Flipping student ability differences from a liability to an advantage: A team-based learning approach to introduce computer engineering and problem solving (programming) to freshmen students

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Flipping student ability differences from a liability to an advantage: A team-based learning approach to introduce computer engineering and problem solving (programming) to freshmen students

Abstract
First-year programming courses have always been a challenge for many students as the course expectation is not only for them to be able to understand programming concepts, but also to produce creative solutions to problems. Moreover, students come from high school with diverse programming backgrounds, i.e., some of them already studied programming and others have no idea what programming is. Team-Based Learning (TBL) seems a natural solution to increase the amount of practice each student will get and to increase students’ interest and confidence. Creating diverse teams to work on different activities will flip students ability differences from liability to an advantage and will help students to learn from each other as well as from the course instructor. In this proposed project, our main goal is to minimize the Drop/Withdraw/Fail (DWF) rate of such courses where programming novice students tend to DWF the course usually based on our experience from previous semesters. A side goal will be conducted to develop the students soft skills over the semester. More than 400 students will be impacted by this project from Computer Engineering (CPRE) and Software Engineering (SE) programs.

Disciplines
Educational Methods | Engineering Education

Comments
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Abstract:

First-year programming courses have always been a challenge for many students as the course expectation is not only for them to be able to understand programming concepts, but also to produce creative solutions to problems. Moreover, students come from high school with diverse programming backgrounds, i.e., some of them already studied programming and others have no idea what programming is. Team-Based Learning (TBL) seems a natural solution to increase the amount of practice each student will get and to increase students' interest and confidence. Creating diverse teams to work on different activities will flip students ability differences from liability to an advantage and will help students to learn from each other as well as from the course instructor. In this proposed project, our main goal is to minimize the Drop/Withdraw/Fail (DWF) rate of such courses where programming-novice students tend to DWF the course usually based on our experience from previous semesters. A side goal will be conducted to develop the students soft skills over the semester. More than 400 students will be impacted by this project from Computer Engineering (CPRE) and Software Engineering (SE) programs.

Description:

Students come from high school with diverse programming backgrounds, i.e., some of them already studied programming and others have no idea what programming is. Team-Based Learning (TBL) seems a natural solution to increase the amount of practice each student will get, and to increase students' interest and confidence. Creating diverse teams to work on different activities will utilize the diverse background of the students and will help students to learn from each other as well as from the course instructor.

Results:

The figure below shows an increase in external motivation, academic growth, critical thinking, and self-efficacy; however, group/peer learning appears to have decreased. The four categories that increased shows that there is a significant improvements in the students' soft skills; however, more investigation is needed to identify why the group/peer learning was affected.

Modified TBL

• No TBL for hard concepts
• iRAT outside the class time
• Interactive online textbook

Team Members Selection

• Variety of TBL experience
• Variety of content expertise
• Leadership skills and ability to speak to the classroom

Content Development

• The course were redesigned
• All TBL assignments are
• Access TBL expert resources

Evaluate Feedback

• Timing of iRAT/tRAT & application activities
• Refine content
• Refine factors enhancing soft skills

The overall change in team skills

Outcomes from The Study:

• Engaging novice and experienced learners in programming. The experienced students were motivated to teach to the novice students
• Increased instructor confidence in facilitating application discussions vs. traditional lecture.
• Taking the iRAT outside the classroom gave the instructor more time to add to the mini-lecture and application activity time.
• The enhanced soft skills abilities of the students are going to influence their future courses participation.
• TBL shown to be effective in student academic success and retention; however, it may also aid in the development of soft skills required for the industry.

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