

Problem based learning on a final year design engineering course: Inspiring the Buzz.

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Study completed: March 2006

This case study has been developed from data gathered through a demonstration of the teaching and learning materials available, interviews with the tutor and a student focus group.

Background

During term two of the Design Engineering Unit, final year students from Bournemouth University work collaboratively to solve real life design problems in engineering, focussed on digital and control systems. Students are split into groups of four and are set a series of problems for which they must prepare a written report and oral presentation on their solutions. Groups meet to analyse the given problems and are then given time to individually reflect, research and investigate the area. The individual work is then shared with the group and a consensus solution developed. Individual group members are allocated either preparation of the report or presentation for each problem, giving each member the opportunity to practice key skills.

A three hour slot is timetabled for the unit and the sessions are held in a flat room with moveable chairs, OHP and projection screen. On alternate weeks the sessions start with students giving five minute presentations followed by comments from peers on style and technique. The tutor then summarises the presentations, offers feedback on the topic and clarifies any issues or discrepancies. During this session the students are then introduced to the next problem. In the intermediate weeks students are given time to work on the problems in groups and meet with the tutor as needed.

All students within the class assess the presentations using a peer-review marking sheet covering content and style, the tutor assesses the written reports and individuals are asked to complete self and peer assessment sheets for their own groups. Individual student marks are based on perceived, peer and self assessed contributions.

Reasons for introducing this teaching method

The tutor, with an “impossibly short time scale” to prepare traditional teaching materials, was asked to teach a unit within an unfamiliar module. The tutor had also recently been introduced to Problem Based Learning (PBL), through an in-house learning and teaching development day, and was interested in using this methodology. The tutor was motivated by developing “independent learners” and wanted to shift the focus of this part of the unit from teaching to learning. “We wanted to provide an experience where learning was undertaken to solve problems, not to meet a syllabus”.

Students' perspective

Overall the students valued the PBL approach taken. "I feel like I've taken in more and developed more of my own personal understanding the problem based way than I think if somebody was actually trying to teach me". Students saw the teaching approach as forcing them to "be proactive" about their learning, encouraged them to be more "self-reliant" and gave them opportunities to work on developing key skills such as presentations and team working. The students welcomed the approach being taken in their final year and saw it as a "stepping stone" from final year into industry where they would be given a problem and felt they would be asked "how are you going to solve it?". "Give me this any day over assignments and exams!"

One student commented that he felt "a little bit short-changed by the whole thing" as he didn't feel he was learning from the "expert". Other students reflected on the methodology putting "more responsibility on the student to actually learn it for themselves". Concerns were raised over how much time students could spend studying for each problem and how varied this could be depending on the individual or problem. Some students felt their groups had worked well together whilst others, due to time pressures, had allocated each problem to a different individual within the group and worked on them independently.

Issues

"Getting the problems right" was seen as the hardest part of developing the unit. "The sheer fear, letting the students loose, you're not in control any more, they're in control". In the first year of implementation a semi-structured approach was used where "the problems were within an overall problem, so the problems themselves sat in an overall structure". This has been developed over time to use stand-alone problems and more recently less structured problems. The tutor continues to reflect on the materials.

As there is a lack of research material available in the timetabled room the groups often disperse after being set the problem, often dividing the work between individuals rather than taking a more collaborative approach. The tutor hopes to develop a mechanism to further develop the group work element of the assignments.

As this had previously been a traditional taught unit, the three timetabled hours per week were all in one block. On reflection the tutor felt that this time, spread more evenly through the week, would be more ideal for students' engagement with the problems and further support the team working element of the process.

Benefits

The tutor felt the main benefit was that "it belongs to them, it's their learning rather than our teaching that they have to take on board and I think that's the key to the process". Because the students all research materials in different ways, one unexpected benefit (for the tutor) was that this approach "broadens their outlook", students cover "issues from different fields" and interact with materials from different disciplines.

Many of the students were motivated by the class presentations and peer review. They engaged regularly with materials throughout the module, both during and outside of the timetabled sessions. In some cases, however, this led to a need to manage students' motivation and clear expectations had to be set to help students to balance their work between modules without curbing their enthusiasm.

Reflections

The first group chosen for the introduction of this methodology was a small group of final year students and formed only half a full unit. This meant the tutor felt the "risks were minimised" of the significant emphasis on peer marking and also helped the logistics of regular in-class presentations. The unit leader and course leader were very supportive of the changes and a colleague from the Learning and Teaching Development Unit helped with the initial implementation through observing sessions and gathering student feedback at the end of the first year. This initial feedback included students reflecting on the use of "real life situations" helping to aid their learning and commenting on the approach as a "more natural way of learning so you remember it better."

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