

# Fostering student engagement using online, collaborative reading assignments mediated by Perusall

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## I. INTRODUCTION

One of the biggest challenges at engaging undergraduates effectively in Biology modules is large class size (Wood, 2009). Typically, the class size of an undergraduate Cell Biology module in our institution ranges from 200 to 300 students. Instructors of large class modules traditionally teach didactically by simply disseminating facts, which become outdated quickly in this growing field of science. Furthermore, using didactic instruction, it is difficult to help students develop skills such as critical-thinking expected of our university graduates.

From the students' perspective, unless the contents and/or teaching methodology interest and engage them, there is little motivation to go beyond superficial learning (Finn & Zimmer, 2012). However, once engaged, students might develop the intrinsic motivation to master the essential contents and skills required for deeper understanding. This might be relevant for their further progression in science or even in their personal life after they graduate from University.

Among different teaching methodologies used to engage students, active-learning during classes is increasingly being used (Wood, 2009). Active-learning can be conceptualized using the idea of generative-learning (Osborne & Wittrock, 1983), in which learning activities are designed to promote cognitive rather than behavioural processes. Such learning activities require students to link together pieces of knowledge acquired to create meaning in a given context. At an advanced level,

students should be able to apply their knowledge to different contexts and think critically.

One of us has incorporated active-learning in teaching, through in-class quizzes using online classroom response systems (Yeong, 2015). While the quizzes generally increased class participation, it was difficult to encourage student engagement with the subject once classes are over. Hence, in the past semester, we designed an online reading assignment to foster student engagement in an authentic manner outside classes.

To this end, research articles were used in assignments to support generative-learning outside class. These research articles provide opportunities for students to analyse and interpret data, as well as make connections between concepts taught in class and their application in research work. More importantly, the assignments were designed as group-based activities based on Vygotsky's idea of zone of proximal development (Vygotsky, 1978) and peer learning. Here, we describe our experience and perspectives using an online, anchored-discussion assignment to foster student learning and engagement, as mediated by the Perusall platform (<<https://app.perusall.com>>).

## II. METHODS

In the academic year 2016/2017 semester 2, research papers were uploaded onto Perusall for students in the module to read and make comments. There were no restrictions on the comments that students can make;

students can ask questions, analyse data and critique the paper. The Perusall platform allows students to reply to each other's comments and questions. The platform was programmed to score the best 12 comments each student made. Students' comments were graded automatically by Perusall but checked manually by instructors.

Students were randomly assigned into groups of six, and had one week to read and comment on each paper. Each assignment made up 4% of students' grades; two assignments were administered during the semester. The first article was on the interaction of a fungal pathogen with macrophages, while the second related defects in cell cycle regulation to cancer. These articles were linked to topics in taught in class, namely lysosomal function and cell cycle regulation respectively. After the reading and commenting assignment, students had to complete an open-book, in-class quiz per article.

### III. STUDENT LEARNING OUTCOMES

The two assignments yielded a total of 3344 and 2913 comments from 245 students respectively. After the semester, we performed preliminary content analyses on a random selection of students' comments. The comments varied in complexity and presentation. For instance, many comments were statements that defined terms, or stated the purpose of experimental techniques that were unfamiliar to the students. Several comments of higher complexity, such as those that explained and interpreted data were also noted. In others, students cited other research papers to support their comments. We further found students using diagrams and concept maps to link and illustrate their ideas.

We observed interactions among students in which exchanges revolved around correcting and building of concepts proposed by the earlier contributors. These conversations usually started with a question, and students with different levels of knowledge on subject provided inputs regardless of the depth of understanding on the subject matter. These collaborative efforts often resulted in better understanding for some students who posed questions and a more rounded perspective on the question at hand for others.

The interactions among students at times extended beyond the context of the articles. We noted exchanges among students that started with questions about ambiguities in the data, and ended with the acknowledgement of subjectivity of interpretation of data. We also read questions about the functions of biological molecules that triggered discussions on general concepts of biology, ranging from the involvement of biological molecules in multiple

pathways to applications of knowledge to drug designs. These observations suggest that the exposure to primary literature when coupled with discussions among students furthered their understanding to the nature of science and scientific research.

### IV. PERSPECTIVES

The online assignments appeared to have engaged the students, as evident from the sheer number of comments received per research paper. It was gratifying to note that a number of the comments were high cognitive level comments where students demonstrated synthesis of knowledge. Furthermore, the level of engagement extended beyond the assigned research paper as students quoted other research papers to support their stand in the comments. The comments also made explicit some of their misconceptions to the instructors. This allowed the instructors an opportunity to correct the students, something not usually possible for didactic teaching in large-classes.

From our experience, some Asian students are shy to voice out their questions and opinions in class. In the online platform, students were not penalized by any comments made. Furthermore, the environment on the platform was overall rather friendly. These might have encouraged students to participate freely in the discussion without the fear of being embarrassed by their perceived "ignorance". More importantly, by making comments even with their incomplete knowledge, students got to learn from constructive comments from their peers. This type of learning is not facilitated when a didactic approach of teaching is used, as facts are just delivered to the students through lectures, handouts and textbooks.

The assignment also provided the opportunity for knowledge building among students. For instance, students built up concepts by adding information onto earlier comments. Students' comments were not restricted to the context of the paper, but extended to the nature of scientific research. This was similar to the scientific discourse that scientists engage in debates about ideas and approaches through publications and conferences. Such discourses widened students' perspectives on the topic of interest as they gained better understanding of the article or topic discussed. Thus, authentic learning of science through collaborative learning and engagement in scientific debates can be supported in large classes by online platforms such as Perusall.

The use of a research article-anchored discussion-based assignment for a large class comes with some caveats.

Firstly, we need to find suitable research articles that are suitable for the undergraduate students. Articles should contain sufficient content related to concepts taught in class, and the data should be interpretable by students without requiring specialized knowledge from a specific field. For this, sufficient time for preparation and planning of both the teaching and research article selection is important.

Secondly, though present, the total number of higher cognitive level comments was not very high. This could be improved by explaining to students the types of comments according to Bloom's taxonomy (Wood, 2009) and encouraging students to go beyond providing definitions and focus on interpretation of data and synthesis of understanding. In addition, the duration of the assignment could be lengthened so students have sufficient time to provide more considered comments. The weightage of the assignment could be increased to reflect the emphasis of the skills students should develop and demonstrate for the assignment.

Thirdly, the number of comments for each research article was huge for a large class. The automated marking by Perusall while useful, appeared to be based on level of sentence complexity independently of context. While the instructors had read through individual comments to check the automatic grading, given the huge number of comments and time constraints, not all the misconceptions were addressed on time. This may be mitigated with the help from teaching support staff who can look through the students' comments and compile the misconceptions. Alternatively, the support staff can comment directly in Perusall to correct misconceptions. The number of students per group could increase slightly so that there are potentially more students to support one another.

Overall, from our initial observations, the interactive format of the anchored-discussion assignment combined with the use of primary literature appeared to promote authentic scientific learning in a collaborative setting. As a tool, Perusall was a very good platform for such assignments to engaging students outside of class time. The impact of using online, collaborative reading

assignments on student learning outcomes certainly warrants further exploration and in-depth analysis.

#### Note on Contributors

Associate Professor Foong May Yeong conceptualised the assignment and taught the module as one of the instructors. Dr Seow Chong Lee helped with the design of the assignment. Both authors noted misconceptions, graded comments and performed the preliminary content analysis on a random selection of comments.

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#### Declaration of Interest

All authors declare no potential conflicts of interest.

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