Showing interdisciplinarity in a first-year textbook using case studies of ‘real world’ research

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Abstract
In this paper I contribute to the collective goals of the symposium by considering the learning opportunities presented in one of the case studies from the textbook being developed for the subject Reshaping Environments. The case studies are practical examples of ‘real world’ interdisciplinary research that are presented in a way that makes the research process accessible to first-year students. The project presented in the case study described in this paper is based on my PhD research in the Human Geography program at the University of Alberta, in Canada. It examined challenges for pursuing social and environmental sustainability in a rural region of Costa Rica that is rapidly transforming under forces of globalization. The case study challenges students to look beyond the environmental sustainability implications of forest recovery that has occurred in the region to consider issues of social sustainability also.

Interdisciplinary teaching and learning is not restricted to factual knowledge but includes a strong concurrent focus on developing student’s skills to engage in the process of ‘doing’ interdisciplinarity, as both scientists and practitioners. I therefore propose that showing rather than telling the value of interdisciplinarity with case studies can stimulate a deeper understanding of the concept amongst students as well as giving it more legitimacy. This is because first-hand case studies of ‘real world’ research expose the practice of interdisciplinarity to students. However, the power of case studies to stimulate deeper interdisciplinary learning is greatly increased when the case studies are used in conjunction with complementary teaching tools such as reflective journals, group discussion and group projects. These tools enable students to reflect on and engage directly with the concepts, processes, tools and ways of thinking that are exposed in the case studies. In this way, students have an opportunity to engage in experiential, and hopefully transformational, interdisciplinary learning.

Introduction
This paper contributes to the collective goals of this symposium by considering the learning opportunities presented by case studies of ‘real world’ interdisciplinary research in the Reshaping Environments textbook. Reshaping Environments is an interdisciplinary first-year subject at the University of Melbourne. It explores the sustainability of human-environment interactions using the perspective of complex adaptive systems. The textbook, which is currently under development, is the culmination of several iterations of an action research process that brought together learning and teaching theory, reflection on teaching experience, student input, and industry perspectives. Its role within the course is to expose the analysis tools and processes of the interdisciplinary research practice that is increasingly needed to confront complex human-environment issues. Practical case studies of ‘real world’ interdisciplinary research will form a large component of the textbook.

The case studies are still works-in-progress. Each was written by a researcher with first-hand experience of the specific research project, and each has been ‘workshopped’ with a group of contributors to the textbook with multiple disciplinary backgrounds. The case study presented in this paper will also be trialled as a learning tool in a pilot tutorial to be conducted with a group of former Reshaping Environments students. This will enable us to incorporate further student input
and our first-hand experience of the way students engage with the case studies before the final textbook is compiled.

In this paper, I propose that *showing* rather than *telling* the value and practice of interdisciplinarity through these case studies can stimulate a deeper understanding of the concept amongst students, as well as giving it more legitimacy than if a more traditional textbook format were used. I use the case study that I prepared for the textbook as a vehicle to reveal and reflect on the ways that case studies of ‘real world’ research could stimulate this deeper learning amongst students. The project presented in the case study is based on my PhD research in the Human Geography program at the University of Alberta, in Canada. The project examined challenges for pursuing social and environmental sustainability in a rural region of Costa Rica that is rapidly transforming under forces of globalization.

**Showing Interdisciplinarity**

An emerging body of literature examines teaching and learning in interdisciplinary courses in higher education (Brew, 2010; Buchbinder, et al., 2005; Fortuin & Bush, 2010; Martin & Jucker, 2005; Steiner & Posch, 2006; Yang, 2009). Collectively, this literature shows that the focus of interdisciplinary teaching and learning is not restricted to factual knowledge but includes a strong concurrent focus on developing student’s skills to engage in the process of ‘doing’ interdisciplinarity, as both scientists and practitioners. In order to confront the complexity and uncertainty of human-environment issues, students need to develop a range of personal and interpersonal skills that include critical thinking, meta-cognition, methodological competencies, self-regulated learning, teamwork and communication. Steiner and Posch (2006) call the development of these skills “learning how to learn” (p.880), and it is this aspect of interdisciplinary learning that most challenges traditional teaching formats.

Inquiry- and problem-based learning models are particularly valuable for developing such skills in interdisciplinary courses (Brew, 2010; Buchbinder, et al., 2005; Kreber, 2001). Inquiry-based learning stems from the integration of research and teaching (e.g. the teaching-research nexus) and engages students directly with the research process (Brew, 2010). Problem-based learning is initiated by posing a problem that students then seek to solve (Buchbinder, et al., 2005). Both are examples of what David Kolb and others call experiential learning, in which learning is presumed to be most effective when students transform it into knowledge through activity or reflection (Kreber, 2001). Inquiry- and problem-based learning models provide students with an opportunity to confront the messiness of ‘real world’ human-environment systems, and encourage them to take responsibility for their own learning along the way. In doing this, they foster many of the personal and interpersonal skills that are necessary to work in interdisciplinary fields of expertise.

The use of first-hand case studies of interdisciplinary research in the textbook is aimed at supporting inquiry- and problem-based learning targeted to interdisciplinary scenarios. The use of case studies as a learning tool has a long tradition in higher education (Buchbinder, et al., 2005); however, the use of case studies of first-hand research practice is much less common. In the context of teaching, Kreber (2001) defines a case study as “the detailed description of a particular real life situation or problem as it happened in the past or as it could happen in the professional life of the student” (p.222). Case studies promote experiential learning by bringing students into a real-world context and exposing its complexity (Steiner & Posch, 2006; Yang, 2009). The case studies used in the textbook combine inquiry- and problem-based learning to the extent possible within the restrictions of written text. They expose the interdisciplinary research process while also challenging students to reflect on it. In this way they serve as a conduit for bringing together many of the personal and interpersonal skills students will need to develop in order to engage constructively in interdisciplinary research and decision-making (Steiner & Posch, 2006).
Steiner and Posch (2006) offer some insights into ways to optimize the interdisciplinary learning possible with case studies:

*A case study should not be understood in a simplified way just as the application of a theoretical concept to a real-world context. Instead, for the application of the case study approach, it is necessary to specify the problem-solving process with regard to the complexity of the problem and the potential underlying theoretical concepts. The process of problem solving should further be made as visible as possible and the set of applicable tools for knowledge integration should be made clear. The higher the degree of complexity and contextualization, the more valuable the case study approach can be regarded (p.881, emphasis added).*

In the following sections of this paper, I therefore briefly describe the research that is presented in the case study. I then reflect on the learning process that I hope this case study will stimulate amongst students. These reflections represent the way I imagine students that I tutored in *Reshaping Environments* last year would engage with the case study. First, I explain how I sought to make clear the problem-solving process, underlying theoretical concepts, and the tools for knowledge integration. I follow this by considering how the case studies in the textbook can be used as a tool within the course to facilitate the transformation of learning into knowledge via reflection and activity. In the conclusion to the paper, I consider three key ways that this case study can contribute to the overall learning goals of the textbook.

**The Research**

The research project presented in the case study sought to answer the question: *How did cattle farmers’ livelihoods change under globalization during and after a period of forest recovery in North West Guanacaste?* A deeper question underlying this research is: *how can this region be environmentally and socially sustainable at the same time?*

This project formed a small component of the research program of Tropi-Dry, which is an interdisciplinary network of social and natural scientists from Mexico, Costa Rica, Venezuela, Brazil and Canada. The aim of Tropi-Dry is to investigate human and ecological processes impacting tropical dry forests in order to understand how these forests can be managed more sustainably. Guanacaste is a province of Costa Rica in which land use has traditionally been dominated by cattle-grazing. In this province, significant areas of tropical dry forest have regenerated following the decline of an export-oriented cattle industry, the rise of international tourism and the implementation of government-led forest conservation policies (Arroyo-Mora, et al., 2005; Calvo-Alvarado, McLennan, Sánchez-Azofeifa, & Garvin, 2009). Examining the social processes underlying the livelihood and land use changes associated with this forest recovery became my PhD project and my contribution to the collective goals of Tropi-Dry.

The project used a comparative, qualitative research approach. I conducted semi-structured interviews in 2007 with landholders and community leaders in five communities, as well as with regional representatives of government agencies, industry groups and businesses. I analyzed the interviews drawing on the conceptual tool of the Sustainable Livelihoods Analysis (SLA) framework (Scoones, 2009). This framework was developed by researchers in rural development to conceptually organize the factors that impact people’s livelihood strategies in an integrated way. It focuses attention on the factors influencing people’s access to different types of livelihood resources (natural, economic, human, social and produced).

This project found that while forests had naturally recovered on abandoned cattle pastures in all five communities included in the study, the social sustainability implications of this process varied considerably. The forest recovery emerged out of changes in landholders’ livelihood strategies as they sought to adapt to changing conditions under globalization. Most landholders had ceased or
curtailed cattle-grazing due to falling cattle prices and contracting international and regional markets. While all landholders struggled to pursue new livelihoods, some struggled more than others. Those landholders who were most able to adapt did so by pursuing a diverse range of new livelihood strategies made possible by globalization. For example, some sold land to foreign investors and retired or pursued off-farm economic opportunities in tourism-related industries. In contrast, other landholders were less able to adapt to changing conditions. They could not access the resources required to pursue the new livelihood strategies emerging under globalization.

This research revealed how locally specific conditions shaped the way globalization altered landholder’s access to livelihood resources in different ways in each community. It also highlighted the influence of national and regional policies, institutions and processes on people’s access to livelihood resources, as well as on the relative value ascribed to different types of resources.

The Teaching

Confronting complexity

The case study of livelihood change in North West Guanacaste challenges students to look beyond the environmental sustainability implications of forest recovery to consider issues of social sustainability also. As outlined above, a strength of the case study teaching method is its promotion of experiential learning. It brings students into a real world context and exposes the associated complexity (Steiner and Posch 2006; Yang, 2009). The case study from North West Guanacaste shows students how the changes occurring in this region involve interactions within a complex adaptive system, including interactions across scales ranging from individual decision-making to large-scale forces of globalization. It highlights how trade-offs can occur between social and environmental sustainability. It also shows students that although forests have recovered across the region, this is linked to very different livelihood dynamics in different local places within the region. Importantly, some of these dynamics read more positively for sustainability than others.

It is important, however, not to leave students with a fatalistic sense that it is just all too hard and complex, and that nothing can be done. This is a challenge that I faced in tutorials: striking a balance between exposing the complexity of sustainability challenges while not leaving students adrift in that complexity without an accompanying sense of hope for a way forward. Problem-based learning (Buchbinder, et al., 2005) will not be effective if students are presented with a problem which they cannot solve themselves or at least envision a potential path for solving it. Therefore, the case study also introduces students to the idea of pursuing sustainability through ‘seeking synergies and reducing trade-offs’ between the multiple goals of sustainability (Chazdon, et al., 2009; Harvey, et al., 2008). This opens the way for students to think about ways to move towards more sustainable relations between people and forests in this rural region.

The case study also demonstrates the dangers of considering one process in a human-environment system when devising sustainability solutions (e.g. forest recovery) without also considering ways that it may be linked to other important processes affecting other parts of the system (e.g. globalization, rural livelihoods). In this way it stimulates students to engage in two key skills of an interdisciplinary thinker, meta-cognition and self-regulated learning (Steiner and Posch 2006). Regarding meta-cognition, it encourages student awareness of, and reflection on, ways to think about complex human-environment systems. Regarding self-regulated learning, it demonstrates that the choices we make about how to approach complex problems have consequences for the scope, effectiveness, justness, and longevity of our proposed solutions.
Making clear processes, concepts and tools

I presented the research project in the textbook case study in plain language and written in the first person to encourage students to engage with the problem-solving process as well as the content of the research. This also makes transparent the presence of a researcher who has to make sense of complex problems and who makes decisions about how to proceed. As Steiner and Posch (2006) highlight, making problem-solving processes as visible as possible optimizes the degree of experiential learning possible with case studies. Again, this also supports self-regulated learning. It makes explicit to students the degree of choice they have in the problem-solving process and the importance of considering the possible consequences of their choices for different parts of a complex human-environment system.

The basic structure and headings in the case studies were decided by the team of contributors and is maintained in each case to facilitate comparison. The problem-solving process presented in the case study that I prepared unfolds slowly. In the ‘Background’ section, I explained how I came to do research in North West Guanacaste because of my involvement in Tropi-Dry. This positions the research project as a step within a larger, integrated research program that was preceded by and stimulated by research conducted in another discipline (physical geography). It highlights the way that different disciplinary perspectives can build on each other over time to construct a more holistic or complete picture of complex human-environment systems than would be possible using a single disciplinary approach. It is important to offer evidence to students that different disciplinary perspectives can be complementary and can contribute to building a larger, more complete understanding of multi-faceted issues. This is particularly useful for students that have adopted absolutist positions (of which there were many in my past tutorials) that favour one disciplinary perspective above all others. It also demonstrates to students why teamwork is an important skill for interdisciplinary research and practice (Fortuin and Bush 2010). Many students in my tutorials were unfamiliar with teamwork and found it difficult and frustrating to participate in group projects with classmates. I believe that showing them that the value of teamwork outweighs its difficulties can foster student commitment to confronting difficulties and developing their own teamwork skills.

After providing the background to the research issue through a historical analysis of the study area, I then frame the problem/issue in a section titled ‘Identifying the Issue’. In this section I specify key theoretical concepts and outline what we already know about the issues raised in the case study from previous research. I then link these concepts and existing knowledge to the specific case study, and explain how they directed me to pose particular research questions (see the examples below).

Sustainability entails a balance between human subsistence, livelihood and lifestyle needs and the maintenance of important environmental services that support human and non-human life (Clark, 2007; Kates, et al., 2001). It therefore has two interrelated parts: social sustainability (meeting human subsistence, livelihood and lifestyle needs) and environmental sustainability (maintaining environmental services).

The concept of globalization refers to the increasing interconnection and movement of capital, goods, people, information, ideas and culture around the world (Young, et al., 2006; Zimmerer, 2006). Globalization complicates the pursuit of sustainability by rearranging the way that human societies interact with their natural environments. For example, in Guanacaste, the rise and fall of the international beef market, the growth of international tourism, and the influence of international

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1 See the companion paper in this symposium by Clinton Golding.
environmentalism are all processes associated with globalization. Each of these processes fundamentally changed the way people used land in Guanacaste.

In addition to this, underlying theoretical concepts that are central to the course and which cut across the different case studies are further explained in the textbook in dedicated chapters, currently in development\(^2\). These chapters will draw directly on the case studies to provide explanatory examples of key concepts in the ‘real world’. This will create a strong link between the more abstract concepts underlying the course as a whole, and their grounding in the concrete examples of the case studies. This can facilitate students to develop skills in self-regulated learning. It gives students multiple pathways for seeking out connections in the course material and digging deeper into underlying concepts.

In the section titled ‘Tools Used’, I outlined the research process I used, including research design and data collection and analysis methods. The exposure of the research process will again be supplemented in the textbook by a dedicated chapter on research methodology that describes, in plain language, the strengths and weaknesses of different methodological approaches and explains when different methods might be most useful. I also explained how I used the conceptual tool of the SLA framework as a way to make sense of some of the complex factors that impacted livelihoods and hence social sustainability. I also described how my choice of research methods (e.g. qualitative methods) impacted how I spatially bounded the case I examined. Again, this makes clear the choices I made that shaped how I framed and approached the research:

In my case, the choice to use qualitative research meant that I could not conduct a study that covered the whole of Guanacaste where the forest transition had occurred. A single researcher simply can’t collect enough in-depth data to explore all the different aspects of a complex issue over such a large area and amongst such a large group of people within the time and resources available in an average-sized research project. I therefore chose to focus on a smaller area in North West Guanacaste. I did this because this area contains more of the remaining tropical dry forests that are of interest to Tropi-Dry. This area is Guanacaste’s dry North West.

I then go on to reflect on what this problem-solving process revealed about the sustainability challenges in North West Guanacaste (e.g. research findings). At the end of the case study in a section titled “Responses”, I also explain how this specific project is a part of a larger problem-solving process involving multiple researchers and projects in different disciplines that study a range of interrelated issues concerning forest recovery, rural livelihoods, globalization and sustainability in Latin America:

Just as I drew on the previous work of the physical geographers in Tropi-Dry to guide my study, other researchers who have begun new studies in Guanacaste are drawing on my work. For example, through written reports, emails and telephone calls, I have assisted a PhD student in Biology from a university in the United States with a current study in Guanacaste. This new study investigates how past land uses and local biophysical conditions on different farms in Guanacaste influence the structure and biodiversity of the secondary forests that recover on abandoned cattle pasture. In this way, my study continues to inform the research questions, design and methods of new research projects that will reveal even more about the sustainability impacts of the forest transition in this region.

For my part, I drew on previous multidisciplinary research to find gaps in what we know about forest transitions and to frame the way I thought about my research

\(^2\) See again the companion paper in this symposium, by Clinton Golding.
problem. In the same way, future researchers will also be able to draw on my study. Through this process of building a larger body of research, we can continuously become better and better equipped to make sense of this complex and dynamic issue. This larger body of knowledge will, in turn, influence how researchers, policy makers, managers and others think about and respond to the challenges of steering forest transitions towards sustainable pathways.

Transforming learning into knowledge through reflection

Although case studies are recognized as a powerful conduit for interdisciplinary learning (Steiner & Posch, 2006), the presence of a written case study alone does not mean that effective learning - in which learning is transformed into knowledge via activity or reflection (Kreber, 2001) – will occur. The case study may be the conduit but it is the way that students engage with it that will foster deeper interdisciplinary learning. With our written case studies, it is primarily via reflecting on the exposed processes of interdisciplinary research that students will have an opportunity to engage in experiential, and hopefully transformational, learning. We will know more about how students engage with the case studies once we have had the opportunity to test-run them in pilot tutorials. However, the Reshaping Environments team also has considerable experience with using case studies as learning tools in the course, and so I am able to reflect on ways that I imagine students will be able to use the case studies in the textbook to reflect on the interdisciplinary processes, concepts and tools that are exposed.

Within the textbook itself, a range of mechanisms will be in place to facilitate reflection and to promote critical thinking. Scattered throughout the case study description are questions posed to students that encourage them to reflect on and question both the sustainability issues raised and the research process itself. Two examples are included below.

1) The “Hamburger Connection” is one example of how environmental changes in one part of the world can be driven by developments in industries in other parts. In what ways does this example reflect (or not) characteristics of a ‘complex adaptive system’? (Sustainability issue)

2) To what extent does the research project in this case study reflect an interdisciplinary approach? Can interdisciplinary research be conducted by a single researcher or does it necessarily involve teams of researchers representing different disciplinary backgrounds? (Research process)

Questions like these can help to stimulate students to think more deeply on issues that are raised by the case study and to encourage them to make connections between it and the more abstract concepts underlying the course. I also imagine that for first-year students who are strengthening their critical thinking skills, the presence of these questions can help to legitimate and focus the process of questioning both sustainability issues and the research process. I found that some students in my tutorials were uncertain and wary about engaging in critical thinking, including both international and domestic students. As many of them are likely coming from a school environment in which they have not been encouraged to question ‘expert’ knowledge or practices, this shift to engaging comfortably in critical inquiry is an important one to foster.

A second mechanism in the textbook further facilitates this. At the end of the case study, disciplinary responses from the other contributors to the text are included. This exposes different ‘expert’ perspectives, including ways that those perspectives diverge and possibly conflict as well as ways that they converge and complement each other. It also highlights the contributions that different disciplinary ‘lenses’ can make to understanding complex human-environment issues. As an example, an excerpt of a disciplinary response to this case study from the point of view of a behavioural ecologist is provided below.
If I imagine myself setting out to address the research topic explored in this case study I would have posed different questions to the author and approached the data collection quite differently. My questions would have focused on how the practices of the people of this region are interacting and affecting ecosystems and in particular the behavioural responses of particular species of fauna. I might have asked: how has the change in land use practices affected the behaviour of fauna in the area? What implications has this had for the way the local people and fauna interact? Have species become locally extinct as a result of the large scale clearing for cattle? Will the regenerated forest have the same diversity of species compared to the forest that was there before clearing commenced? Will fauna be able to recolonise the forest re-growth areas or have they become isolated in remote patches?

A third mechanism is the inclusion of ‘Further Questions’ that stimulate students to reflect on related issues and problems arising from the case study. These questions can be used to stimulate problem-based learning centred on the case study.

Q) The Costa Rican government has recently introduced a new national food security policy that aims to increase the production of basic foods like beans, corn and rice by small-scale farmers. How might the government design this program to have the most positive impact on livelihoods, land use and forest cover in the future?

Beyond the text in the Reshaping Environments course, there are a number of avenues that can encourage deeper reflection on the case study. I briefly consider just two of the most important: individual reflective journals and group tutorials. Students write in reflective journals each week during the course and the journals are an integral part of their learning journey in Reshaping Environments. Experiences with these journals in the context of Reshaping Environments and beyond (see for example Pavlovich, 2007) show that they provide an important space in which students can develop reflective skills, as well as explore and record their own personal learning journey. For their part, tutorials are an important opportunity for ‘dialogical’ experiential learning (see for example Yang, 2009). I see the case studies as powerful tools to ground group discussions of the key concepts of the course, and particularly on the value and practice of interdisciplinary research.

Finally, the case studies can also be used as a platform through which students can emulate processes of interdisciplinarity. A group project is a core component of the assessment work of Reshaping Environments, and provides students with an opportunity to engage in the practice of interdisciplinarity. Through this project, they are able to develop interpersonal skills important for interdisciplinary work, such as teamwork and communication. By reflecting on one or more of the written case studies prior to engaging in this project, students may have a better idea of what an interdisciplinary problem-solving process might involve, and how they might use conceptual and methodological tools to aid them.

Conclusions

We will know more about the contribution of the case studies to students’ interdisciplinary learning after we have had the opportunity to reflect on them as learning tools ourselves together with students. However, I see this case study contributing to the goal of the textbook - to expose the analysis tools and processes of interdisciplinary research practice - in a number of ways. I consider three of these contributions to be particularly valuable especially as they would not have been possible had the textbook used a more traditional format.

First, this case study demonstrates practically how the combination of multiple disciplinary perspectives can progressively build a more holistic picture of complex human-environment
systems and their responses to large-scale, externally-driven change. The case study highlights how knowledge is fluid, is seldom complete, and can be built-up collaboratively over time within communities of researchers that have diverse disciplinary backgrounds.

Second, the case study makes explicit the conceptual and methodological tools that enabled the research. It shows how the use of such tools can help researchers, including students, to confront what may initially seem to be impossibly complex scenarios. Specifically, it introduces students to the conceptual tool of the SLA framework and the methodological tool of qualitative research.

Finally, and perhaps most importantly, the case study justifies an interdisciplinary approach by showing students how such an approach facilitates greater understanding of complex human-environment issues than would be possible using a single disciplinary approach.

Students cannot deeply learn the value and practice of interdisciplinarity by being told it: they need to ‘see’ it in practice and then to have an opportunity to reflect on it and actively engage in it. First-hand case studies of interdisciplinary research such as this one can make a large contribution towards exposing that practice to students.

References


