Chapter 15
Biology Student Teachers' Reflections in Eportfolios as a Trigger for Self-Study of a Teacher Educator

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The Context of This Study

Student teachers in the Graduate Diploma programme for high school teaching at my university complete 10 weeks in three curriculum courses and 14 weeks of professional practice experience in schools as part of their broader 10-month preparation to become high school teachers. During this time they are expected to demonstrate evidence of reflection and this is assessed as part of their coursework. Jay and Johnson (2002) have stated that reflection was "the current grand idée in education and plays a central role in the preparation of many new teachers" (p. 73). While learning from experience through reflection is far from automatic, I wanted to promote sagacity where student teachers actively used reflection to understand what worked well and why- to gain insights into professional practice.

I had developed and taught this course for 12 years, followed by a 3-year gap (during a period of high administration load) then resumed teaching this course in a modified form with additional components such as students' developing reflective practice through an eportfolio. Therefore while I positioned myself as a "Knower" through my own teacher educator and high school teaching experience, I realised I didn't really use students' reflections on their experiences as a source for "knowing about my students to inform my practice". As a teacher educator I wanted to become more aware of areas of comfort and discomfort as experienced by my students, so that I could adjust my teaching to accommodate their issues and concerns. Challenging the relations of power and privilege (knowledge) has not always been the focus of self-study. Kuzmic (2002) argues that self-study has been marred by a failure to challenge boundaries and that self-study must take account of the lived realities, experiences and perspectives of students in teacher education. Therefore

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positioning myself in relation to others allowed me to move beyond just focusing on "self" in that I used the insights of others as a source of self-learning. I questioned: How could I use students' reflections to gain insights into my own practice?

Therefore this chapter discusses how as a science/biology teacher educator in New Zealand, I used student teachers' reflections on pedagogy, practice (including the use of resources) and theories of learning and teaching in a pre-service biology curriculum (methods) course, as a trigger to inform my own development as a teacher educator. The main data sources were PSTs' reflections as posted in eportfolios, a student focus group session with a colleague and my own reflections.

Reflective Framing and Reframing

According to Schön (1983, 1987) framing is the process of identifying what a practitioner will attend to within a context. Then reframing of practice can occur in response to analyzing information including examples, understandings and actions in order to create a new way of 'seeing' the problem. Reframing turns the focus of the research back on the researcher to examine her or his framing of the question and seek alternative perspectives. Reframing lies in stark contrast to "action based on habit, tradition, or impulse" (Samaras & Freese, 2009, p. xiii) and therefore offers a way of approaching research that requires confronting our assumptions made in and about our teaching. In this way, reframing is not about coming up with a different solution but instead involves asking a different question.

Recently Conner and Sliwka (2014) have emphasised that teacher education courses are more likely to be effective if content is applied to appropriate learning contexts, when there are repeated opportunities for reflection, and when student teachers experience good modeling of practice by teacher educators and teachers in schools. Effective modeling by teacher educators (Goodlad, 1990) relates to Vygotsky's (1986) concept of relational imitation. As Goodlad wrote, "We recommend, then, that the responsible faculty plan not just a sequence of courses and field experiences, but deliberate demonstration of pedagogical procedures their students will be expected to use in the practice part of their preparation programs" (p. 291). I questioned whether I was effectively modeling the practices I wanted my students to demonstrate and whether I was making my deliberations (deliberate decisions about ways to teach) explicit enough so that students would see that I was "walking the talk".

While developing students' reflective practice is a learning outcome of the biology teacher education course, I was interested in how I could also use these reflections as a source to check my own assumptions about what they knew and were learning, and use this knowledge and potentially deeper understanding to inform my own reflections and future actions as a teacher educator of this course. This is not to say that I saw myself as the key determinant in what students learnt. Far from it as I subscribe to the idea that we are working with adult learners who have multiple capabilities and capacities to steer their own learning. However, my own experiences

as a high school teacher and 18 years as a teacher educator, along with the roles and responsibilities that are associated with working with the education sector, confer a responsibility on me to make explicit my knowledge, experiences and any wisdom that might help beginning teachers. I also believe that teacher educators need to model how we become more "knowing about our learners" as part of the professional disposition of embracing continuous professional learning and basing changes to practice on information, rather than just hunches.

As previously stated, pre-service teachers as adult learners, can direct experiences to support their own learning (Dewey, 1938). However, they need examples and tools to help them reflect on their experiences as learners; and they may need support to examine what is working for them and what else they need to know, as they set and review goals and assume responsibility for their own development as active learners. Being familiar with what and how to teach is a necessary condition for teachers to support effective learning. This not only applies to enabling learning of content knowledge but also to enabling learning about the processes of learning and teaching. PSTs experiences of learning in school and teacher preparation programs tend to set the pattern for how they behave in their own classrooms (Belland, 2009).

Therefore it is important in teacher education courses to highlight the significance of reflection as a tool for identifying what prospective teachers are good at and what they need to work on. Their own reflection forms a key part in their professional development (Beck, Livne, & Bear, 2005; Buzzetto-More, 2010). By valuing reflection as part of this course and what was assessed, as well as valuing students reflections to inquire into my own teaching, I was attempting to model good practice and doubly valuing reflection as a process that they could use with their students in schools to enhance the key competencies of managing self and metacognition that are part of *The New Zealand Curriculum* (Ministry of Education, 2007).

The inclusion of reflective statements in eportfolios as a requirement for an assessment in an initial teacher education course not only places emphasis on reflection but also on the importance of knowing about and using eportfolios as a learning tool. This knowledge can be transferred to how teachers incorporate the use of eportfolios with their students in the high school classes they teach in the future (Hauge, 2006) and can help with the development of ICT skills more generally. Therefore there were content and process advantages in using students' eportfolio reflections as a source for my own self-study.

Developing Digital Expertise

Given the burgeoning variety and sophistication of educational software and digital tools in schools, PSTs need to have multiple opportunities to become aware of and experience a wide range of digital tools as they develop their knowledge, learn to teach using a diverse range of teaching and learning strategies and develop their expertise (Ertmer & Ottenbreit-Leftwich, 2010). Using technologies effectively

requires developing a repertoire of complex digital literacies.[1] I wondered if I could combine this need and use it as a source for reflecting on how I utilized eportfolios for helping me and my students reflect on practice. I discuss this dual tension in the discussion section.

Eportfolios are now a well-established tool in initial teacher education that can provide beginning teachers with a vehicle or opportunity for supporting their ongoing professional learning (MacEntee & Garii, 2010). Eportfolios have been used to support students to connect to personal, internal and external examples of practice, resources, planning framewoks and reflective posts where they consider the relevance and application of their thinking and learning to teaching and learning. Thus the use of eportfolios can help prospective teachers to consider the wide array of teaching approaches including teaching using digital sources and indeed using eportfolios with their own students in subsequent teaching practices that occur as part of their qualification. Further the use of eportfolios can assist self-directed learning in what Conner (2014) has called *evaluative constructivism* where learning is an inquiry oriented, self-questioning activity through purposive and intentional processes for learning. Using reflective writing, PSTs can construct meaning from their previous and new experiences and develop their *adaptive expertise* (Hatano & Inagaki, 1986) where they consider alternative approaches, modify, adapt and adjust their teaching and apply these modifications to specific teaching and learning contexts (Darling, 2001).

The biology teacher preparation course was supported by an online moodle platform where learning intentions for each session and resources and questions were posted. While most students in the course were familiar with basic digital information processing skills, I was surprised that some students were not accustomed to using the moodle site to support their on-going learning through social forums. This was a reflection of the expectations for the program as well as for this course.

Graduates of initial teacher education programs in New Zealand must meet the Graduating Teacher Standards that include the requirement to "demonstrate proficiency in oral and written language (Māori and/or English), in numeracy and in ICT relevant to their professional role" (New Zealand Teachers Council, 2008). I made an assumption that my students would have considerable experience with a wide range of digital tools. However in a study of students' technology experiences, Bennett and Maton (2010) concluded that while many young people used a range of technology-based activities, their expertise was highly variable from being quite restricted in their digital practices, to pushing boundaries and being very creative in how they used tools. Bennett and Maton also pointed out that casual use of technology-based activities may not prepare students for academic practices or they may not transfer what they do in their private use to how they can use technologies in teaching. Therefore I had to challenge my assumptions about the levels of digital

[1] Digital literacy (Netsafe, 2010) is the ability to understand and fully participate in the digital world. According to NetSafe, a digital citizen is, along with other attributes, a confident and capable user of ICT who uses digital technologies to participate in educational, cultural, and economic activities and is literate in the language, symbols, and texts of these technologies.

expertise of my students especially about how they may be unaware of how digital tools can be used to learn more effectively.

Research Approach

As part of modelling of reflective learning and adaptive expertise, students in two senior biology curriculum courses for secondary teachers were expected to write five reflective statements in their eportfolios. They chose whether to share their reflections just with me or with the whole class. The instructions were:

1. Each student is to set up and create a Biology View in 'MyPortfolio'.[2] (See the 'how to' section for instructions)
2. As a key component of your **e-portfolio** you are to keep a '**reflections**' journal. This is an ongoing record of your thoughts as you reflect on the progress you are making. This could be about your own pedagogical content knowledge, or how certain lessons may have gone, or observations from the classroom.
3. There should be at least five reflections over the whole semester. As each one is written please share it with me so I can provide feedback. When on professional practice you will also keep a journal, and there may be some overlap in your reflections. This is not a problem.
4. At least **two examples of online resources** should be included where web 2.0 tools have been used. These will be covered in class and a *url* link can be inserted as a link. When this is done, please reflect on the use of this tool, and its possible use in the biology classroom. Examples include the use of wikis, quizlet, voicethread, animoto, or others as appropriate.
5. If possible, please include examples of student work (anon) or activities while on professional practice that show the use and application of different teaching strategies. These can be included as part of your reflections above, i.e. how well they went, what would you do differently next time etc. These examples could be written, or photos of student work (e.g. models, a photo of an experiment, an example of student produced work using an ICT application etc.). Ask permission first, but these examples of student work can help you when applying for positions later on and provide good evidence about student achievement.

All assignments for this course were uploaded to the PSTs' eportfolios which was the standard "myportfolio" website used by teachers and school students in the New Zealand education system (www.myportfolio.school.nz). Students were also provided with an on-line example during class time of five reflections that a student in a previous class had constructed.

Aspects of my pedagogy and the methods of this research were linked to the reflective cycle in models such as the teaching for better learning model (Aitken,

[2] http://myportfolio.school.nz/

Sinnema, & Meyer, 2013) that are an important part of developing as an effective teacher. I conducted this self-study over 2 years (two iterations of the same course).

As students entered their reflections in their eportfolios, I was sent an email notification. This enabled me to consider their reflections in an iterative way in relation to planning course experiences and what I emphasized during classes. Initially I focussed on tasks and activities that they found useful in a very technocratic way. On deeper content analysis of the writing (Fraenkel, Wallen, & Hyun, 2015), I identified key emotional aspects related to their experiences that I had not anticipated.

A colleague acted as a critical friend and conducted a focus group session with the students, which was audio recorded. Drawing on multiple sources and multiple perspectives in this way to gain feedback supported the credibility of the work, provided simple triangulation and also a context for critique of what I needed to change in my practice and how I viewed my own identity as a teacher educator. As Loughran (2002, pp. 243–244) asserts "reframing is much more difficult from an individual and personal perspective than when acting in collaboration with others." I needed to dig deeper into what beliefs I had about myself as a teacher educator and how "knowing" what my students were placing emphases o in their reflections enabled me to shift my pedagogy and how I positioned my identity as a teacher educator. Discussing this with my critical colleague enabled me to do this.

Analysis

Due to the complexity of the students' reflections, they were analysed using content analysis of the narratives (Fraenkel et al., 2015; Sarantakos, 2013) and coded to account for this complexity. Each reflection item was between several paragraphs to half a page and therefore contributed to multiple categories. I electronically coded the components or partial sentences as:

- strategies for learning about content
- reflection on pedagogy
- Evaluation of resources
- Observations of others teaching
- links to experiences as part of the university course
- links to their own teaching on professional practise
- links to evidence of school student learning for next practice

The collations of the coded items appear in Table 15.1. A t-test was used to compare the number of reflection items in each category for both classes to determine their similarity. There was a significant difference between the two classes [$p = 0.05$] only for learning about pedagogy. The first class had a higher value for reflection on pedagogy (Table 15.1). Otherwise there was no significant difference between the two classes. I am not placing too much emphasis on this difference because of the relatively small sizes of the classes.

Table 15.1 PSTs' reflections as categorized from eportfolios

	Strategies for learning about content	Learning about pedagogy	Resources to support teaching	Reflection on other teacher	Links to university class	Links to their own teaching	Links to evidence of school student learning for next practice
PSTs in first class							
A	3	9	8	2	0	6	3
B	0	12	25	1	0	9	0
C	3	6	4	0	4	4	2
D	0	7	6	0	0	4	1
E	2	5	2	1	0	4	1
F	3	4	11	0	1	3	3
G	3	6	3	1	1	5	1
H	6	6	5	0	0	7	0
I	5	6	2	0	0	6	1
J	5	2	6	1	0	3	1
K	2	5	8	0	0	4	0
Mean #	2.9	6.2	7.3	0.6	0.6	5.0	1.2
PSTs in second class							
L	1	7	3	1	0	6	0
M	1	4	4	3	2	4	2
N	5	11	9	2	2	8	1
O	5	6	6	2	2	6	2
P	3	3	4	0	1	4	0
Q	2	5	4	1	0	4	1
R	2	7	6	1	1	4	2
S	3	4	4	2	1	4	1
Mean #	2.8	5.9	5.0	1.5	1.1	5.0	1.1
t- value comparing both classes	0.13	2.34	0.22	3.9	1.22	0	0.002

T_{17} (0.5) = 2.11

Ethical Considerations

My involvement in the biology course as part of my teaching meant that I had "insider" status when setting up the assignment and during the teaching of the course. I had to clarify my intentions and sought students' permission to use their reflective statements for analysis after they had received their grades for this course. Because I was also assessing the PSTs there were possible conflicts of interest. Not all students volunteered to be part of the study. It was important that the research project (nor participation in the project) did not influence student grades. However, I was trying to model teaching practice as *Teaching as Inquiry* (TAI) (Conner, 2015; Timperley, 2011) that they could potentially use as teachers in schools. I indicated that I was reflecting on my own teaching but using their outcomes as a basis for this reflection. They received letters outlining the extent of their involvement. Near the end of the course, I sought their permission to use their reflective statements and to participate in a focus group discussion that was facilitated by one of my colleagues who acted as a critical friend. There was also a formal written consent process as approved by the UC Educational Research and Human Ethics Committee.

Findings

While I was conscious of the range of things students might reflect on, it was important to let them chose with the provision that it related to biology teaching and met the requirements of the assignment. I modified this in the second class and emphasized several times that they could use a complex array of experiences that were based on their professional practice observations, what they had learnt in their preservice class and in their own time, and how these linked with their own development as a teacher. Their reflections were quite detailed and included e-links to the ideas they were reflecting on, graphics and digital resources, web supports and youtube videos, as required by the criteria for the assignment. This provided additional resources for me as the teacher of the course and for the other students in the class.

In the first iteration of the course, students mostly reflected on resources followed closely by statements about pedagogy (Table 15.1). Many of them made links to their own teaching but to varying degrees. The reflections came from a sample of 11 students from the first class and 8 students from the second class who gave consent for me to use their reflective statements.

Although the sample size of students is small, the data indicate that many students made links to their own teaching but to varying degrees. Students from both classes did not identify many strategies to help them bridge the gaps in their own content knowledge. This may have been because the course was designed for learning how to teach rather than for learning biology content per se but many students recognized the importance of being well prepared with resources to help the students they would teach learn content and that developing their own content knowledge helped them to be more effective teachers.

Students in both classes included very few reflections related to their professional practice experiences particularly on what their associate teachers in schools did. As well there were relatively few reflections on the teaching and learning experiences they had in this particular university class. This surprised me and therefore I tried to emphasize the range of aspects they could reflect on for the second class more often and indicated that they could post more than five reflections if they wanted to. Due to the small numbers of participants in each class, and the variation within each class, there is no significant difference in overall outcomes when comparing both classes, except for the reflections on pedagogy for the first class, indicating a level of consistency between outcomes for both classes. This was a disappointing outcome given that I thought I was emphasizing the types of reflections that could be made and thought I had mentioned them more often in the second iteration of the course. This action then, made little difference to the outcomes. Potentially this was because the students considered that posting their reflections was part of an assignment requirement and not part of their learning as such. This means that in the next iteration of the course I will present the eportfolio reflections as a mechanism or strategy that can help them to learn about being a biology teacher more explicitly. I will also change the assessment outline to indicate that they can reflect on as many items as they choose to and then they should select the five for the assignment at the end of the course.

Whilst categorizing the reflections was a useful exercise for me to see what students were considering most (and potentially valued more or found more challenging), their detailed comments about specific activities or how they adapted their teaching provided much more in-depth information. It was these in-depth comments that acted more as a trigger for changing my own practice. For this reason I have included some of their quotations in the next sections, as illustrations to indicate the sorts of comments they made and my responses to them.

Given that the assignment brief also indicated they should use evidence of students' work to support their reflections, the data in the last column in Table 15.1 indicate very little reflection on student evidence for informing teaching. PSTs who did this only used observational and anecdotal evidence rather than evidence of achievement or work samples/assessment outcomes of the students they were teaching. Therefore because of this and it's impending focus within schools for ongoing professional learning, I will add a focus on using student evidence of learning both within the next iteration of the course and give it more prominence in the assessment guidelines. The next section provides specific examples of their reflective statements and what they wrote about their developmental needs.

Strategies for Learning About Content

The reflection from students about how they might adjust their learning about content was disappointing. Nine students commented on strategies that would assist their learning of biology content knowledge. However the number of references to

content knowledge overall was low compared with the other categories in the analysis of their reflections. Several students commented on how they needed to improve their content knowledge expertise as shown in the following example of a post in an eportfolio.

> Student A: I need to study hard so I know my stuff, and learn it to a point that I can recall knowledge quickly and easily.

Several others commented on ways to encourage school students to support each other with developing content knowledge and to use appropriate student engagement strategies to do this. Some examples below show students' awareness of the need to monitor learning and how important student engagement is in the learning process.

> Student C: I saw that students were actually learning the content I was teaching (I don't know that they weren't learning it before, but I doubt it. It was nice to know they *were* learning from my teaching). It goes to show the importance of being creative and finding ways to teach that your students respond to instead of sticking to the same old thing all day, every day.
>
> Student I: The more able students (conveniently half the class) would really enjoy teaching their peers one on one, and their peers seemed to enjoy learning from a more relevant perspective for a change. I was able to monitor the accuracy/enthusiasm of the teaching and was really impressed with how the material was being explained (*by the students themselves*). It also not only keeps the more academic students engaged, but also reinforces the understanding of the material greatly.
>
> Student A: I asked the students in Year 12 to create a poem, song, rap or colored storyboard that summarised DNA replication (I gave them a list of keywords that had to be included in the summary). They did this task in pairs, and had to present their finished song/rap/storyboard to the class in the final lesson. The level of engagement that I got from this task was huge – the students loved it! And the quality of the performances was great. All groups chose to do either a song or a rap, and they were so creative and summarised DNA replication really, really well. Not only this, but I heard them singing the songs they had created down the corridors and at lunchtime after they were finished.
>
> Student H: I did manage to learn the basic concepts, however I seemed to always lack the in-depth understanding that was needed to answer some of the student's questions. This definitely had an impact on my teaching… To help get around the problem, sometimes I would get students who really understood the concepts being explored to explain things to the class or individual students who were having trouble. This worked really well, because it gave those students who knew the content the opportunity to practice presenting their knowledge.

The examples of reflections above also indicate how the students were willing to try alternative ways of supporting learning and valued the success that this enabled.

The video creation activity in this class captured the PST's imagination and they thought they would use this activity and apply it to teaching in a range of biological contexts. Students' comments were positive affirmation of the utility and application of the activity but also that they had understood the value of transferring this idea to the teaching and learning contexts they would be designing in the future. As well this experience highlighted why it is important to be well prepared (another key point that I emphasize during class) as portrayed in the following comment by one of the students.

> Student O: This exercise involved pairing up with another student teacher to "wing it" as each of us we were filmed individually presenting what we knew about a skeleton (prop)

> as if doing a presentation to a class of students. It was hilarious to say the least and a lot of fun (for me anyway) an on the spot realization of how we need to read and know what we are talking about before jumping in front of a class unprepared. When viewing the video footage, despite thinking I had put on an air of confidence (faked it), I saw how I looked when I didn't know what I was talking about, my facial expressions gave it away and it was so obvious that I didn't know what I was talking about in any great depth and just "winging it"…. It motivated me to read well about topics and look for interesting content to give me more confidence to teach and talk about the lesson content with genuine enthusiasm.

I try to emphasize pedagogical content knowledge, i.e. the ability to apply and adjust pedagogy and considerations about teaching in relation to specific topics or content areas. Therefore while I have previously viewed my own stance as being a "knower" of content and being a "knower" of pedagogy, due to these reflections I had to reconsider this stance. The comment above and similar comments from other students, indicated to me that students were considering appropriating pedagogy to specific content and that they were, in general conscious of the need to be well prepared. Their comments about the usefulness of some of the activities we did in class and their application of these activities in school classrooms indicated that they felt they were useful for helping school students to learn content knowledge. PSTs enjoyed them much as school students might. So what did these PSTs' reflections indicate about my practice and my stance? Perhaps I was not emphasizing the importance of understanding content knowledge enough.

Reflections on Pedagogy

All of the PSTs in this sample identified multiple aspects about their development of pedagogical knowledge and linked these to specific examples of digital resources, their benefits and some of the drawbacks or aspects of pedagogy to consider as well.

> Student E: This free-to-use app literally does it all. Evernote lets you create notes and save them in different notebooks. The diverse text editor gives you a lot of freedom when creating the notes to ensure that you can add whatever you want in, making it a great lesson planner. Additionally, you can save the notes you make to different notebooks that you can title, allowing you to organize each of your classes separately.
>
> Student J: Mindmeister can benefit my students in a variety of ways. My students can use it for effective note making and organisation. They can also use it for revision and it can be a collaborative experience because they can share it with their friends who can then also get a copy and edit it further. I can use Mindmeister for conceptual development of my unit plans and the topics I intend to cover each week. I can then share this information with my students that can be used by them in preparation and planning. I can use this as Diagnostic as well as Formative assessment as a quick review of the topics we learnt in class which can help in further development of concepts or reporting to their parents.
>
> Student I: A downside to this is that it requires the Slowmation programme to be installed as well as that the process can be quite lengthy as I found when producing the Slowmation movie attached on Osmosis.

These comments signaled to me that they were considering the benefits, multiple uses and drawbacks of using particular technologies. Therefore the students had picked up on my indications of the importance of this. However, students in the focus group suggested they would have liked access to each others' comments during the course and not just at the end. Therefore I will suggest this as a possibility to the next class so they can learn more from each other. There are ethical considerations about sharing that they would need to agree to before this can happen, but there is scope within the eportfolio software to allow sharing with whomever students choose.

Some of the reflections on pedagogy were more general statements that indicated an awareness of the need to provide a range of learning experiences and for them as teachers to be creative in what kinds of experiences they provided. For example,

> Student K: We as teachers need to address this issue and start making steps towards incorporating more hands on tasks in lessons. In biology this doesn't necessarily mean we have to start doing more dissections or bacterial streaking. What it means is that we have to start taking different approaches to presenting the same material.
>
> Student E: Games and activities are perfect for formative assessment because the more students interact and share, the better they learn. Students can be learning and not even know it.
>
> Student L: One person noted that not all students learn at the same pace as you are teaching, and while I didn't apply the "rewind me" method, I think it is a brilliant for students, not only to catch up because of absence, but also to refer back, reflect on their own understanding and to cement concepts.
>
> Student E: In class we have been given multiple examples of how to use this pedagogy of learning and it allows the students to take control of their learning, be creative, and use critical thinking skills that are necessary in all subjects but also very beneficial to biology.

As part of the modeling of good practice, there were times in this class where I specifically made use of strategies and explained why they might be useful, such as the "rewind me" strategy of reflecting on class sessions in a forum post or indicating questioning protocols for scaffolding critical thinking. Some of these appeared in the PSTs' reflective statements as indicated below.

> Student A: They had to think about the process in order to verbalize what they were doing (by talking through the steps as they moved through them with the model of DNA) so that by the end of it they were each able to write a really good summary of the steps of protein synthesis. I think that getting students to talk through their model is a really vital part of the process, whether it's just to a partner or to the class. If they just made the model, they're not really engaging with the content; they need to show that they understand how the model works, and explaining it out loud is a great way to achieve this.
>
> Student E: Because I do not have the most experience in the labs and facilitating activities, I found that the activities we did as a class helped my understanding of how labs work and how to organize them. It will be very helpful to be able to go on our (biology) group page and use the lab activities that have been posted.
>
> Student K: I do like the idea from class of making a video to present to the class as (school) students aren't always confident with getting up in front of the class.

These statements were somewhat affirming that the activities they identified had shown examples of pedagogy and perhaps how the approaches could be transferred

to multiple contexts. The most common activity that was commented on by the PSTs in the second iteration of the class was the rat dissection. During this practical activity we discussed the ethics of doing dissections with school students and how teachers introduce the ethic of care and regard for animals was very important. This obviously provoked students to think about these issues carefully as illustrated by the following student's comment. This particular student was so engaged because she had not undertaken an animal dissection ever before, that she took photos of her student partner as he undertook the dissection and then posted the photos on a shared space within her eportfolio so that the whole class could access them. She wrote,

> Student O: Personally I felt quite ill at the thought of dissecting a rodent and the smell was quite revolting therefore I would expect students to be well within their reasonable grounds to not want to participate in this activity. However upon overcoming my own aversion to the procedure, I began to think about how the activity in itself brings about questions of ethics and the respect for life of all living creatures…..Sometimes emotive or research based content does not grab the attention of adolescents particularly when it comes to critical analysis of ethics and human interaction with the earth environment. However participating or even looking at a dissection of a dead animal for any great length of time does provide thinking and learning opportunities over and above simply looking at specific internal organs of a creature. If I was teaching (this) I would consider setting the students a small research assignment about ethical considerations, animal welfare, or something connected to different perspectives about respect for all life on the planet in contemporary society.

It was interesting that students in general, realized the increased ways digital resources, digital assessments and using a range of interactive tools could support learning. The students mentioned in class several times and one student commented in his eportfolio that sometimes they were actively discouraged to use digital tools when they were on professional practice in schools. I was dismayed by this and will indicate in the future that as newly graduating teachers, they can lead the way.

> Student L: While student-centred learning was still in its infancy at both my schools (for professional practice) and the use of electronic media in some cases non-existent (due to older teachers holding on to [un]-proven and ingrained methods?) I was in one instance verbally discouraged from using electronic media and digital resources by one of my associates. I found that very strange as our training focuses heavily on the use of electronic resources as an indispensable and invaluable aid to enhance learning for all students.

I was pleased though that the student considered her "training focuses heavily on the use of electronic resources", affirming my emphasis on this. This student had also picked up on the equity value of using digital resources that I had been mentioned briefly in class. Such aspects as enlarging text, turning on text to voice modes or being able to replay video or look at content online at any time are advantages for many students, especially who have English as a second language. I will continue to emphasize this equity message associated with using digital resources.

During the course, I tried to model how to use websites to compare planning and to evaluate resources. This has proved to be useful to students as they can see the benefits for accessing this information to support their future teaching as exempli-

fied by the following quote from an eportfolio. There were comments about websites replicated by other students in different ways.

> Student O: As a beginning teacher I would use this website (TKI[3]) as a guide when designing my own lesson plans, and compare the effectiveness of new ideas relative to learning outcomes to what information this website outlines as key learning points.

The student teacher's comments indicated that the use of the eportfolio for recording their reflective statements resulted in substantial gains for them as learners. This especially applied to identifying and critiquing resources and considering pedagogical approaches and how these applied to their own teaching. Learning from each other was a core element that was facilitated by sharing their reflections but that could be enhanced further by emphasizing the benefit of sharing more so in class. As student B wrote about the use of eportfolios:

> Student B: I will also be making full use of the sharing system that myPortfolio offers users. This has been very useful as I can see others' resources and plans and with permission be able to use them in my teaching, and if I feel like it making adjustments to those to suit the class I am teaching.

Students B's comments also reflect the idea that teaching in the New Zealand context expects teachers to choose what they do from a range of resources and use their professional judgment and expertise to adapt resources and ideas to meet the needs of their learners. Students in this class had grasped this idea well.

Student L wrote a whole page about his use of reflection as a learning tool. The quote below indicates his growing awareness of how student backgrounds should be taken into account when planning sessions for level of interest, difficulty and quantity of activities.

> Student L: What I found about my own personal reflections and those of my associates were that they were actually a good starting point when preparing the next lesson, as I now had a much clearer idea of what worked well during a lesson and what didn't work well.

I was surprised though that not more students reflected on reflection as a learning tool. Thje requirement to post five reflections as part of a summative assessment, placed value on this activity as a process for learning and as a model they could use with their students in schools. Naturally, there was variation as to the extent and depth that students reflected on their own teaching, aspects of teaching and learning that they observed during the course sessions and observations of their associate teachers in schools. The students' reflective statements acted as a trigger to help me identify what activities and aspects of the university course they found useful. It turned out that the eportfolio itself was one of the most useful experiences as indicated by the following comments from the discussion with a critical friend during the focus group at the end of the second course.

> Student M: One really good thing about it is that it is ongoing (beyond the course).
> Student O: It encourages us to share our resources more easily.
> Student L: I agree with having the reflections all in one place .. I don't know, it's nice to have it all laid out.

[3] Te Kite Ipurangi website https://www.tki.org.nz/

Student N: Myportfolio is "data kind" in that you can embed links and videos.
Student P: I liked the structure with groups, personal page, you could share pages or it (pages) could be made private.
Student Q: In a practical sense you don't have to print everything out.
Student S: You can edit things. You know compared with "dropbox" where once you hand things in, it's gone.
Student R: It's a good way to get feedback.

One student thought that eportfolios could replace the student management system used for all courses, whereas another student thought that the student course site just needed reducing and managing and others agreed. This has triggered me to revise the organization of the course link in the student management system and I have since rearranged the topics, sessions and resources to be more modularized and systematic.

Several students indicated in the focus group interview, that they needed more assistance with getting started to create their pages in eportfolio. This indicated that my assumptions about their existing ICT expertise were incorrect. In future I will give much more direct instruction to develop their capabilities to use eportfolios.

Discussion

My self-study indicated aspects of my teaching that were much wider than my initial scope of considering whether e-portfolios were useful and whether I could use then to investigate my own teaching. In retrospect, I was using the students' reflections in e-portfolios as a "catch all" for gaining insights into potential tensions and problems within my practice. In this discussion I first consider what students reflection indicated about the use of eportfolios, as this was my original intention. Then I discuss how the reflections themselves acted as triggers for a much wider consideration of the activities we undertook in this class and how my identity is gradually shifting from a "knower" stance to one of modeling "knowing about my students".

Use of Eportfolios

Using eportfolios and sharing these reflections amongst the participants in the class leveraged their experiential and situated learning and social learning that made it useful which has been determined as two significant factors that can support students' learning, motivation and retention of content (Chen, Calinger, Howard, & Oskorus, 2010). It also enabled them to participate in a student-centered learning activity since eportfolios are individualized and customizable. This allowed the PSTs to choose what to write about, in their own time, and therefore was self-directed. That is, the student teachers were given control over the content and links that they chose to make, rather than prescribing the topic for reflection.

Some reflections indicated they were able to consider how they would apply the use of resources or pedagogies in multiple contexts, but in many statements this was not evident. However, many of these students related their biology teaching to experiences they had with years 9 or 10 classes when they had taught biology topics with these classes. It also seemed important as, Knight et al. (2006) have indicated, that while they were choosing what to reflect on, they indicated why they selected particular approaches, resources or experiences and how they used examples or pedagogy to illustrate their deeper learning and transference to other contexts or next practice. When student teachers are consciously aware of how they can appropriate content and pedagogy, they are more likely to enhance their *adaptive expertise* (Darling, 2001). Therefore I will continue to emphasize the importance of considering why they might use particular resources and how they can adapt them appropriately to accommodate the needs of their students.

Several students had not used eportfolios previously so through having this experience they would be more likely to use them with their own classes in high schools in the future. Having to learn about the functionality of myportfolio coupled with their comments about other ICT tools and resources enhanced their awareness of access and use of digital resources and on-line interactive activities. The eportfolios also provided a tool and easily accessible space for sharing their ideas with the other class participants, further enhancing their social learning opportunities.

The timing of the writing of the reflective statements as part of the course was also important. As it was scheduled, the course has two 5-week teaching blocks punctuated by 7 weeks of professional practice in schools. The students in this class did not write their reflective statements until well after their professional practice in schools, even though I had indicated orally that they could do this in relation to our activities in class and went through the assignment orally with them prior to their professional practice in schools. Therefore there was a social learning opportunity during their professional practice that was not well leveraged as indicated by Evans and Powell (2007). There is also scope for allowing students to extend beyond the five required reflections, especially given the power of sharing their reflections and how this can support professional learning socially (Hauge, 2006). It would be interesting to allow students to post as many reflections as they liked and to ascertain whether this would help to address to some extent what Orland-Blank (2005) calls “what remains untold”. That is through repeated reflective practice, PSTs may become more confident and willing to share what has not worked and their learning from these experiences more. In the future I will encourage students to create reflective statements throughout the course, then choose which ones they use for evidence for the summative assessment. As it stood, students generally only produced the minimum number required (5) for the assessment except where formative feedback to two students indicated they had not met the requirement for the assignment.

Other advantages of using eportfolios more generally included: their total mobility, they are easily shared with anyone, anywhere, facilitate shared learning, reproducible, improve ICT skills, provide support for the development of future teacher actions, enable a personal approach to learning and development as a teacher, provide evidence and examples of development (Barrett, 2000). They can also include

multimedia and embedded files, as well as enhance the development of new learning and make connections to prior learning. Therefore there is wide scope to explore how the use of eportfolios in initial teacher education programs can be incorporated into course design to support the development of ICT capabilities (Chen et al., 2010) and for assessing PSTs' progress towards becoming a reflective practitioner (Cooper & Love, 2007) through showcasing evidence of learning (Delandshere & Arens, 2003; Denner, Norman, Salzman, Pankratz, & Evans, 2004).

I will definitely use and recommend the use of eportfolios in the future since they acted as a source for posting reflections, a source of evidence for the learning outcomes for the class and as a repository of ideas they could use in their teaching. An additional advantage is that students are able to access their posts and the shared pages including their lesson planning assignments, when they are employed as teachers. They can also develop them further to help provide evidence for their teacher registration requirements.

The analysis of students' reflections informed and triggered changes to my practise as a teacher educator. For example, in the second iteration of this self-study, I realized that the purpose of using eportfolios could have been clearer and therefore revised the approach to the assignment. I tried to be more deliberate about explaining why we were doing activities throughout the course (i.e. I indicated the purpose of activities more as I was trying to model how effective teaching makes the purpose clear and used talk aloud reflections (Berry, 2007)). I prompted spontaneous student teacher reflection, both oral and written during classes to provide them with multiple opportunities for reflection and will continue to do this in the future to assist the development of reflective practice. A point of interest will be to see how often they use eportfolios to keep their reflections when they are encouraged to record them more frequently.

In the first class students' reflective paragraphs did not identify many strategies to bridge their gaps in content knowledge, so in the second iteration, I developed an on-line formative self-paced quiz for them to self identify their content knowledge needs. This strategy may have led to the second group of students being slightly more reflective about how to learn content knowledge. Students were also invited during the second class to suggest content areas that we could focus on multiple times and the course sessions were adjusted to accommodate these suggestions.

From "Knower" to "Knowing" More About My Student' Experiences

Through discussion with my critical friend, I came to realise that my own identity as a teacher educator was that of "Knower" where because of my 7 years teaching in schools and 18 years as a teacher educator, I thought I knew what prospective teachers needed to know to become a biology teacher (content knowledge and pedagogical knowledge). However, the reflections and focus group discussion indicated, that if I was serious about meeting the needs of my students, I needed to find out

more about my students' prior knowledge and experiences during my teaching. My awareness of the need to check in with students, particularly for animal dissections and pre-empting lack of prior knowledge and skills related to ICT has been heightened.

While we have criteria for selecting students into the programme and therefore some assumptions can be made about their knowledge and skills, the sobering thought is that all students are different and therefore finding out about my students' needs will be ongoing. To reduce the daunting nature of this realisation, potentially students can be assisted to self-identify their specific needs more directly, such as the self-directed formative quizzes that I trialled in the second iteration of the course.

As a result of analysing my students' reflections, I have changed my practices directly but also changed my positioning as a teacher educator. I have changed the organisation of the online student management support site for this course to create modules so that students can access these at any time and check which content or activities they would like to experience in class. In this way, I hope to model student-centred learning in that the PSTs will be able to determine through the use of the student management link, what we do in class time and what they do in their own time.

Since we are working with adult learners and we are also supposed to be modelling student-centred learning based on students' needs, modifying the course in this way and allowing the students to choose what we do, may address their needs better. This of course needs to be set in the context of the course learning outcomes and what students are required to demonstrate to pass the course. Potentially though, allowing this flexibility might free up some session time, where previously I thought I had to "cover things" because it was important for student teachers to "know" them. As a teacher educator it has become more important for me to help them identify (know) what they need as beginning teachers.

Limitations of This Study

While the eportfolio reflections were useful "triggers" for self-study there were some limitations due to the e-portfolio acting as a contribution to assessment for the course, whereby mostly students only submitted the required five reflections. Because some students identified they had a low level of digital literacy, I will make a deliberate effort to check on students' e-skills more thoroughly in the future and appropriate the level of instruction accordingly.

Other limitations were related to capturing students' thoughts as they occurred and that these thoughts probably change over time. As Orland-Barak (2005) has discussed, eportfolios provide a snapshot of thinking while much remains untold. The focus group discussion conducted by a colleague about what they found useful and what they thought would enhance the use of eportfolios confirmed some of the

aspects related to my teaching but also provided valuable information about further modifications and applications for this pre-service teacher education course.

Conclusion

My intention to reflect on my own practice by using students' reflections as triggers was designed to inform my practices so that PSTs' educational experiences would be enhanced as discussed by Maclean and Poole (2010). I made assumptions about students' technical expertise that they would be able to intuitively use eportfolios. As a teacher educator, I need to continuously check on students' existing knowledge, skills and progress and development more often. I had assumed that they all had a reasonable capability and some experience in using online systems, which was not necessarily true for all students. While they were given opportunities to ask for help, perhaps in a small class, they did not want to acknowledge their need for help as it would indicate a deficiency to the other students.

While the PSTs appreciated becoming familiar with eportfolios as part of this senior biology curriculum course, they were only beginning to realize the power of them for supporting their own learning. I am now realizing the benefit and the window into their learning and experiences that they provided for me. There are possibilities for supporting PSTs' learning using multiple forms of reflection to assist their development as teachers and to inform teacher educators' practices. In particular, there is scope for student teachers to be guided in developing a more mature eportfolio as described by Challis (2005) and for teacher educators to utilize and identify the developmental needs of their students during courses through their electronic posts.

The implications of the findings of this study for my teaching are to keep using PSTs reflections as part of this assignment to inform my understandings of my students' needs and development and therefore what adjustments I might need to make as a teacher educator. Specific changes to my practice include:

1. Developing a more detailed tutorial on how to set up pages in eportfolio and check on students ICT skills
2. Promoting the use of eportfolios in more courses within the overall initial teacher education program
3. Within the course, I could be even more explicit about how eportfolios could be used to support learning
4. More time could be provided within tutorial time for students to write reflections on what they have learnt in class sessions
5. Indicate to the student teachers, multiple ways for observing, collecting and providing evidence of students' learning as a source for their reflection as teachers who need to know what their students need

6. Find additional ways to identify students' needs and respond accordingly
7. Redesign on-line support modules so that students have more flexibility in identifying their needs and can have input into what is covered during class time and what they can do in their own time.

This research study was not designed to transform myself but rather to refine what I emphasised in classes. In the process of doing this self-study, I have changed my positioning to become more aware of the need to identify PSTs' concerns and needs. Their reflections in eportfolios were only one way of doing this. Face-to-face discussions, individual conferencing with students and providing feedback to students both orally and for assignment work helped students to benchmark their development and also provided me with indications of what else I needed to focus on. The PSTs valued being able to use a tool (myportfolio) that is also used in schools and they were considering how they could use this tool more effectively with students they would teach. This self-study through reflecting on PSTs reflections, triggered my own changes in pedagogy and practice as well as my positioning as a teacher educator. As a result of this study, my own identity is shifting from that of "knower" (about teaching biology) to the importance "knowing" more about what my students are thinking and what their needs are, so these can be addressed more directly.

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