

WHEN CHEMICAL ENGINEERING EDUCATION CLICKS

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Purpose

In this communication, an experience of how interactive learning has been integrated into an undergraduate Liquid Liquid Extraction (LLE) course is presented. Both clicker-based peer instruction and virtual learning technologies are implemented to stimulate students' engagement and academic achievement.

Methodology

LLE is a core course of chemical engineering programs. At the Orléans University Institute of Technology students have theory, workshop (problem solving) and practical classes in LLE. Second year students should have an overall understanding of ternary liquid-liquid equilibria, partition coefficients and phase boundaries. They are expected to solve mass balances in continuous and staged units (cross-flow and counter-current) and determine the number of equilibrium stages in packed-type column extraction processes.

Over the past two academic years, interactive learning has been used to encourage student engagement and problem solving skills in LLE workshop sessions. In this context, Mazur's (1997) peer instruction approach [1] coupled with interactive technology, such as clickers, was implemented. The interactive system consists of a radio frequency receiver connected to a computer via USB, a set of student response devices and the clickers' software which enables the interactive responses [2]. Each semester involved a maximum of 80 students divided into smaller workshop groups of 25-30 students each. A sequence of problem solving, formative assessment on basic concepts, self-assessment questions, and peer-instruction [3] were iterated over each workshop session, lasting for approximately 1-hour. Useful data to evaluate the methodology effectiveness, student opinions, and overall course performance were collected. The use of interactive classroom systems in tandem with e-learning (e.g. moodle) was also explored.

Results

Our initial findings highlight a positive relationship between formative assessment approach and exam performance over the academic years 2015-16 and 2016-17. Midterm grades reflected a standard distribution with an increasing mean score in comparison to that obtained in the same course in previous years where the courses were lectured in traditional format (Figure 1). The exams and scoring scales, however, were similar year to year.

From student's perspective, high levels of satisfaction were consistently reported. At the end of each session, a significantly high proportion of students found combined interactive and e-learning instruction to be beneficial, enjoyable and intellectually stimulating. Overall, feedback was overwhelmingly positive.

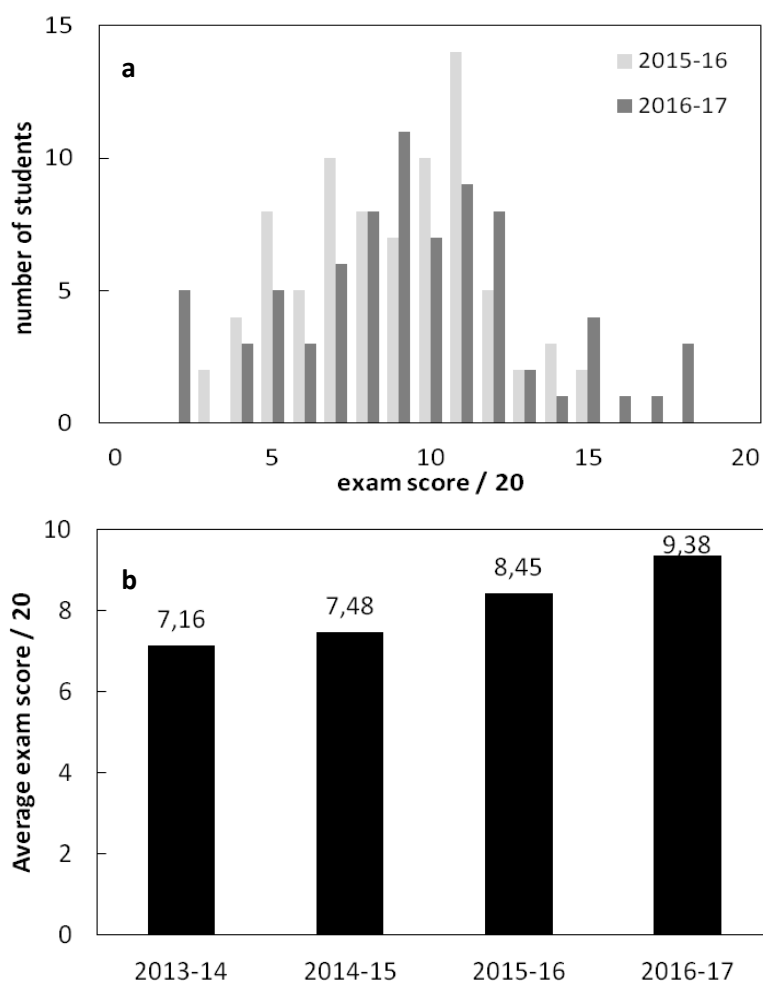


Figure 1. a) Midterm exam scores for students taught LLE course in interactive modality within the last two academic years, b) Average LLE exam score since 2013.

Conclusion

We can comfortably claim that overall LLE course performance was positive. It can be thus hypothesized that interactive instruction may enhance student engagement and self-confidence for solving problems in chemical engineering. This practice can also be used innovatively for gathering meaningful data to allow adjusting teaching in real time and sharing specific insights for making instruction more attractive and effective. Furthermore, it is gaining great interest among faculty to replicate blended active learning experiences in other undergraduate courses. From a pedagogical perspective, we envisage experiencing some more advanced technological features and continue stimulating the engagement of our students.

References:

- [1]. Mazur E. Peer Instruction: A User's Manual, Prentice Hall: Upper Saddle River, 1997.
- [2]. Turning Technologies, LLC. TurningPoint 2008 Getting Started Quick Reference Guide, First Edition, July 2007.
- [3]. Aricò FR & Watson D. Combining Self-Assessment and Peer-Instruction to Enhance Learning and Teaching Effectiveness [paper 0361]. Proceedings for the Society for Research into Higher Education (SRHE) Annual Research Conference 2015 (Dec 2015, Celtic Manor, Newport, Wales).