

Supporting student transition: embedding reading practices into the first year Science curriculum

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Abstract

Although being able to critically read and comprehend scientific texts is fundamental, many students find reading the primary literature overwhelming and may lose self-confidence as a result. Our aim was to build first year science students' confidence in reading relevant and reliable sources of information and develop their critical reading practices through a First Year Experience Project focusing on supporting student transition. To achieve this, we utilised a flipped classroom approach to design and embed interactive online modules and a face-to-face workshop in a first year Science subject. Student participation and completion of the learning activities was evaluated with students commenting very positively on the usability, accessibility, usefulness and relevance of the reading practices resources. Based on the success of this initiative, we recommend that discipline specific, contextualised resources which develop effective reading practices should be integrated into the first year curriculum.

Introduction

A key practice in science is the use of the scientific literature to communicate research findings. Therefore, being able to read the scientific literature selectively and critically is fundamental for science students to integrate knowledge from multiple sources into their inquiry-oriented courses. However, commencing first year (FY) science students are often surprised by and unprepared for the amount of reading they are expected to do (Du Boulay, 1999). They may be overwhelmed by technical details, complex figures and tables, and the unfamiliar terminology in the primary literature (Round & Campbell, 2013).

To support students' transition into the first year of university and beyond, the prominent role reading practices play in tertiary study needs to be recognised and addressed. Given the increasing diversity of the student cohort, considerations include: students' academic capital; the shift towards digital literacy and blended teaching and learning approaches; and, a more self-directed style of learning. These, along with the volume and variety of reading material available, mean being able to successfully search for and filter this material are critical first steps for students. Clearly there is a need for embedding a program addressing how to read complex scientific texts (journal articles and other primary literature) early on in the science curriculum (Coil, Wenderoth, Cunningham & Dirks, 2010).

The aims of our initiative were to support student transition into first year tertiary study by:

1. developing students' critical reading practices of the scientific literature, and
2. building students' confidence in effectively choosing and reading relevant and reliable sources of information which would be integrated into an authentic assessment task.

To achieve this, we designed and embedded online and face-to-face activities in a FY subject.

Supporting student transition: embedding reading practices into the first year Science curriculum, Emerging Initiative.

Why develop and embed reading practices into the first year Science curriculum

Embedding reading practices into the Science curriculum and the First Year Experience

Reading practices tend to be regarded as a study skill which can be taught in add-on or generic skills classes by academic support staff while class time is devoted to disciplinary content (Coil et al., 2010). Generic reading resources are widely available; however, students often see these decontextualised learning materials as additional and optional. Our intention was to induct students into the science discourse community through embedding the teaching of reading practices within the way that the science discipline uses language. With this knowledge, students would be better equipped to choose relevant, reliable and valid sources of information to use when writing scientific reports.

As members of the subject design team for the new FY core science subject, Principles of Scientific Practice (first offered in 2015), we identified that it was the ideal subject in which to embed reading practices. The majority of commencing FY science students (n ≈ 900) enrol in the subject which introduces students to the major themes of contemporary science and inquiry-oriented experimentation. We formed an interdisciplinary team comprising an Academic Language and Learning (ALL) developer and a Science academic specialising in learning design, to develop bespoke reading practices resources for this FY Science subject.

Our project was funded by a university wide First Year Experience grant scheme (Egea, Griffiths & McKenzie, 2014) implemented to embed transition pedagogies in the curriculum and promote student success in the classroom “one class and one subject at a time” (Tinto, 2012, p. 4). We identified the Design and Diversity FY Curriculum Principles of Transition Pedagogy (Kift, 2009) as most relevant to our project design and created our resources after careful consideration of the fundamental reading practices our diverse commencing cohort need to prepare for their respective science degrees. To promote an inclusive and accessible learning design for all students we used a flipped classroom approach.

Inclusivity through a flipped classroom approach

Implementing a flipped classroom approach brings a technology-enhanced, student-centred learning environment which allows for more flexibility, first exposure to concepts prior to class and more time for active learning in class (Kim, Kim, Khera & Getman, 2014). Presenting content online augments accessibility and enables inclusivity (Devlin, Kift, Nelson, Smith & McKay, 2012) as it supports students’ learning in their own time and own pace. For our flipped approach we created interactive online modules (hereafter referred to as modules) which carefully scaffold how to find, choose and read the appropriate scientific literature for a range of science disciplines. The face-to-face workshop (hereafter referred to as workshop) facilitates a collaborative learning environment in which students identify the components of an exemplar scientific article and determine the purpose of each section. Finally, the students apply these reading practices when researching the scientific literature for their assessment task (a scientific report on their laboratory experiment).

Learning design process for developing reading practices resources

Identifying the learning objectives and students’ needs is a critical first step to ensure alignment between process and product in learning design. We researched and curated support material (e.g. online videos) to inform our design choices. The next step was to

storyboard the modules, ‘chunking’ the content into three ‘skills groups’ to ensure balance across learning objectives, and to develop the workshop activities. We built the online modules using Adobe Captivate, embedding them into the Learning Management System (LMS, Blackboard) and testing them on several operating systems before release. We provided a tutor’s run sheet on workshop facilitation, including prompts, questions and suggested timing. After embedding the modules and workshop into the subject curriculum, we evaluated their efficacy by monitoring student completion rates and through post-activity student surveys (with ethics approval).

Project deliverables: interactive online modules and workshop

The modules prepare students for reading a scientific article based on a similar experiment to the one they conduct in their laboratory sessions. The modules are made available for the semester, and may be reviewed and the built-in quizzes retaken as required. In the workshop the students work collaboratively on the worksheets they accessed via the LMS before class. The workshop discussion summarises the main points of the article and provides opportunities for students to check their understanding and receive feedback from tutors. In the post-workshop activity students apply the concepts through writing an abstract. The sequence of learning activities prepares the students for the final assessment task (Figure 1).

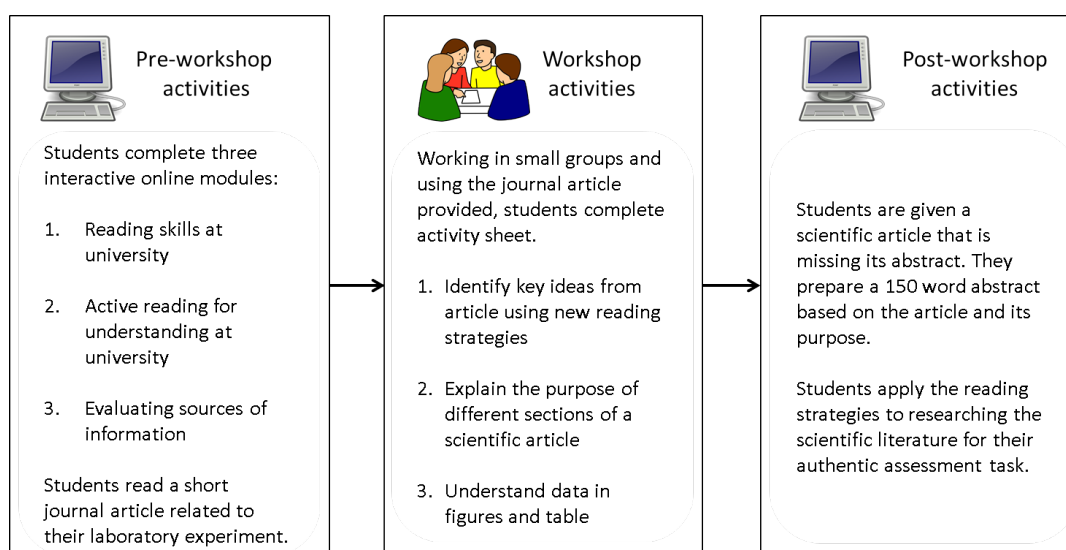


Figure 1. Outline of the modules, workshop, and post-workshop learning activities.

Evaluation and impacts of the interactive online modules and workshop

We evaluated our reading practices intervention at the end of both semesters in 2015 using a mixed methods approach: online statistics tracking to identify completion of the modules; a post-activity anonymous online survey evaluating students’ experiences and perceived value in the learning activities. The survey included Likert scale and open-ended questions. In Semester 1, 76% of students (n = 779) completed all modules prior to their workshop, and a further 14% attempted at least one. In Semester 2, 76% of students (n = 207) completed all modules prior to their workshop, and a further 4% attempted at least one. In the post-activity surveys, overall students agreed that the online modules helped them develop their reading strategies (Table 1). The majority reported using the strategies when finding and reading scientific articles for their assessment task, which demonstrates the high learning value of the

modules, workshop and the flipped classroom approach. Students indicated confidence in their ability to select and read the scientific literature. Furthermore, most students indicated that they would use the reading practices that they had developed in the future.

Survey item	Sem 1 2015 (n = 124)	Sem 2 2015 (n = 19)
The pre-workshop modules helped me develop efficient and effective reading skills.	62%	74%
The pre-workshop modules helped me understand the structure of scientific journal articles.	85%	58%
I used the strategies covered on the pre-workshop modules and/or workshop, such as skimming, scanning, active reading and evaluating sources, when researching papers for my scientific report.	74%	58%
I feel confident that I can read scientific journal articles more efficiently and effectively.	80%	68%
I feel confident that I can find and choose relevant scientific journal articles for my assignments.	80%	84%
I will use the skills I developed in the pre-workshop modules and/or workshop in the future.	90%	79%

Table 1. Student evaluation survey results of modules and workshop

In the open-ended section of the survey, many students commented on how the modules had supported their transition to university: *“Gaining an idea of the expected structure of a scientific report and the level of understanding expected for a first year. It is good that they started at the basics.”* Students felt less overwhelmed when dealing with the scientific literature: *“... made me feel less burdened when researching scientific articles and constructing one of my own”* and *“Information on the format of scientific articles and learning how to read them more effectively and not feel too 'scared' to approach them.”* Students saw the value in developing these strategies for their university studies and future career: *“[the workshop] gave me insight to what I was learning and what is expected of me as a science student and scientist.”*

Conclusions

Key to the initiative’s success in seamlessly embedding discipline specific contextualised reading practices has been the collaboration between the interdisciplinary team members (ALL and Science) sharing their distinctive expertise and acting as critical friends. The project deliverables were carefully planned, designed and scaffolded around the FY Curriculum Principles to enhance learning and transition for the diverse student cohort and their needs and capabilities. Integrating reading practices and ‘bringing reading – in contrast to writing – to the fore in students’ literacy practices’ (Lea & Jones, 2011, p. 390), not only helps students understand the important role that reading plays in their university studies and beyond but also builds their capacity as trainee scientists.

Student evaluations clearly show that for most students, the flipped modules and workshop enhanced their transition to university by developing their critical reading practices and building their confidence in using the scientific literature. In addition to the impact our intervention has had on student learning and achievement, a value add is the sustainability and transferability of the reading practices resources we have created. Based on our success, we recommend that discipline specific, contextualised resources which develop effective reading practices should be integrated into the first year curriculum.

Supporting student transition and achievement: questions for consideration

What challenges do students face when they begin reading discipline specific texts?

What reading practices resources are available to your students and who provides them?

Is there a need to develop discipline specific reading practices resources in your subject or course? What would you address to achieve best outcomes for your students?

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