# ENHANCING STUDENTS' LEARNING THROUGH A BLENDED LEARNING CYCLE FOR ENGINEERING MATHEMATICS

Iwona Czaplinski[a], Pamela Burrage[b], Steve Psaltis[b], Dann Mallet[b]

Presenting author: Dann Mallet (dg.mallet@qut.edu.au) and Iwona Czaplinski (i.czaplinski@qut.edu.au)
[a]Science and Engineering Faculty, Queensland University of Technology, Brisbane QLD 4000, Australia
[b]Mathematical Sciences School, Queensland University of Technology, Brisbane QLD 4000, Australia

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## BACKGROUND

This study responds to the need for developing effective teaching methods helping students with the acquisition of specific STEM skills (West, 2012, 2013). It applies principles of blended learning design (Saliba, Rankine, & Cortez, 2013), in the context of mathematics courses (Stevenson & Zweier, 2011; Calderon, Ginsberg & Ciabocchi, 2012; Carbonell,Dailey-Hebert & Gijselaers, 2013) with attention paid to the potential for use – affordances – (Gibson, 1977, 1979; Hartson, 2003; Good, 2007) of Information Communication Technologies (ICT) offered by e-learning environments (Kirschner, 2004; Kirschner et al., 2004).

## AIMS

The overall goal of the study was to improve student engagement and satisfaction, by re-designing a 1st year engineering mathematics unit. Specific objectives included:

1. investigating ways of effectively using the online tool *WeBWorK* for mathematics competence diagnostics,
2. improving the delivery of face-to-face (f2f) lectures and tutorials by designing, developing and implementing activities that explicitly link f2f delivery with online components, and
3. improving 1st year student engagement by developing a model of close collaboration between the teaching team and student success and learning support programs.

## DESCRIPTION OF INTERVENTION

Inspired by recent changes to the University's learning and teaching vision, the authors anchored the unit's re-design process in the blended learning methodology (Saliba, Rankine, & Cortez, 2013). Its principles were used to systematically evaluate the delivery modes and learning and teaching (L&T) methodologies of the unit, define areas for improvement, design and implement the changes and complete the first part of the study. More precisely, the changes included: (1) re-designing the unit's online presence to be more efficient in providing students with a well-organized, structured L&T platform; (2) embedding online tools in the unit content; (3) designing and developing 'challenge questions' – activities making direct connection between theoretical content of the lecture with its practical applications during the f2f, small-group workshops, and (4) coordinating the actions of institutional learning support and student success programs to make the support visible to students.

## DESIGN AND METHODS

The project used an action research approach to investigate the designed intervention's effectiveness. A questionnaire composed of Likert-scale items and open-ended questions was distributed at the end of semester to two cohorts of students (Summer 2013 and Semester 1 2014). Here we report on the data analysis focused on the students' perception and the uptake of the potential for an action (affordances) offered by *WeBWorK*. The results allowed the designer and the teaching team to reflect on and re-think the ways the tools have been used in the unit, re-program the tool and implement the modified tool in Semester 2 2014.

## RESULTS

Preliminary conclusion: The results of the data collected in phase 1 of the project indicated that students did not perceive full potential offered by the tool, therefore the possibility to enhance their engagement and satisfaction has not been entirely exploited.

## CONCLUSIONS

Based on the data analysis, the authors formulated: (1) hypotheses for explaining the results and (2) possible improvements to be made in order to allow students to use more efficiently the potential offered by the tool. These will be discussed at the presentation along with the first observations made based on the implemented modifications.

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