Enhancing engagement in flipped learning across undergraduate Science using the Flipped Teacher and Flipped Learner Framework

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Context

Flipped learning is a form of blended learning in which new instructional content is delivered online prior to class, making time for more student-centred active learning during the face-to-face class.

To facilitate more student-centred blended learning in our faculty, we aimed to:
1. Use the “Flipped Teacher and Flipped Learner Framework” [2] to design, implement, communicate and evaluate flipped learning activities in undergraduate Science subjects;
2. Build students’ understanding of the advantages of the flipped classroom model in order to improve their overall engagement and approach to learning.

The Flipped Teacher and Flipped Learner Framework

Our Framework [2] identifies seven elements that are influential to implementing flipped learning. Using this framework, flipped learning activities have been integrated into the Science curricula (see subject cases below). A mixed methods approach [3] was used to evaluate the efficacy of the Framework, particularly the role of communication of the benefits of flipped learning to students and academics (element 6). Student completion of pre-class online tasks was tracked through the learning management system (Blackboard). At the end of the teaching session, questionnaires were used to evaluate student experiences of flipped learning.

Discussion

Our Framework was successfully used to design and implement flipped learning activities in a range of 1st and 2nd year Science subjects.

Our results show that students are engaging with flipped learning activities. Furthermore, the majority of students surveyed agree that the flipped learning activities enhance their understanding and learning in the subject. Students valued the flexibility to prepare for class whenever they choose and at their own pace.

Communicating the rationale for using a flipped classroom approach has been a key component of the successful implementation of the flipped classroom model in our science subjects.

1. General Microbiology, 2nd year medical sciences, 580 students

Short pre-class online video lectures introduced key concepts and linked to in-class activities.

- 80% students agree/strongly agree that online modules developed their understanding in this subject (n = 127)
- 71% students agree or strongly agree that the combination of online modules, lectures and practical classes enhanced their learning (n = 127).

2. Principles of Scientific Practice, 1st year core science, 750 students

Interactive online modules with videos and quiz questions introduced key concepts prior to the collaborative workshops and practical classes.

- 85% of students completed all online pre-class modules in the session
- 72.4% students agree/strongly agree that the online modules developed their understanding in this subject (n = 574)

3. Biocomplexity, 1st year life sciences, 600 students

Disciplinary threshold concepts [4] presented prior to lectures, with active learning in each lecture that relates to pre-class material.

“The students are responding well to the more interactive lecture style; they are more comfortable with in-class discussions and Q&A activities now. Helps keep them awake in 8am lectures too!” Subject coordinator, Spring 2016

4. Environmental Remediation, 2nd year environmental sciences, 63 students

Online module accessed prior to field trip.

“[The videos] were really easy to follow and I can watch them on my phone from anywhere” Student, Spring 2016

References

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The Flipped Teacher & the Flipped Learner Framework

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Planning
(a) Consider suitable pedagogies such Active Learning (Bishop & Verleger, 2014), Problem Based Learning, Collaborative Learning, First Year Transition Pedagogy (Kift et al., 2010)
(b) Identify and preserve activities best suited for engaging students in face-to-face classrooms
(c) Adapt existing curriculum to enable students to reflect and consolidate material/ideas in-between tasks/faces to face sessions (Reyna, 2014)
(d) Identify ‘troublesome knowledge’ and develop a Flipped Classroom strategy to address it (Meyer & Land, 2003)
(e) Flip threshold concepts to prime understanding of the topic
(f) Flip complex concepts to establish foundational knowledge for extension in the classroom
(g) Ensure Flipped Classroom learning activities align with learning outcomes and assessments (Biggs & Tang, 2011)

Storyboard Lesson Plan

Before Class Activities

Content Organisation

Visual Design

Inclusive Design

Building Testing Deploying

Communication

Timing for Activities
(a) Adapt the learning activities to a variety of time frames (Johnson, 2013)
(b) Plan activities that can be done in time allocated (c) Before class: knowledge, remember, understand, describe, explain (d) During class: apply, analyse, evaluate, create (e) After class: hypothesis, reflect (Anderson & Krathwohl, 2001)

Pre-class activities
(a) Curate Open Educational Resources (OER) to introduce concepts and trigger discussions (Moffett, 2015) (b) Follow up with quizzes with instant feedback (Cooper, 2000) (c) Consider online collaborative activities such as wikis, blogs, etc. (e) Outline how the pre-class activities link to the classroom activities and subject learning outcomes (Garrison & Vaughan, 2008)

Classroom activities
(a) Debrief pre-class activity, address misconceptions (b) Extend pre-class material and show examples (c) Introduce collaborative/active learning task in the classroom (d) If working in groups, randomly select a student as group leader to collate and report ideas, solutions to problems, etc. (e) After class follow up task, e.g. reflective writing (MacDonald, 2011)

Introduction
The Flipped Classroom promotes ways to further engage our students and foster independent learning skills. This Flipped Teacher and the Flipped Learner Framework can be used as a tool to inform academics on how to Flip Classrooms. Additionally, it will inform our students of the advantages of this educational strategy.

Building, testing and deploying
(a) Build your online content into your LMS or via stand-alone learning objects using e-learning authoring tools
(b) Test your online content works on major web browsers
(c) If tracking and grading is required, test your SCORM package
(d) Present material in a variety of presentation modes (textual, visual, aural and kinaesthetic) (Birch, 2006; Sankey & St Hill, 2005; Solvie & Kloek, 2007)

Evaluation and Improvement

Content organisation
(a) Information architecture (Brown, 2010) (b) Segmentation of content into a logical step-wise progression (Lauer & Trahasch, 2005)

Visual design
(a) Apply multimedia learning principles (Mayer & Moreno, 2002) (b) Ensure the layout design is clean and easy to follow (c) Use colour effectively and web safe fonts to enhance readability of content (g) Multimedia learning and visual design principles will enhance the look and feel of your content (Malamed, 2015).

Inclusive design
(a) Equitable use of teaching resources accessible for students with different learning styles (b) Flexible access to resources and teaching (c) Easily navigable structure and clear expectations (d) Inclusive learning climate that considers the diversity of students (Kerr, McAlpine & Grant, 2014)

References
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Evaluation and improvement
(a) Close monitoring the student’s usage via LMS logs and reports (b) Asking students for feedback via online surveys (c) Asking tutors and co-teachers for feedback on student engagement and performance (d) Take a mixed methods approach to identify areas of improvement for stages 1-6 (e) Use Kirkpatrick’s four levels of evaluation (Kirkpatrick & Kirkpatrick 2006) (f) Make the required adjustments for the following semester