Thyme room
12.45-1.10pm

Active learning to develop key research skills in Master's level computer science coursework

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Contribution: In this presentation, we share insights from an initial study on embedding critical academic literacy skills using active learning strategies in a Master's level computer science course. Our goal was to implement these changes in teaching approach and assess the impact on student performance, skills development, and engagement.

Background: Master's level courses at the National University of Singapore (NUS) typically focus on advanced content and are often taught via traditional lectures. One goal of higher education is to develop students' critical thinking and research skills. Prior work suggests these skills are best taught explicitly, when they are embedded in the curriculum, using active learning strategies, and using recent high-quality research as a basis for inquiry.

Relevant Literature: Higher education teaching using active learning strategies has been found to "increase student performance across the STEM disciplines" (Freedman, 2014, p. 8411). Increasing the ability to think critically is one of the goals of higher education; a recent review of critical thinking research suggests that it is more important to focus on domain-specific critical thinking skills than generic critical thinking skills (Huber & Kuncel, 2016). This is because "domain-specific critical thinking may be related to mastery of that domain (Huber & Kuncel, 2016, p. 459). One framework for operationalising active learning is Chi and Wylie's (2014) ICAP framework, which categorises types of learning based on observable behaviors. Their framework hypothesises that interactive and constructive learning activities (the "I" and "C" of ICAP) are more effective for learning than passive and active learning activities (the "P" and "A" of ICAP). This study used the ICAP framework to identify active learning strategies to teach domain-specific critical thinking skills.

Research Questions: 1) How do actively embedded critical academic literacy skills impact student critical thinking skills? 2) How do active learning strategies used to teach critical academic literacies impact student engagement?

Methodology: A Master's level computer architecture course at NUS was redesigned using principles of active learning from the ICAP framework and by embedding the critical academic literacies of critically analysing research publications. The project was evaluated using self-reports of conceptual understanding, ongoing assessment of critical reviews, and a final survey of student engagement. The conceptual understanding survey was administered during the first and final sessions in order to assess improvement in terms of conceptual understanding. Critical reviews were assessed through a baseline assessment administered before the skill was taught, as well as ongoing assessments throughout the semester. A survey measuring student engagement, based on researcher-designed questions and the Australalasian Survey of Student Engagement, was administered anonymously at the end of the semester.

Findings: Results of the engagement survey suggested that the students in this course were consistently engaged, taking the lead in their learning, challenging themselves, thinking critically about the topic, and learning skills above and beyond the stated curriculum. For all of the measures of student engagement, the majority of respondents indicated that they had been engaged; 100% of free responses about the most satisfying aspect of the course mentioned engaging actively with the content. The participants overwhelmingly reported actively learning the content and skills.

Student responses to the survey indicated that they felt their critical thinking skills had improved. The free responses reinforced these results. When asked about the most significant learning experience in the course, 100% of the free-responses mentioned critical analysis skills.

As described above, this course had the dual objective of teaching students the relevant content and teaching them critical analysis skills for the discipline. The analysis of student written work demonstrated that students became more confident in critically analysing research publications.

Keywords

Active learning, blended classroom, master's level, computer architecture, computer science

References

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