Higher Education Quality Council of Ontario
Conseil ontarien de la qualité de l'enseignement supérieur
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Stakeholder Summary

Ryerson study examines learning activity in introductory physics course

In the on-going quest for improved learning in large-class settings, an active-learning approach for an introductory physics course yielded mixed results, according to a new report from the Higher Education Quality Council of Ontario.

Evaluating the Effectiveness of Modified Peer Instruction in Large Introductory Physics Classes examined the use of collaborative, multiple-choice format question (MCFQ)-writing activities for students as a supplement to standard peer instruction methods.

Project description

The study focused on students in 2012 and 2013 introductory physics courses at Ryerson University. It explored whether student-generated multiple-choice questions – developed collaboratively in small groups in class and online – enhanced their understanding of fundamental concepts in physics, their attitudes towards physics and the degree of student engagement compared to standard peer instruction methods. Changes in conceptual knowledge and student attitudes were assessed using both quantitative and qualitative approaches including a socio-demographic survey and student interviews at course completion.

Findings

Incorporating MCFQ-writing activities into peer instruction methods in a large course has some positive, though inconsistent, effects on students' conceptual learning, according to the study. For the 2012 cohort, student characteristics appeared to have little effect on learning gains, while participating in the MCFQ-writing activities was associated with a significant improvement in conceptual learning. In contrast, in the 2013 cohort, students' personal characteristics were strongly associated with learning gains, but participating in the MCFQ-writing activities appeared to have little effect on conceptual learning. When the results of the two cohorts were pooled, gender, English-language proficiency and attendance were each associated with larger gains in conceptual learning than participating in the MCFQ-writing activities.

The study found a positive shift in students' attitudes regarding problem solving sophistication and applied conceptual understanding, and a negative shift in personal interest in physics and sense-making effort (feeling like the effort needed to make sense of the material is worthwhile). Compared to students who only participated in standard peer instruction activities, adding MCFQ-writing activities did not further improve students' attitudes toward physics.

Student interviewees often did not recognize the MCFQ-writing activities as a unique component of the course and many did not specifically remember participating in them. Those who did recall the writing activities gave positive feedback, recognizing them as an opportunity to reflect on material, monitor their own understanding and try "getting into the mindset of the professor." However, many

interviewees noted the difficulty of prioritizing different course activities, and the researchers found that the multiple-choice questions that were collaboratively developed by students were not of a high quality.

Recommendations

Acknowledging some limitations to the study, the authors recommend that instructors consider the cost, time and resources needed to implement these small-group, collaborative MCFQ-writing activities as they require significant preparation, as well as time-consuming monitoring of students' online activities. While the authors encourage instructors in large classes to consider alternative interventions to increase student learning, they note the potential for resource overload among students and the importance of considering students' preferred study methods.

"Although the new MCFQ-writing activities proved to be less effective than expected," the authors conclude, "interviewees expressed overwhelming support and appreciation for the diverse opportunities for active learning in the course."

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