

What environmental sciences can tell us about teaching in higher education

***Transcript of recorded interview: Kerrie Tomkins talking with Agnes Bosanquet (October 2022)***

***Agnes Bosanquet:*** Hi, Kerrie! It's great to be talking with you today. I thought we'd start with a question for those who are completely outside your discipline. Can you tell me what environmental sciences is?

**Kerrie Tomkins:** Oh, hi, Agnes! And thanks for inviting me to do this post. So environmental sciences is, I guess, a collective term for a number of subject areas that fall in the environment space. So, for example, climate science, atmospheric science, earth science, there's also geomorphology, contaminants, GIS [Geographic Information Systems] and remote sensing. So that's just to name a few, a number of different sciences that all fall under that environment banner. I guess also these days we would also put in some of our subject areas that are not, I guess, the pure sciences, but like environmental management, environmental planning, we also would include them under our environmental sciences banner.

**Agnes Bosanquet:** So can you tell me a bit about what the purpose of studying environmental sciences is for students?

**Kerrie Tomkins:** Well, I mean everybody's been watching the TV lately, and you just can't help but see pictures about the environment, the challenges that we're facing in understanding the environment and managing the environment and also understanding our impacts on the environment. So students that are often interested in doing, say, an environmental sciences degree or an environmental management degree, they're passionate about the environment, but they're also passionate about doing something to address some of the challenges or the problems that we're facing, and that's challenges and problems that we're facing now and also into the future. Particularly young people, they're really passionate about things like climate change because they're worried about what is happening now with climate change, but also what is it going to be like for them in the future. And so that's why we get a lot of students. They are just generally interested in the environment, but also have a desire to do something about it to make a positive impact to contribute going forth.

**Agnes Bosanquet:** So one of the things that really defines the student experience in environmental sciences is fieldwork, and I'm wondering if you can tell me a bit about fieldwork, and why it's valuable for student learning.

**Kerrie Tomkins:** Yeah. Well, fieldwork is actually a really integral part of learning for students that are in an environment course. What we do is we try to take students out into the landscape into different sites that would represent something that … they might be expected to do in a future job or a future career. We might take them out to say western New South Wales, or we might take them interstate, or even [overseas]. We have a field trip that goes to New Zealand.

Of course the idea is that by taking them out into the field they can actually see things for themselves. If we're trying to teach students in a classroom, you know, it tends to be just showing them photos and telling them about it. It's not the same as them actually seeing and hearing, or smelling, or doing, or feeling for themselves. So our fieldwork is really valuable because we can actually let students actually discover that learning for themselves. It’s a far more authentic style of learning and students love fieldwork. It's the one thing that they remember of their course. They don't remember lectures. They don't remember pracs. They don't really remember [assignments]. Well, maybe they remember some of the assignments, especially once that they like, but they all enjoy the fieldwork. One of the other real advantages of field work that we find is that students are one hundred percent engaged one hundred percent of the time when they're there.

When you're in a classroom, you're sort of in some ways competing against these other things that students are doing. They've got their phones, you know, and … they've got computers and emails are popping at them. Or they might also be sitting there thinking about an assignment that they've got due the next day, or something like that. When they're in the field you tend to get rid of all those other distractions. So they are there. They can see, they could do. They've often got work to do … They're away from phones and other electronic things. And, in fact, sometimes we're in a remote locations where there is no signal. So there's not even that possibility of having the distraction. But, mind you, I think when you take them into the field, they also want to be engaged. They're really enthusiastic, they're interested to know, to learn more about what they're seeing and what they're doing. So they are the key things. One hundred percent engaged one hundred percent of time, allowing students to discover and learn from themselves in a really active, authentic way rather than in a classroom.

And I think the other good thing about field work, and what's really valuable, is because it's a real social aspect for students. Students not only remember fieldwork because it was so memorable in terms of the landscape, especially if it was something very different to where they've ever been before. A lot of students have never been west of the Blue Mountains, and you take them to western New South Wales and all of a sudden, you know, they're in this sort of very flat, barren landscape. It's a real eye-opener. But also you’ve got students together. So they actually make lifelong friends from field trips, and indeed [that’s true] for me personally from when I was a student. My lifelong friends are the people I met when I was doing fieldwork when I was an undergraduate student.

**Agnes Bosanquet:** Fieldwork, I think, for many people will be a foreign idea. They certainly are from my sort of disciplinary background, where I spend a lot more time with text and writing and doing essays. Can you sort of paint a picture for me about what happens with field work? You've mentioned some of the places you might go, but how do they work? What are your students doing? What are the teachers doing?

**Kerrie Tomkins:** Sure, I'll take you through. Okay. So the journey starts when we leave campus. Okay. So here's where the adventure starts. Everyone's going to pile their bags onto a trailer usually, and get in a bus or get in the vehicle, and off you go. So it's already there's always a buzz of excitement. Everyone's looking forward to going, you know, going away, and it might be them particularly for multi day field trips. This would be the case. We do also have a day or part day field trip, so they're a little bit different, but it's still a similar thing. Everyone's excited to be going somewhere.

Okay. So we get to our field sites. And of course, the first thing is that you know, students are like, ‘Oh, my goodness, where are we?’ You know they're in a different place where they've never been to before, and sort of getting a bit of the lay of the land. So what we would typically do on our multi day field trips is, we'd have a couple of hours or half a day uh reconnaissance, where we would go around to different sites where we're going to be working for the time, introduce students to the types of things that they got to be looking at, or the types of work that they're going to be doing on the field trip.

In our third year units, we would be giving students a little bit more autonomy and responsibility to define the work that they're going to do so. They might, for example, have to come up with a project that they want to investigate, so they might, you know, have the rest of the day in an evening to think about it, and then they've got to come back with a project proposal to say, okay, we want to investigate this, and you know this is this is a method. This is what we're going to do.

Maybe for students that are in first or second year, we would provide them with that guidance and tell them, okay, this is the sites that you'll be working at, and this is the type of work that you'll be doing. Sometimes we leave students in the field by themselves, and you know for some of them that can be a little bit daunting in in terms … We’re in the general vicinity, but we're not there supervising them, you know, hour by hour. It's great because the students can work at their own pace, they can relax, and they can chat to each other, and they can really take responsibility for what they're doing, and of course come back to us and say, this is what we did. This is what we found. Or can you come and help me interpret, you know, my data that I've collected from this particular aspect.

So, what staff would tend to do is rotate around different groups and be providing I guess a bit of strategic questioning for students. You might point out and go: What do you think this layer is? So what do you think this means? Rather than actually telling them specifically, this is the answer. It's asking those questions to generate those thought processes in their mind and help them understand. For a lot of our field trips, it's about interpreting the landscape, and so what we want to do is try to help them connect the dots, and by pointing out those dots in the landscape and getting them to start thinking about it How can you connect the dots and make sense of what you're seeing?

We often do a lot of work in the evening during field troops, so they are long days. They’re hard work, but they are extremely rewarding and very and the most valuable for learning. So at night time students might be doing data entry [with] the data that they've collected during the day. They might be typing it into, say, an excel spreadsheet, or something like that. They might be doing some interpretation of that data before they go and collect more data, because that might guide you know what they do the following days.

And also it's a good practice to get into the habit of always thinking about what you're doing as an ongoing thing rather than just leaving it to the end and realising, oh, we forgot to collect this bit of information that we really needed.

At the end of the field trip, sometimes we get students to actually have already interpreted their data, and they might present a story about what they found, or they might come back back home, and they might have a bit of time, a week or two weeks or something to actually work up their data and present it in a report style assessment.

It really depends on the level – 1000, 2000, 3000 and postgrad level – and also what the goal of the field trips are …

I’ll just mention quickly about the half day and the day field trips.

These are the field trips we might run a little bit closer to home, so maybe around the Sydney region, still to new sites, still getting students to make observations, to collect data to interpret the data. It's just not for as long a period of time. We might also want to take them to sites where we want to demonstrate specific things. If you're looking at like environmental contaminants or say environmental planning, you might be going to a certain part of the city where it really demonstrates the planning challenges that have been faced in urban areas.

I guess the longest field trip we've probably got is eleven days, and that's our New Zealand field trip, so a long period of time. Most of our field trips are probably maybe one day to say two, three days. There's a few that are four, five, six days. That's in third year. First year, maybe more like the you know, field trip in a prac or a field trip for half a day, field trip for a day. So it varies, but they're the most memorable experiences, and also very, very valuable for learning.

**Agnes Bosanquet:** Sounds wonderful. One of the things that struck me when you were speaking is this whole body approach to learning, and the kind of the sensory aspect of it, and the social aspect of it. One of the things that you talked about was observation and I’m interested in the sort of skills of field work, because when we had a little talk about it you it's almost like you're describing it as not quite like university. There's something different going on there. Can you tell me a little bit more about observation and the skills of field work?

**Kerrie Tomkinis:** Yeah, absolutely. I mean so, because I guess when we're in a classroom, or even in a prac class, you're often providing students with a lot of the information already whereas observation is about students getting that information for themselves. So maybe I’ll give you a more specific example. Say if we wanted to understand the evolution of a river system, and we're looking at a bank, a river bank. Well, the first thing that the students need to do is they actually need to clean off some of those sediments so they've got a really clear view of what the different layers look like in the sediments. The next thing they need to do is understand how they would actually analyse those sediments. So this is where they start to put their skills into practice … you know, you would run a tape measure down your profile, and you'd be recording the um the depth of those different layers, you'd be recording the thickness of layers. This is your observations, you're looking for changes. You're looking for similarities. You're looking for patterns you're looking for, you know, colour. You're looking for whether it's gravelly or sandy or muddy sort of sediments, So that's where your observations come in as a key skill.

Then you might apply some more specific skills where you might want to do some different tests to verify things that you can't just see with your naked eye. So you might take some samples of these different layers, and you might say test things like the PH of the of the different sentiments, or you might look at the texture of the sediments, and whether they're sandy or muddy or clay, and you might also look at other more specific properties of those layers. So you've got to know those tests. You’ve got to apply those skills, but it's also really based on your observations of what you can see, and one of the things we do when we're with students in the field is with that strategic questioning is ask them: What do you see? Do you see three layers or four layers or five layers? And get them to think about how you interpret these different profiles. Whereas when you're in a classroom, you sort of can't do that same thing. And also you can't get students to touch things and really, you know, to see if they feel different. Or get up really close. It's a really different environment. And also one where you get students to actually do things for themselves rather than just telling them which is not the same.

**Agnes Bosanquet:** I think that's specific example really helps with thinking through what you do. I wonder if I can get you to abstract that a bit and think about how teachers outside of environmental sciences can apply these ideas. I mean I'm now converted. I'm all in you know. I'm like, yes, sign me up, I want to go on a fieldtrip. But how can people apply that outside of your discipline?

**Kerrie Tomkins:** Okay, yes, that's a great question. So for us, fieldwork is a key part of our courses because it's about learning. You learn best about the environment by being in the environment. If other teachers took a similar approach and thought about their disciplines and thought, well, if you're going to get a student to learn best about their subject matter, how can they learn? You know, in that environment. So i'm just going to draw some examples that I can think of off the top of my head, you know. If you're an archaeologist you'd be best, you know. Students would learn best at an archaeological site. If you're studying museum studies, you learn best in a museum. Maybe ancient history is about going to some significant ancient history site. Education, of course, is in an education environment.

I guess the other way of thinking about this is what sort of future jobs and sort of future careers are your students going to have? What sort of work you expect them expecting them to do in the future? Because I think that should guide the things that we organise and we come up with for their learning. So we try to think about, for our students, if you like to go into becoming a contaminated site officer, or something like that, then they will be working on contaminated sites. So let's take them to a contaminated site and give them that real-world experience.

Whilst fieldwork is only one aspect, I guess the key message is - and this is one thing we try to adopt in the environmental sciences, because we do represent so many different fields, and not all of them are necessarily about fieldwork where you're looking at soil - it's more about having an out of classroom experience and tailoring that out of classroom experience to something that's going to be really relevant to future careers, future jobs that they're likely to have.

I’ll give another example for our climate students. Many of them are interested in getting work in the Bureau of Meteorology, you know. A fantastic example is, wow! Imagine going to the bureau and having a look at you know the weather forecasting on their screens. You know how weather forecasting works in action. For our GIS and remote sensing students, because … GIS remote sensing is about spatial data, they actually go out in the field and verify that spatial data. So they actually go and look to cross-checked whether what they were seeing from spatial imagery actually matches what you see on the ground, so that can be in urban areas. It can be anywhere.

So I guess that's what it's all about is an out of classroom experience that gets students immersed in something that's going to be really relevant to their course now, but also into the future. And gives them a bit of a taste, and they're the things that students remember. That's why our students remember field trips. They don't remember lectures.

**Agnes Bosanquet:** Can I ask a question: if someone's thinking this sounds like a really attractive idea but they would have to start very small, I wonder if there are any lessons from how you managed the COVID experience without being able to do the amazing field trips. What did that look like?

**Kerrie Tomkins:** Okay, so COVID was a challenge. Okay, I'm going to give you two

two approaches … So one approach was because we couldn't run our field trips, we couldn't take students out, we did do a lot of video recording of us in the field. Now in this case, our goal was to demonstrate particular field-based methods. So we were out there in the field and recording ourselves demonstrating how you might use an instrument, what you would use it for, and showing students how we were collecting that data using that instrument. Now, that was kind of the best thing that we could do at the time and also try to still help [and] hopefully show students what you do. But it's not a good substitute for giving students that experience themselves of using that instrument, turning it on, playing with the buttons, actually working out what to do. And why is it not working? Or what's this data mean? It's not the same as them doing it themselves. So we did know, we were very cognisant of the fact that it was the best we could do, but it was not something we would choose to do. We would always choose to get students to do it themselves.

Okay. So another approach which works for some teachers was to make the most of where students live. In other words, a lot of people adapted the activities that they wanted them to do, or assessments, to something that a student could do within their own home range. It might be in their own home backyard, or it might be in their own suburb or streets or something. So they could still go out and get that first-hand experience. It's just that we weren't sitting on a minibus, we’re in close contact, which we definitely couldn't do due to covid, or staying overnight. I guess what we did was we made more of local sites and, you know, things that are in students own backyards. And I know the biologists also did this a lot – where you could get students to look at the plants that are growing in their backyard. They could analyse leaf structure based on a leaf that they've got from their own backyard or they could analyse something that's in the ecology of a patch of bushland that was close by because you were allowed to go out for exercise. So you know, as long as it was something they could do within an hour of their house, then that what we were aiming for.

So we did have to adapt. Everyone's definitely enjoyed being able to go back to normal and go to visit sites. But there were actually some strategies that still were quite effective, and that was making getting students to make the most of where they're living, their own local environment – with the same goal overall to get students to experience first-hand themselves, to discover things for themselves rather than us just showing them or telling them.

**Agnes Bosanquet:** And as the lockdowns eased, you used the University campus as well didn't you?

**Kerrie Tomkins:** We actually have always used the University campus in our teaching,, particularly in first year, and also for some of our second year units. Part of that is about group management because we tend to have large numbers of students, so it's more difficult to take large numbers of students away or multi day field trips. So making the most of the campus, and close by a campus, so Lane Cove National Park. We go down to Brown's Waterhole quite a bit for pracs But we also do use things on campus,

for example, ENVS1000 unit we have started to use the new creek that they just just rehabilitated, just daylighted the creek leading into the lake. We were even getting them to look at gravel size and learning different skills in analysing the gravels at that site. We've used the campus for things like teaching students how to survey. That's been very common because really all we want is just a hill slope. It doesn't have to be a hill slope in any particular location, so the campus has got very open grassy hillsides which is just perfect. You can also do that in a prac. You can just do that within a couple of hours, you can have taught students the methodology and they can actually put those skills into practice themselves. So that's really handy, and even just the Macquarie business park has been really quite useful for us. So in my own unit *Australian Environmental Futures* we take students on a walk down Shrimpton's Creek, which is just sort of near Macquarie Shopping Centre up to Epping Road looking at the intensity of development and the impact on creek health. Students have got to think about how the future development is going to impact on the creek health. Of course, that is in a prac. You know, it's five minutes’ walk from campus. Students can be doing all the things. They're making their own observations. They’re taking notes themselves in the field book, and they using that information to write up an assignment.

So there’s definitely I think a lot of things to use around campus. It's just, I guess, a matter of being a little bit more creative when you're designing a practical or another out of classroom experience. What sort of things can we make the most of that are nearby that really are valuable for students?

**Agnes Bosanquet:** Thank you very much. So is there anything that you would like to add to our conversation to finish up?

**Kerrie Tomkins:** I guess my key message, I think, to everyone would be: Don't be constrained by the classroom and traditional methods of teaching and assessments. I think we're in a brave new world. Innovation, of course, is first and foremost on everybody's mind. How do we innovate? And I think this is part of innovation. This is thinking outside the square. So I would encourage everybody else to maybe think about including an out of classroom experience. There’s a challenge for everybody. How could you include an out of classroom experience in your teaching so that it's a memorable experience for your students. And of course it's a really authentic learning activity. So yeah, that would be my take home. Don't be constrained by the classroom. Get out there and have fun. It's also a heap of fun.

**Agnes Bosanquet**: Fantastic. Thank you very much.

**Kerrie Tomkins:** Okay, thanks, Agnes.