Making the grade

Professor Richard Bennett discusses the role homework plays in improving student learning, and a strategy he has employed in his engineering classes to encourage completion of assignments

To what extent does homework contribute to overall learning and achievement?

Students retain a lot more when they practice, or immediately use what they have learned. Students retain much less from listening, reading and watching. Homework plays the critical role of encouraging students to practice and use what they have learned.

That being said, homework needs to be carefully designed so that it reinforces learning objectives, but is also engaging. Structures are also needed to encourage active learning, such as study groups, when students are completing homework assignments.

What motivated you to research this topic?

We teach large freshman engineering courses that have historically had less than desired pass rates. On our courses, 96 per cent of the students who complete at least 80 per cent of their homework pass, which is not surprising. We were concerned about the 25 per cent of our students who did not complete at least 80 per cent of their homework – what were the reasons for this, and what can be done to engage more students in homework?

Have you found similar characteristics in students who complete less of their homework?

These students tend to be less prepared in high school in terms of maths and physics courses, and rate the quality of their high school classes much lower. Correlation of homework completion with the mathematics American College Testing (ACT) score is fairly low at 0.28, so that is not a major factor.

We found little correlation between homework completion and perseverance, as measured by a grit test. We are in the process of analysing 30 45-minute interviews conducted with students, and a couple of themes are already emerging. For example, there are time management issues, which include taking on too many courses and part-time jobs. There is also a level of frustration among these students; they are frustrated by their exam scores, and feel they cannot get help when they need it.

Can you discuss some of the strategies that you have used to promote student engagement with homework?

We use a variety of strategies to promote engagement. Some problems incorporate humour, while others are related to real-life problems. We continually work on adding feedback to our online homework system as we believe immediate feedback is not only useful to students, but keeps them engaged. We have provided linked examples to help students. There is also a staffed study room, and evening help sessions, with some taking place in the student dorms. We try to find the right balance of challenging the students with the homework problems, but not making the problems so challenging they are frustrated.

Could you explain the rationale behind the early homework completion bonus?

The format for the class is a lecture, followed by an active learning recitation the day after and a homework assignment due at midnight via an online homework system. We examined completion times, and found that the majority of students were completing their homework in the last six hours before it was due. We would like for students to at least look at their homework before the recitation, as it is a great time to have their questions answered and concepts clarified. The early homework bonus was instituted simply to motivate students to look at the homework before recitation.

Are you attending any upcoming conferences or events related to this project?

The American Society of Engineering Education Annual Conference is a great place to keep up with the latest in engineering education, and I will be attending again next year (15-18 June, 2014). I am also Chair of the masonry building code committee. This gives me a great chance to interact with many practicing engineers. Although the technical topics at the code meeting are not directly applicable to freshman engineering, it still is a great place to discuss engineering education needs with those who will be hiring our students.

Improving student engagement

Researchers at the **University of Tennessee**, USA are examining low homework completion rates among engineering students in order to enhance collaboration and skills in engineering education

THE PRACTICE OF assigning work to students outside of normal class hours is designed to help reinforce what they have recently been taught. Homework is a means of increasing knowledge and improving skills. It can also help students to be better prepared for future lessons and exams; or it might reveal concepts that are not entirely clear to them, and therefore encourage pupils to seek further guidance.

However, some students will not complete the assignments for various reasons, including a lack of organisational skills, difficulties with motivation and personal situations. There has also been some debate on whether homework actually serves its intended purpose. Therefore, it is crucial that assignments are tailored towards specific learning objectives as well as the individual needs of students. Research on this delicate balancing act has shown that when homework is properly designed, students who complete the work demonstrate improvements in performance, retention and graduation rates.

IMPROVING PARTICIPATION

Seeking to understand how to increase student engagement in homework, Professor Richard Bennett is leading a study to develop strategies to address this issue. He tested his freshman engineering classes at the University of Tennessee, although the strategies used and results obtained could be applied to any learning environment. "We believe that all students face the same challenges in terms of homework engagement," he explains. "The issues can be magnified with engineering students as they tend to have more homework, however, we believe that homework engagement strategies are applicable to all disciplines."

Bennett is collaborating with researchers from the Engineering Fundamentals Division and the Teaching and Learning Center at the University. Bringing together a multidisciplinary team of professionals from behaviour science and collaborative education, in addition to engineering professors has been essential to creating a well-rounded project. "Engineering professors have received little to no training in educational pedagogy; on the other hand, educational researchers at times do not fully understand the challenges of an engineering degree," he notes. "We have been fortunate to have a good working relationship, where we recognise each other's strengths and weaknesses."

UNDERSTANDING AND ENCOURAGING ENGAGEMENT

To achieve the project's primary objective of getting to the root causes of why students do not complete their homework, Bennett and his collaborators are using a number of different approaches. Qualitative data on students who complete less than 80 per cent of their homework assignments was gathered and analysed to identify possible correlations. This method included looking at students' past performance in school, their background on the subject, demographics and attendance at lectures. Extensive interviews were also conducted with this student group to gain first hand insights into why they are not completing their work. Bennett and his collaborators plan to use their results to explore methods for supporting students with homework in the future.

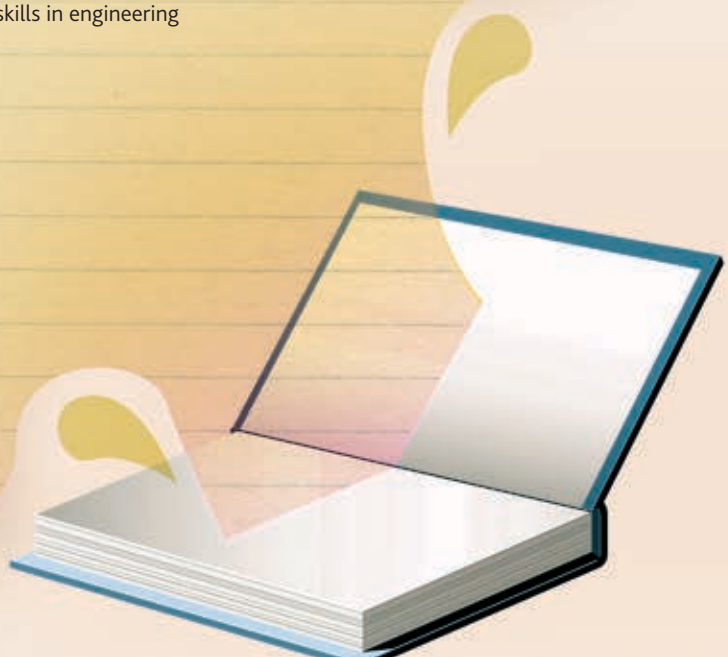
For the project's second objective – to enhance collaboration and skills in engineering education – Bennett is examining a recent strategy to encourage student engagement in homework; a bonus for early completion of assignments. The inspiration for this idea came when Bennett attended his first American Society for Engineering Education Annual Convention in 2010. There, he was made aware of this incentive to give a bonus for early homework completion.

The need to encourage students to complete assignments early resulted from Bennett's observation that most do not begin their homework until just a few hours before its deadline. Students in Bennett's engineering classes have to submit their work via an online portal, which revealed that nearly all submit their work six to eight hours before the due date. By delaying assignments until the last minute, students miss out on the opportunity to clarify with the professors any questions they have about the work.

As a result, Bennett introduced a 10 per cent early homework bonus for assignments completed more than 24 hours before the due date. This strategy has proven a success to date: "The impact of the bonus has been that over 50 per cent of the homework is being completed in the bonus time," Bennett reveals.

POSITIVE RECEPTION

The early homework completion bonus has had a beneficial impact on homework engagement not just for the top students, but also among lower performing and less engaged pupils.



To understand its impact on underrepresented groups, Bennett compared completion rates before and after the homework bonus. He found that homework completion improved the most – from 49 per cent to 60 per cent – in students who scored in the lower 20 percentile on exams. "This, and other data, suggests that part of the issue with the lower performing students is time management issues," Bennett tells. "The bonus is having a positive effect on this, although there are still other issues to address."

To gain an insight into students' impression of the bonus strategy, Bennett conducted a mid-semester survey. When students were asked if the bonus has affected their learning, 83 per cent of those who replied stated that the strategy had positively affected their learning. Some specific ways in which their learning was improved included better preparation for lectures, improved practice at self-guided learning and improved understanding of class material.

COLLABORATIVE LEARNING

An additional effect of the early completion bonus was that it led to students helping each other more with assignments. Bennett observed that the class' online discussion board – which was previously most active near an assignment's deadline – was now being used more after a lecture. Similarly, there is also an emphasis on student study groups. The engineering programme provides study rooms, although it has been a challenge to schedule and form groups with the students. Nevertheless, there are clear benefits for such groups: "Students are often better at explaining things to each other, and are better at understanding each other's difficulties and misconceptions. Having to explain a problem to another student reinforces the concepts in one's mind," he adds.

EVOLVING TEACHING ENVIRONMENTS

The next stages of Bennett's research will look towards future challenges in teaching and student engagement. A key part of this includes the changing face of teaching environments, which are shifting towards a more digital learning experience for students. "We do see teaching methods changing to more online-based tools," Bennett highlights. "This provides an efficient, and often very effective, way of conveying information, but maintaining personal engagement in an increasingly digital teaching environment is one of the biggest challenges facing education." This development is certain to have effects on students beyond personal engagement, and research projects such as Bennett's will be key to ensuring students get the most out of their education.

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INTELLIGENCE

RESEARCH INITIATION GRANT: INCREASING STUDENT ENGAGEMENT IN HOMEWORK

OBJECTIVES

To improve student engagement in homework during first year engineering courses.

KEY COLLABORATORS

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