Enhancing critical thinking skills in first year environmental management students: a tale of curriculum design, application and reflection

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ABSTRACT

This paper chronicles the experience of academic staff in developing a course to enhance the critical thinking skills of environmental management undergraduates. We outline our considerations and process for course development, discuss insights from course evaluations, and reflect on the challenges encountered. We believe these perspectives will be useful for others who are developing critical thinking skills curricula, especially first year courses. Aspects of the course design which were considered particularly effective were the use of scaffolded assessment, the application of threshold concepts, and well-structured collaborative learning activities paired with quality tutors. The key learning for the authors from the evaluation of the course was that while the tools and strategies developed were very useful, interweaving these tools into year 2 and 3 courses would help students see the ongoing value of critical thinking in their work.

Introduction

Environmental management graduates are required to have well-developed critical thinking skills in order to navigate through the "wicked problems"[1] they will encounter during their careers (Jones & Merritt, 1999; Tasch & Tasch, 2016; Thomas, Barth, & Day, 2013; Vincent & Focht, 2010). In response to this need, a 2011 curricular review determined that the Bachelor of Environmental Management (BEM) degree at The University of Queensland was in need of a first year critical thinking skills course. The skills focus emphasized that environmental management graduates should have the ability to critically evaluate a range of information and incorporate this into decision-making in a transparent and justifiable manner. As such, course staff chose to develop pragmatic critical thinking skills, rather than a more philosophically based curricular. The intent was to design a dynamic and innovative course that delivered learning and teaching experiences which would explore and apply critical thinking skills to environmental management topics. The course was delivered in 2012.

The designers of the course had more than a decade each of experience in teaching across environmental management, and a sound grounding in education through a Graduate

Certificate in Higher Education. However, neither had a formal background in critical thinking pedagogy. Embarking on this task equated to Alice's journey down the rabbit hole[2]; a journey into the unknown or unfamiliar. The aim of this paper is to chronicle this journey and document the subsequent learning experiences of staff. This is achieved through a brief review of the pedagogical literature on teaching concepts relevant to the course; discussion of the rationale for the development of specific strategies; reflections on effectiveness of the course based on evaluations led by the university's Teaching and Educational Development Institute (TEDI) and in-course evaluations; and, reflections from course staff.

Enhancing critical thinking skills: conceptual and theoretical issues in environmental management

The notion of critical thinking as an enabler for students to effectively solve problems has been promoted as an invaluable strategy for improving student learning in contemporary education (Bailin & Siegel, 2003). Critical thinking, in the context of environmental management, is the ability to think rationally and reasonably (Mulnix, 2012) about what to believe and do (Norris & Ennis, 1989) about complex environmental issues which are often fraught with values, emotion, and vested interests. According to Haigh (2016, p. 165) "applying critical thinking and achieving critical depth are mantras of higher education but, other than promoting mimicry, little attention is paid to how to help learners search for deeper understanding". Thus, educators are encouraged to: provide clear instruction in critical thinking; teach how to transfer skills to new contexts; employ cooperative or collaborative learning methods, and; employ constructivist approaches that put students at the centre of the learning process (Cantor, DeLauer, Martin, & Rogan, 2015).

Despite this, Ramsden (2003) suggests that students often attempt to apply replicable learning behaviour to "pass" a course, which is often demonstrated by surface (rote learning skills and a lack of critical thinking) or strategic (focus on assessment items) learning approaches. These learning approaches are unsuited to interdisciplinary and complex, multi-faceted fields such as environmental management, given a need to address wicked problems with no clear, definable "answers" (Jones & Merritt, 1999; Warburton, 2003). Deep learning, rather than strategic or surface learning, approaches are considered essential within these fields (Bryce, Johnston, & Yasukawa, 2004; Cook & Babon, 2016; Tasch & Tasch, 2016; Warburton, 2003). According to Fullan and Langworthy (2014), new pedagogies should aim at achieving this deep learning, a model that focuses on the learning experience and going beyond the mastery of content knowledge. From this approach, the teaching process should help students to develop the ability to lead their own learning and to do things with what they learn (Pawson et al., 2006). In this context, teachers are partners with students in activities characterized by exploration, connectedness and broader, real-world purposes.

Environmental management also requires an understanding that may necessitate the student approaching issues different ways, and often this journey can challenge the student's worldview (Bradbeer, 1999; Jones & Merritt, 1999). This was an important element to consider in our course design, as often students enter the program with very narrowly constructed views (committed to being either wholly for or against an issue). Just as contextual understandings of environmental issues and challenges are important, so too is self-awareness of personal values (Jones & Merritt, 1999), which allows students to identify their own "cognitive biases and blindspots" (Van Gelder, 2005, p. 45).

The unwillingness or lack of capacity to push beyond traditional styles of learning (from either students or teaching staff) can result in student alienation within the learning process (Mann, 2005). Mann (2001) argues that to reduce alienation and to foster a mindset of lifelong learning, we, as educators are required to consider how we might open discourse and participation and create involvement and ownership within the learning community. Learning strategies developed should attempt to lessen feelings of isolation by handing power back to the learner, reduce barriers (us and them/teacher and student) and dissonance, and encourage creativity and the exploration of ideas through engagement with the learning process. These perspectives reflect Pawson et al.'s (2006, p. 105) problem-based learning, where the "onus is on students determining their own learning needs".

The traditional educational model has emphasized content mastery as a key foundation of learning (Fullan & Langworthy, 2014). It has been argued, however, that university teaching has tended in the past to focus on memorizing content rather than student learning (Pithers & Soden, 2000); shortcuts such as lectures and objective tests seem to be predominant (Snyder & Snyder, 2008). These traditional teaching methods have been less effective in promoting the development of problem solving abilities (Fink, 2013; Snyder & Snyder, 2008). Clement (1979) and Norman (1981) suggest that there has been greater emphasis on what to think and learn rather than developing skills for how to learn and think critically.

The relevance of applied learning in the development of critical thinking skills is evident across the literature (Byrne & Johnstone, 1987; Jones & Merritt, 1999; Mulnix, 2012; Pawson et al., 2006; Van Gelder, 2005). Central to this approach is not teaching students what to think, but rather how to think, by guiding students through active and deliberative practice (Mulnix, 2012). For this reason, emphasis was placed on interactive, applied tutorial activities.

To minimize the dissonance created by the complexities of envionmental management issues, strategies for deep learning and engagement are promoted as they seek to encourage student interest through providing instructor support and creating opportunities for student ownership of learning (Mimirinis & Bhattacharya, 2007; Wass, Harland, & Mercer, 2011). The literature suggests the use of "threshold concepts" for applied learning to develop critical thinking skills. Threshold concepts require new ways of thinking in order to develop an understanding of the subject matter, and which can serve to transform learners' "internal view of subject matter, subject landscape, or even world view" (Meyer & Land, 2003, p. 1). Through this approach to applied learning, students develop confidence and expertise while simultaneously exploring and developing an open, problem-solving mindset. Additionally, reflective space and time is provided for students to develop self-awareness of their world-view and the impact it may have on their perceptions.

The introduction of interactive applied learning experiences and critical thinking skills development are consistent with constructivist approaches used in the psychology of education (Cakir, 2008). They show that meaningful learning processes are not based on transferring information from teachers to students but on complex social relationships between "teacher" and "student", where students transform information, building new knowledge and experiences (Vygotsky, 1986). Although people can learn and interact directly with some information, the outcome is influenced by the quality of such relationships/interactions between the individual, knowledge, and teachers (Kansanen & Meri, 1999; Wass et al., 2011). While we cannot expect to engage all students to the same degree, there is an expectation that an effective learning environment will allow the greater number of students to achieve

positive learning outcomes (Biggs, 1999). Teachers facilitate linking between new knowledge with the pre-existing knowledge. In doing so, teachers do more than guide the learning of new concepts and ideas, they also encourage deep analysis and discussions that enrich the learning experience through critical thinking. This also supports the prioritization of applied learning within tutorials that are developed on constructivist principles (Cakir, 2008).

Based on these theoretical perspectives, course design incorporated the following as methods for teaching critical analysis skills to first year environmental management students:

(1) Encourage student ownership and deep learning, through avoiding alienation;
(2) Adopt an applied learning approach, through use of threshold concepts; and
(3) Provide an effective learning space, by positioning teachers as facilitators of student learning.

Course structure

The course aimed to enhance students' capacity to critique and evaluate a range of information (including peer-reviewed science, government and consultancy reports, media, and the internet and advocacy sources). This was undertaken through a purpose designed curriculum that presented complexity within a framework of threshold concepts. The course aimed to achieve this by developing the students' capacity to report on and communicate issues based on a critical analysis of available information. The key strategies employed to enable these outcomes within the course therefore included the need to:

- encourage students' choice and ownership of topics;
- mix the assessment items with group and individual efforts;
- provide clear guidelines on what to achieve within each module and tutorial session;
- integrate a high level of reflection on students' own biases and perceptions, as well as their peers', and information coming from different sources; and
- provide a space for discussion and critique outside the class room.

Therefore, the learning objectives of the course aimed to demonstrate student capacity to:

- identify, understand and critically analyse information from a wide range of sources and disciplines to inform and enhance understanding of environmental management issues;
- integrate and synthesize a range of information into a literature review;
- place environmental management issues within the broader political, socio-cultural, economic and legal context; and
- demonstrate the capacity to critically reflect and effectively communicate in differing formats, appropriate for an environmental management professional.

It was envisaged that the skills developed within the course would provide the foundation not only for academic life but also for lifelong and professional learning. Following Snyder and Snyder (2008, p. 90), we believe that "merely having knowledge or information is not enough. To be effective in the workplace (and in their personal lives), students must be able to solve problems to make effective decisions; they must be able to think critically". However, the key constraints in this endeavour were time and course staff's lack of experience and knowledge of the pedagogy of critical thinking (Pithers & Soden, 2000). Given the

course aimed to enhance application of critical thinking skills, emphasis was placed on the assessment or testing of critical thinking skills, rather than the philosophical foundations of critical thinking.

The myriad definitions and approaches highlighted a need to provide a more digestible overview of critical thinking (Wass et al., 2011). The core concepts from the literature were reflected in a critical analysis checklist that presented questions students should consider when reviewing information. The checklist highlighted the following:

- context (e.g. what was known about the author/s);
- analysis and evaluation (e.g. logic of argument and propositions);
- assumptions, values, views, biases (e.g. any tacit assumptions made in the work); and
- reflection on self as the reader or receiver (e.g. are values causing leading to rejection/ acceptance of information without consideration).

These resources were introduced in lectures and utilized throughout tutorial activities. From the perspective of the course staff it was considered that a structured approach between lecture, tutorial, and assessment tasks provided the necessary scaffolding for students in a first year, skills focused course. Rather than the institutional norm of a two hour lecture, one hour tutorial format, tutorials were designed to be the strongest component (two hours) in recognition of the importance of learning by doing (Thomas, 2010) and active interaction with tutors and classmates (Cakir, 2008; Vygotsky, 1986). Conducted by experienced tutors, tutorial activities were designed to be interactive and have both individual and group orientated components. In some sessions, examples and cases had direct links to assessment topics or were topical issues chosen given their relevance to the degree and to students' professional interests (Cakir, 2008). Students' group work in tutorials was conducted within small informal groups formed around a shared assessment topic. Assessment was also linked to lecture and tutorial activities to allow students to explore the tasks prior to submission.

Assessment included a literature review conducted in three stages. These stages included: a preliminary analysis of the literature on the students' topics; a follow-up, overview of the students' literature, and; the final literature review. Threshold topics were provided for students' assessment, meaning students completed all three assessment items on the same topic. However, students were given some latitude to build ownership of their topics and refine their own focus within the topic and this allowed an element of empowerment at least in topic choice and focus (see Leach, Neutze, & Zepke, 2001). Tutorial activities provided space for discussion of task expectations and constructive feedback throughout the scaffolded assessment process. The literature review development was complemented by an oral presentation on the students' topics, and an online discussion across broad related themes. Tutorial activities assisted students to develop a research question, improve data retrieval skills, and evaluate and synthesize the literature.

For the online discussion forum, tutors posted four specific discussion topics to the course Blackboard site (an online, interactive learning platform) for students to reflect and comment on during the semester. Students were encouraged to respond to at least one other student's posting by exploring the issue at hand, thereby widening discussion and perspectives on the topic. By guiding and encouraging students to retrieve, evaluate and synthesize information from the lectures and readings coupled with group discussion and cooperative learning activities, tutors aimed to promote an active learning strategy that would improve "higher-order thinking skills" (Yuretich, 2004). The final assessment, an oral presentation,

Table 1. Key curriculum design considerations for teaching critical analysis skills in environmental management.

Course component	Curriculum design considerations
Course purpose	Encourage creativity and interest. Learning outcomes linked to skills which students may apply in daily life (e.g. conscious consumption of news through the media).
	Provide a learning environment where the wickedness of problems is embraced and deconstructed aims to encourage students to accept uncertainty and create ways for understanding complexity. Case studies are examined through interrogation of values, opinions, and perceptions – of the students as well as of the case itself.
Lectures	Present lecture content designed to pique students' interest, encouraging student ownership over content.
Tutorials	Develop collaborative learning environments where students have a voice and may establish a sense of place with peers and tutors, attempting to counter feelings of isolation during the first year.
	Provide supportive learning environments where students may explore various facets of ideas in a safe space, and also examine the appropriateness and power of different forms of expression and communication (e.g. through analysis of different types of media and modes for information dissemination).
	Encourage creative thinking and exploration of issues and topics as individuals and within groups.
	Collaborative learning environment in tutorials provides students with the space to receive supportive and constructive feedback on their ideas and research outside of the formal process of assessment.
Course material	Breaks down key concepts (language/discourse) into checklists that link lectures, tutorials and assessment to provide clear links between discrete learning activities and the 'big picture' for students' studies.
Assessment	Threshold concepts allow students to take ownership of their topics, so that students' research offers personal satisfaction in addition to serving as an academic activity.
	Topic choices allow students some ownership in the direction of their learning, and provides the opportunity for specialization of students' learning experience.
	Scaffolding of assessment aims to demystify academic culture through providing ongoing feedback to students to assist with development of research and writing skills, rather than assignments serving as activities purely for assessment of skills and abilities.

aimed to provide the opportunity for students to practice communication skills that are considered a particularly important skill within environmental management (Szili & Sobels, 2011). Key course design considerations are presented in Table 1.

Evaluation

Evaluation of course design tends to be limited but may provide a learning tool for improved teaching (Smith, 2008). With the development of the new course and the application of innovative teaching and learning strategies, the course provided an opportunity to reflect on course outcomes based on student and course staff perceptions. Evaluation of the first iteration of the course occurred in both formal and informal ways. First, weekly tutor meetings allowed the course staff to reflect on, and modify where necessary, practice and delivery. Second, the course staff reflections on student assessment were also discussed after each assessment was graded and finalized. These reflections informed ongoing delivery but were also recorded and where incremental change was not appropriate, these were flagged to be incorporated into the next iteration of the course. Third, written feedback specifically on tutorial sessions was provided anonymously by students.

A formal evaluation process was implemented by TEDI, the university's Teaching and Educational Development Institute, with appropriate ethical approval prior to commencement. The evaluation included a pre- and post-course online survey, with the opportunity for in-depth views from a focus group discussion. Surveys were identical, based on the Participant Perception Indicator (PPI) and utilized the online survey platform

SurveyMonkey. With a student cohort of 117 (*n* = 117) in 2012, all students were invited by email to respond to the surveys in addition to tutorial and lecture reminders. For the pre-course survey (conducted in week 2), a response rate of 36% was achieved, with a total of 56 students beginning the survey and 42 completing it. The post-course survey (conducted weeks 11 through 13) yielded a lower response rate of 21% with 33 students starting and 24 finishing. Students were also invited to participate in a focus group; however, it was not pursued as only five students were prepared to participate. The low response rates typically reflect a general trend in research involving tertiary students (Sax, Gilmartin, & Bryant, 2003).

Data and results

The course aimed to enhance students' critical thinking skills. As such, development of critical thinking skills was central to course evaluations, and the focus of continual reflection of the course staff. Data presented here include course staff reflections during weekly meetings and student responses to the course evaluation. Pre- and post-course surveys aimed to garner feedback on student experience within the course. Students were asked about: grade expectations; perception of their current capacity for critical analyse a wide range of information, and; confidence in relation to course learning objectives. Where appropriate, open ended questions were used. The following discussion will address responses to some of the core interests in the development of this course and were linked to the themes that emerged from the literature, such as student perceptions of applied learning experiences, and the use of threshold concepts and scaffolded assessment.

Overview

Overall, it was perceived that the course was a positive learning experience, and the objectives and structure were sound. Students indicated broad appreciation for their learning outcomes.

> I believe the course to be relevant for the future as I will now critically think on issues rather than accepting data as truth. This coupled with stakeholder values will be a fantastic tool in determining best solutions. (Post-course survey #7)

> Before I started this course, I had no idea how well I would do. I did not think I was good at critical analysis, making me think that I would not do well in this course. However, the lectures and tutorials have really helped me in improving my skills. (Post-course survey #1)

However, some students indicated that the content was not challenging enough, or was not suited to a single course. In addition to presenting valuable insights into the appropriateness of the course, these perspectives may reflect the propensity for those individuals with the most-developed faculties for critical thinking to actively engage in their education, and therefore be more likely to complete the survey (Porter & Umbach, 2006).

> Absolutely, critical analysis is an essential skill, relevant to us in everything we read and are exposed to (at work, at uni and in everyday life). It is important to know how to interpret a broad range of information types, and this course has given us these tools. However, I think that some of the course content was a little too obvious – we are not stupid! (Post-course survey #6)

> I understand its relevance to the course, where it is important to be able to understand and analyse a wide range of sources, and make judgements upon their credibility, reliability etc. However I felt these things were not necessary to make a whole subject out of, as we learn them along the way through our secondary and tertiary schooling. (Post-course survey #10)

In addition to the above comments, students perceived that the course provided the opportunity to learn skills they did not have and that are deemed fundamental for achieving their academic goals:

> Yes as it provided me with many new analysis skills which I did not feel I had before participating in this course. It enhanced my critical thinking of the related literature to help me discern what literature was more reliable than another. (Post-course survey #17)

Similarly, in relation to their career, there appeared to be consensus on the necessity to understand and practice critical thinking.

> It's important stuff. Most of the courses we do aren't specifically aimed at environmental management careers. It's knowing how to handle the multidisciplinary of the field – you won't learn that in maths or biology or stats class. (Post-course survey #6)

> I think it is relevant to my career aspirations as the course has improved my ability to critically analyse a wide range of literature and gave me very helpful feedback in doing so. (Post-course survey #13)

There was greater support for the hands-on tutorials than lectures. The criticisms of the lectures were perhaps because they contrasted so much with the applied nature of the tutorials. Other criticisms of the lectures included perceived repetition of content.

> The course was good, and the tutes [tutorials] were really helpful in regards to the assessment. The lectures were a. too boring, and [b.] sometimes completely based on common knowledge. (Tutorial feedback #2)

> Provide some further incentive for students to attend the lectures. Maybe provide additional information for the tutorials or assignments, often the content covered in the two hour tutorial was then repeated in the lecture, making the lecture seem repetitive and boring. (Post-course survey #14)

The comments above may also be indicators of the strategic learner, where the student sees knowledge as an end game, taking new concepts as "common knowledge" rather than reflecting on how that knowledge was constructed and developed or indeed how it may continue to evolve over a lifetime of learning.

Students' perceptions of skills development

In the pre-course survey, students reported that they already had "knowledge" and "experience" with critical analysis skills (Figures 1 and 2); this was apparent both from feedback to course staff and within the data. Their perceived "confidence" in critical analysis was slightly less. The following quotation, however, summarizes a general feeling that they already had knowledge, experience, and confidence in critical analysis:

> So far the course feels like it only covers very common knowledge that most people would/ should already know. (Pre-course survey #36)

This perception was reflected in students' grade expectations with all anticipating high grades. In the post-course survey, students self-reported a greater confidence in their
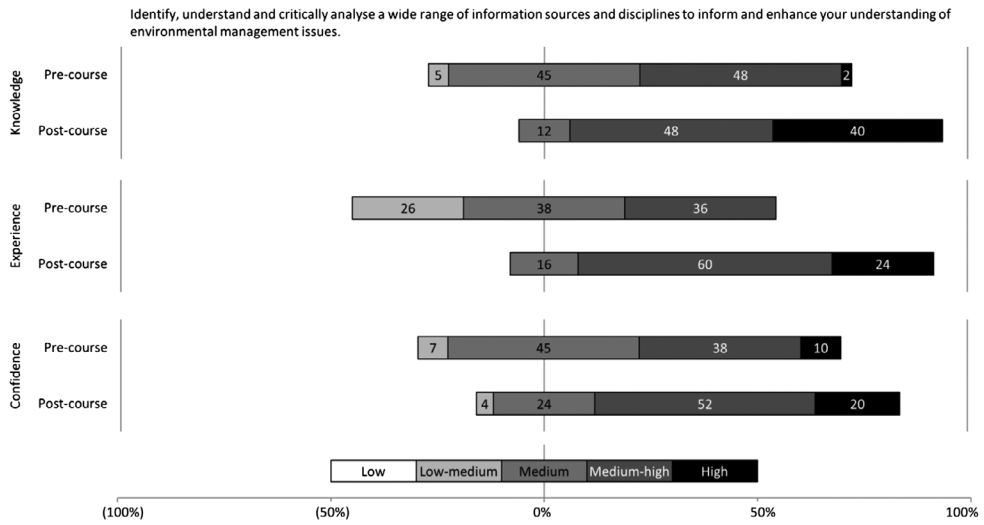
Figure 1. Students' self-reported knowledge, experience, and confidence in critical analysis.
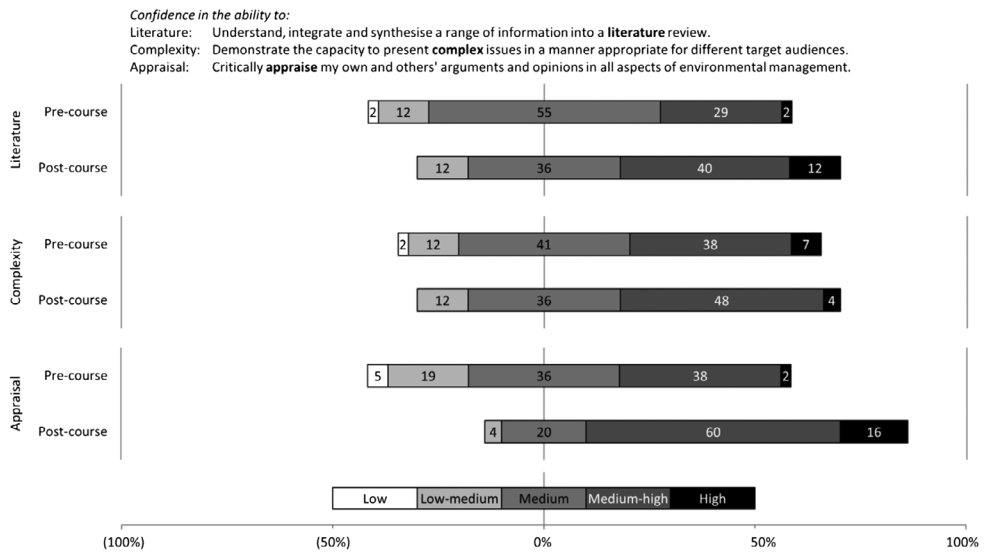Notes: Pre-course $n = 42$; post-course $n = 25$.

Figure 2. Students' self-reported confidence in their capacity to critically appraise literature, appreciate the complexity of environmental issues and to be able to critically appraise arguments and opinions.
Notes: Pre-course $n = 42$; post-course $n = 25$.

capacity to critically appraise literature, appreciate the complexity and interdisciplinarity of environmental issues and to be able to critically appraise arguments and opinions. This is summarized by the following quotation from in-tutorial written feedback:

> This course has been a great introduction to critical thinking and I will take what I have learned throughout my university degree The ENVM1002 team has always been supportive. (Tutorial feedback #1)
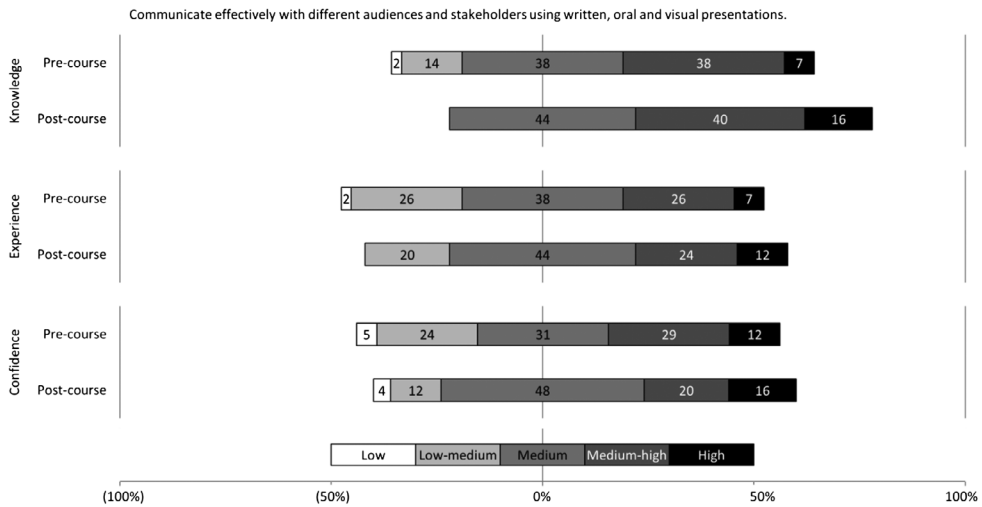
Figure 3. Students' self-reported knowledge, experience, and confidence in effective communication for environmental management across a range of audiences.
Notes: Pre-course *n* = 42; post-course *n* = 25.

Students were surveyed on their capacity to be able to communicate effectively in written, oral or visual formats to differing audiences and stakeholders. The results indicated some increase in knowledge, though minimal change to experience and confidence (Figure 3). Because they are first year students, it may be that with more practice and application of the knowledge they acquired, their confidence would improve.

Assessment design and topics

Efforts to make the topics meaningful and interesting to students appeared to be successful with the following comment reflecting the tone of informal feedback to course staff throughout the course. Informal feedback included comments in lectures, tutorials, one on one conversations with students, and via email contact.

> The topics to evaluate for the [literature review] were enjoyable to read about and I haven't found that with many other subjects. (Post-course survey #7)

Informal feedback also indicated that the scaffolded design of assessment 1 was appreciated in that the students felt they were supported in developing their skills. This indicated that potential student alienation was, at least to some degree, averted through the scaffolded assessment design.

> I really like the way the course doesn't put all the focus on an exam at the end of semester. I like the way they there is assessment items all through the course and I like the way that they are all connected and relevant. (Post-course survey #2)

> Discussions of topics for essays in class, and gradual development of the structuring of our ideas really eased the workload over the semester. (Tutorial feedback #7)

The overall academic performance of the cohort was high. Reflection of course staff on assessment 1 suggested that the two early submissions could be combined, student feedback also reflect this perception.

Felt like I didn't learn much. Assessment 1b seemed repetitive and didn't really contribute to a greater understanding of what to do in the literature review (assessment 1c). (Post-course survey #11)

Tutorials

The tutorials were viewed positively by course staff, and considered productive by students. Participation in interactive group sessions was valued by students, and as such is considered to have both facilitated skills-based learning and avoided potential student alienation by breaking down barriers between cohort and tutors.

The tutorials were well organized, always involved group participation, and hands-on work. Overall was a great subject and semester. (Tutorial feedback #5)

Very interactive teaching methods used to get us involved. (Tutorial feedback #6)

[The tutor] was open to all students' opinions and allowed class discussions and group work. Always followed up on checking group progress and proved very helpful in forming new ideas. (Tutorial feedback #8)

Despite tutorial attendance being voluntary, participation rates were high. However, there was a general decline over the semester as is the experience for non-compulsory attendance in other courses. The experiences of the tutors delivering the sessions also offered insights, which complemented feedback from the students. The longer two-hour and small group sizes (maximum 20 students) contributed to the ability to deliver immersive and engaging activities and facilitated interactions between students. Combining tutorial group activities with individual assessment provided a good balance between collaborative learning and individual responsibility for academic performance. The tutorial structure provided by course coordinators at the outset of the semester presented a plan for the duration of the semester, which offered tutorial staff an encompassing understanding of course expectations. The immersive and constructive environment of the tutorials contributed to developing a space for students to explore ideas without the fear of being found to be "wrong".

[The tutor] gave a lot of information and very helpful feedback on ideas for our assignments. [The tutor] never told us we were wrong, instead [the tutor] gave us constructive criticism. (Tutorial feedback #9)

Included us in all discussions and encouraged us to give our input. [The tutor] knew what [the tutor] was speaking about. Took on our recommendations about what we want covered in tutorials. (Tutorial feedback #3)

Reflections and discussion

While the course was developed rapidly, attention to planning afforded course staff the capacity to offer students a cohesive and collaborative course structure. Utilizing the skills and expertise of all staff in weekly planning sessions also provided invaluable feedback throughout delivery. The design and implementation of this course, with its threshold concepts developed and explored in the tutorials and scaffolding of assessment tasks, appeared to provide a learning environment that allowed students to explore through collaboration and reflect on learning through timely feedback. We understand from the literature that

attention to these issues can minimize alienation, although demonstrating success of this has proven difficult. Evaluation responses also suggest that students recognized the importance of critical thinking skills and there was both formal and informal evidence from student feedback to suggest that the skills learnt and experiences shared within the course were beneficial.

In particular, it is considered that one of the greatest successes of the course was the learning opportunities facilitated by the tutorials. These sessions appeared to enhance critical thinking skills which is considered important in the context of environmental management where issues can be controversial and wicked (Rittel & Webber, 1973). Collaborative learning has been lauded as an important strategy that facilitates students developing their critical thinking skills (Kim, 2013). The quality of students' thinking and writing improve as they engage in group discussion and reflect on assessment tasks, suggesting a focus on writing and rewriting as well as class discussion. These collaborations also have implications for the reduction of alienation that students may feel within the first year of university studies.

Course staff felt there was evidence of critical thinking skills being applied in the online discussion forum as both factual and thought-provoking questions were posed. This is consistent with previous studies (e.g. Angeli, Valanides, & Bonk, 2003; Yang, Li, Tan, & Teo, 2007), and it indicates that teaching methods that incorporate online discussion and face-to-face interaction can be effective and conducive to the development of critical thinking skills. Course staff hoped that students would use the online discussion space provided to explore new and challenging ideas. Though many students appeared to embrace the online discussion, this was not the case for all students. The downside of online discussion may relate to the platform, which is neither user friendly nor facilitative of interactivity. The assessment activity also appeared to suffer from elements of strategic learning behaviour where, for some students, participation appeared to be driven by grades and not by the benefits of collaboration and reflection (participation by some was last minute and not affording the benefit of full engagement and reflection).

Designing and communicating these learning opportunities and providing individual, group and reflective learning processes/opportunities within the practice-based learning sessions was a revelation that was not only beneficial for this course but has also changed the approach of course staff to other teaching obligations. An additional benefit of the course evaluation was the input from the University's TEDI unit. Independent reporting from this unit appears to reflect several of the outcomes discussed above.

> … while the implementation (and evaluation) of ENVM1002 has not been without difficulties (falling attendance rates, poor response to focus group invitation) it appears that students responding to the surveys are achieving the prescribed outcomes as indicated in the course profile. Early indications suggest that with some reflective thinking around curriculum and learning activities that this course has the potential to provide a solid introduction to the development of critical analysis skills and interdisciplinary thinking in the Bachelor of Environmental Management.

Were there things we could have done better? Of course, staff are still reviewing the delivery of meaningful lecture material in a manner that stimulates student interest. There is a challenge in that students indicate "we know this stuff" even though experience has suggested otherwise. Strategic learning remains an issue and the experience chronicled here demonstrates that these issues may reflect broader challenges in tertiary education in relation to student engagement and attendance (Rodgers, 2001).

Conclusion

Developing a first year critical analysis skills course for environmental management was a challenge for a number of reasons. Foremost being that while university teaching staff expect students to demonstrate critical analysis skills, few of us have the direct pedagogical expertise in teaching these skills. Grounded in pedagogy to minimize alienation and provide opportunities for deep learning, the course focused on scaffolded assessment and tutorial sessions that provided a collaborative learning environment. Tutorial activities were informed by the Vygotskian approach (Vygotsky, 1986; Wass et al., 2011), which highlights the interdependence of three critical components: knowledge, the individual (the student) and the facilitator (the teacher). It was considered that a facilitative, rather than instructive, relationship was central to improving the effectiveness of the learning experience as a whole (Kansanen & Meri, 1999).

Reflection on the course suggests the notable achievements of the first iteration included clear and defined aims and objectives at course, lecture, and tutorial levels, which provided all course staff with a united vision for the desired course outcomes. Scaffolded assessment linked through the course content and choice of assessment topics provided opportunities for students to take control of their learning. Providing feedback throughout the scaffolded assessment provided intellectual engagement and minimized the potential for alienation. Structured activities, quality tutors and collaborative learning were the outstanding success of the tutorial sessions and have resulted in staff reflecting upon traditional methods of teaching generally. While the course staff have reflected upon the perceived lack of interest to the lecture series, the tutorial sessions may in some way have impacted on student perceptions. In comparison to the collaborative learning environment of the tutorial sessions, it is unsurprising that there was a perception that lectures were less engaging.

Criticism of lectures has weighed heavily on staff and future iterations of the course will aim to provide more opportunities for collaboration in the learning process, however this may be problematic given class sizes and room configurations designed for traditional lecture delivery. While flipped classes are being trialled within the university, capacity and facilities to support these new learning environments are limited. Reflection and evaluation has led course staff to question the need for a lecture series, which poses a fundamental shift from the traditional tertiary teaching, a change which may be very difficult to sell within a traditional faculty environment.

The evaluation of the first iteration of the course has led to considerable reflection on learning and teaching within the environmental management degree. The course was initially developed to address poor application of critical thinking skills within the program and while students perceived that they had learnt critical thinking skills throughout their learning life there was an indication of increased confidence on the completion of the course. The question that remains untested is: have the skills and confidence gained within the course been reflected throughout the remainder of their degree? Anecdotal evidence from subsequent 2nd and 3rd year assessment feedback – in 2013 and 2014 – suggests this may not be the case, leading course staff to consider that the strategic learner is again at large and that on completion of the course that knowledge and skills learnt have been compartmentalized and stored as what was needed to pass that course. Perhaps what is needed is a link to these learning experiences in later years of the degree within selected courses. This is potentially a new rabbit hole to be explored.

Notes

1. A wicked problem is a socially complex problem which is difficult to define as it is characterized in a range of different ways by different interested parties. Any attempts to solve a wicked problem may result in unforeseen consequences. Effectively addressing a wicked problem may require change at the institutional level (Rittel & Webber, 1973).
2. See "Alice's adventure in Wonderland" by Lewis Carroll.

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