and team skills through group-based work (Michaelson et.al, 1992).

OBJECTIVES

To encourage students to take responsibility for their own learning, to enhance independent learning, to improve student learning outcomes through teamwork and to strengthen efforts to retain a diverse students in STEM topics. Method: We trialed a modified form of TBL in a Physics and an Environmental Science first year topic. Students were given pre-class preparation materials and an individual RAP (Readiness Assurance) online test before the workshops. The Pre-workshop individual RAP test ensured that all students were exposed to concept based questions before their workshops and motivated them to use the preparatory materials in readiness for the workshop. The students were placed into random teams and during the first part of the workshop, the teams went through a subset of the quiz questions (team RAP test) and in the remaining time, teams completed an in-class assignment. At the end of the workshop teams handed in their solutions to the lecturer and these were marked and timely feedback was given. After the workshop students were allowed another attempt at the individual RAP test to see if their knowledge had improved. Research

RESEARCH DESIGN

The ability of TBL to promote student learning of key concepts was evaluated by experiment using pre & post testing. The pre-test was part of students' assessment while the post-test was optional. Results: The students were highly engaged in their learning and very positive feedback from the students was received. After attending TBL workshops, the mean scores for both post-tests increased in both cohorts. Analysis of pre-post testing of 2nd, 4th TBL quizzes of physics cohort showed a significant impact ($p<0.002$, $p<.001$) on their learning while there was no notable difference ($p<.05$) in the pre and post-test of quiz 1, 3 by paired t-test. We found a significant improvement ($p=.0001$) in the test scores of all quizzes for the environmental cohort.

CONCLUSIONS

In this paper, we sought to describe the usefulness of TBL by providing the evidence that TBL can improve student performance in STEM topics.

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