A Mastering Physics Story:
Engaging 900 students using Mastering Physics with Learning Catalytics at a university in Singapore
Summary

In this context, the instructor teaches Physics to Engineering students at a university in Singapore. Through a lecture-tutorial mode where online assignments are delivered, the instructor meets his large cohort of students twice a week in mass lectures and uses Learning Catalytics to assess students' understanding of Physics concepts. The use of Learning Catalytics provided opportunities for him to scan students' responses in real time so that he could think of his next steps based on these responses. The instructor was awarded a Teaching Excellence Award in his institution in 2018, and the use of Learning Catalytics allowed him to be even more effective during lectures. The Learning Catalytics sessions are quite well received – the instructor believes it helps students to be even more engaged and focused on specific concepts.

Description of Course

The course taught is Physics for Year 1 Engineering students and the text used is Physics for Scientists & Engineers with Modern Physics, 4th Edition (Giancoli). The course is for first year Engineering students and there are approximately 900 full-time students and 200 part-time students.

Students who typically enroll in the course have diverse backgrounds in Physics. The classes typically meet twice a week for mass lectures conducted by the instructor and once a week in tutorials with their tutors. It is a course that spans a full semester.

The instructional model used to teach the course is hybrid, where part of the lessons are being recorded and uploaded online so as to free up time for in-class activities. There are no lab components, but there are hands-on activities during some of the tutorial lessons.

Product Implementation

The lecturers in the Physics department started using Mastering Physics around 2011 but Learning Catalytics wasn’t embedded in the system until a few years later. As the enrolment of Engineering Physics easily reached 2000 for each
cohort, it became impossible to mark assignments for each student. Using an automated online assignment mechanism, such as Mastering Physics, helps to fill this gap.

The lecturers want to implement technology-enhanced lessons such that students enjoy it. The instructor rewards students for their consistent hard work and does not penalise for mistakes in this activity. One of the university initiatives is to adopt a flipped classroom instructional model, and with the availability of hi-speed internet across campus, the instructor managed to integrate both Mastering Physics, Learning Catalytics in the course quite successfully.

The students were given points for their participation in class, regardless of the correctness of their answers. This encourages students to give authentic responses so that the instructor can better assess learning. The lecturers also have make-up, self-paced Learning Catalytics quizzes for students who are unable to attend lectures, so that they can do the questions while watching the lecture videos.

The instructor in this story started using Learning Catalytics actively in 2017. He implements technology in the class in a way that complements learning. In class, Learning Catalytics is a very useful tool to him, given the variety of question types it offers.

Students are given weekly Mastering Physics online assignments – they are typically given 7 to 10 days to work on them. The students can work together or can get help online to learn the topics. The instructor will assess this by setting one or two similar questions during the mid-term tests to check for learning. As a result, students who have not truly learned the topics well may get points on the assignment but will eventually lose points on the mid-term and final term exams.

Students typically use Mastering Physics to complete assignments outside of class. There are hints within the questions that provide additional scaffolding when students are struggling but hints may or may not help students. Before Learning Catalytics, another university initiative was to get students to own “Clickers”. Hence, there was a time Clickers were used in class to get students to vote for answers. Around 2015, the previous sales manager from Pearson introduced Learning Catalytics to the instructor, but he was initially skeptical because the use of Clickers took up a lot of previous lecture time. However, in 2014, pre-recording part of the lecture content and making them available to students became possible. Thus, lecture-time could be freed up. When Learning Catalytics was integrated in Mastering, the question then switched to the logistics of getting 800-900 students to log on into Learning Catalytics, whether there is enough bandwidth on the university’s Wi-Fi, particularly questions requiring graphical inputs.

When using Learning Catalytics, the instructor may ask students to do their calculations and submit their answers through multiple-choice questions, numerical input or short text. When students input via short texts, they may exercise their ‘freedom of speech’ and submit ‘naughty’ answers (e.g. "I’m still on the MRT train.") As lectures are recorded, there may be some students who choose not to attend the lectures in person and view the recorded lectures later. Excluding these students, the instructor may end up with about 700-800 students attending the live lecture. As a result, the instructor prepared self-paced quizzes for those who missed the live sessions.

The lecture is conducted in this way:

- The instructor delivers a question via Learning Catalytics and students will attempt the questions in various formats individually and submit their responses.
- The instructor will screen through the responses to have a sense of how much understanding or misinterpretation there is among them.
- He will then get the students to discuss their answers and deliver the question a second time to elicit their responses and see if there is any change or improvement.
• He will assess how much more he should talk about the topic, or question, based on their responses. Typically, the instructor can only cover 3-4 questions out of a total of 10 questions that he has prepared for the lecture because of the additional time to make these judgements.

Instructor Experience and Perception

Prior to using Learning Catalytics in a large lecture setting, the instructor would get off the stage and walk around the lecture theatre to see what kind of difficulties or misconceptions there were based on their written answers or worked solutions and then plan a few steps ahead. After using Learning Catalytics, the instructor was able to scan through all the 900 responses at once allowing him a sense of what/how he should teach next. His objective is to elicit authentic student responses and place more emphasis on participation versus correctness.

The instructor highlighted that one main challenge facing educators today is that while trying to provide a more holistic education, we have more to teach in the same amount of time. For content, educators have to prioritize what to keep and what to discard. The availability of technologies provides them “more degrees of freedom”, more room to maneuver. There is constant challenge of how to further optimise learning during lectures, mainly on technology integration itself, rather than just on Learning Catalytics (the tool) alone.

The instructor believes that technology is a tool, which should only be used if useful/meaningful. The availability of lecture recordings will also impact attendance, so it is a challenge to keep the learning during lectures a dynamic (with greater teacher-student interaction) and meaningful experience. Most of the time, a good lesson is improvised according to the learning needs of the students, but the greatest constraint is time.

Student Experience and Perception

Students use Learning Catalytics twice a week during mass lectures. The instructor observed that as long as students do not lose marks if they got the answers wrong, they like it. Students had no major issues using Learning Catalytics to submit their answers. The Learning Catalytics sessions are quite well received – the instructor feels the product helps the students to be even more engaged and focused on specific concepts.

Prior to the actual use of Learning Catalytics in Aug 2017, the instructor planned ahead for the implementation of Learning Catalytics by getting the students taking the bridging course in June 2017 to trial the product. He experimented with the teaching approach and helped the 500-600 students in the bridging course ease into the learning process of using the product. These students subsequently joined the larger group of students taking the course in Aug 2017. Some of them were even observed to have helped the others who were new to the learning app when they encountered minor technical issues.

Knowing that their answers may be projected on the large screen, some of the students ‘deliberately’ submitted answers that were either erroneous or debatable, most of which were humorous or witty responses.

Conclusion

The instructor constantly strives to have laughter in every lecture while reflecting on his teaching methods. He sees similarities between the journey of digital transformation of teaching Physics with the law of inertia, as it is probably also
applicable to humans and their habits. People tend to stay in the same way of working and learning, particularly if effort is required to make changes.

The instructor believes that we are creatures of habit. An instructor will teach in the same way he was taught. Some instructors may think that a good presentation equates to good teaching. But at times, instructors need to leave little strategic gaps here and there for students to sort out “anomalies” for themselves, which then allows for active learning.

The instructor also believes that teaching is probably a science and an art – an instructor needs to understand the dynamics of teaching and learning, that is, cognitive science and psychology, and how to assist/support weaker students, such as to always check whether students know what you mean, and respond in real time to help scaffold learning. He believes that Learning Catalytics has helped him achieve these objectives and enables him to be an even more effective instructor.

**Next Steps**

The instructor will continue to use Learning Catalytics for his lectures because he found that the students like the experience and have gained more confidence in using it more effectively. He has also plans to do his own education research with institutional approval based on the use of Learning Catalytics.