DETERMINING DISCOURSES: CONSTRAINTS AND RESOURCES INFLUENCING EARLY CAREER SCIENCE TEACHERS

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ABSTRACT

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This study explores the thinking and practices of five early-career teachers of grades eight to ten science, in relation to their histories, schools, students, and larger cultural and political forces. All the teachers are young women, two in their fourth year of teaching, who teach together in an affluent suburb, along with one first-year teacher. The other two are first-year teachers who teach in an urban setting.

All of these teachers most closely associated good science teaching with forming relationships with students. They filtered science content through a lens of relevance (mostly to everyday life) and interest for students. Thus they filtered science content through a commitment to serving students, which makes sense since I argue that the primary motivations for teaching had more to do with working with students and helping people than the disciplines of science.

Thus, within the discourse of the supremacy of curriculum and the prevalence of testing, these teachers enact hybrid practices which focus on covering content – to help ensure the success of students – and on relevance and interest, which has more to do with teaching styles and personality than disciplines of science. Ideas of good teaching are not very focused on science, which contradicts the type of support they seek and utilize around science content. This presents a challenge to pre- and in-service education and support to question what student success means, what concern for students entails and how to connect caring and concern for students with science.

ACKNOWLEDGEMENTS

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Introduction

Beginning thoughts

When I first envisioned this study, I knew that I wanted to work with early career science teachers in the greater Vancouver area. At that time, my primary interest was in what constrains and enables prospective and in-service teachers in *questioning the context and the content* – taking a analytical or critical stance with regard to what content they should teach, and how, given the students in their classrooms and particular goals of science literacy – both providing access to and reshaping school science toward more equitable, democratic, and sustainable ends. These notions of a critical stance and of science literacy were (and are) important to me.

However, I could not presume that these would match what was important for my participants. I found myself heeding the cautions of Noddings (1984) that we not coerce teachers to adopt our own philosophical and pedagogical stances. I found that I had to better mesh my agenda with theirs. Indeed, I had to learn what their agenda was. And so my focus shifted to understanding how these teachers develop their practices and how these practices are reconciled within varying constraints, both external (such as discourses of following prescribed curriculum and testing) and internal (such as notions based on previous experiences). Their practices revolved around their own visions of good (science) teaching, and what got in their way of enacting these visions more than what resources upon which they drew.

The study

In focusing on what constrains (and enables) new teachers' enactments of their notions of good teaching, particularly the discourses that affect and are affected by their practices, I aim to address several enduring issues in teaching in general and in science teaching in particular in contemporary contexts. The attrition rate of new teachers across the U.S. is up to 40% (Berg, Donaldson, & Johnson, 2005), and between 15 –20% across Canada (National Graduates Survey, Statistics Canada, 2000) in the first five years of teaching. The reasons for such high rates of teachers leaving the profession have much to do with the discourses that infuse the profession with norms of isolation, and lack of support in a demanding and often misunderstood career, which have remained virtually unchanged for decades, from Lortie's (1975) classic study to contemporary investigations (e.g. Kauffman, Johnson, Kardos, Liu & Penske, 2002). There is a significant need, therefore, to find ways to better support new teachers, and experiment with growing ideas of the importance of collaboration (Little, 1993; Darling-Hammond, 1998; Olson & Craig, 1999, McLaughlin & Talbert, 2001).

In this study I aim to look at what constrains and enables new teachers – in their first five years of teaching –teaching in ways that they feel efficacious. This is certainly one important factor in the retention of teachers. As important as it is, whether or not teachers feel efficacious, does not necessarily mean that their teaching matches the images in reforms (Cohen, 1990). In science education, there has been much attention paid to engendering an all-encompassing view of science literacy, which includes not only scientific concepts, but the human processes of scientific investigations, and the complex relationships between science, technology, and society (NRC, 1996, B.C.

Ministry of Education, 2006). Thus, I also look at what constrains and enables teaching toward such visions.

In addition, studies aimed at understanding how to pre- and in-service teachers do and do not develop reform-based practices have largely focused on content knowledge of teachers. There has been a focus on how thinking about science content frames pedagogy, or on pedagogical content knowledge (see Barnett, J. & Hodson, D., 2001; Loughran,J., Mulhall, P. & Berry, A., 2004; Van Driel, J.H., De Jong, O., & Verloop, N., 2002; Zeidler, D., 2002) There has been less attention paid to how science teachers develop their practices in response to their views of students – what they need to know about them, how to learn this, how and what students should learn, and why – and the relationships they try to form with students. In my analysis of new teachers' notions of good science teaching, I aimed to connect the way they think about teaching science to the relationships that they try to build with students.

In this study, then, I ultimately seek to tell the stories of new teachers in two contexts to learn about how they develop their views and practices within the discourses of teaching of which they are a part; both external (such inherited historical discourses shaping curriculum and testing) and internal (such as previous experiences, values and beliefs). I aim to look holistically at why they think and act in ways that they do. As you will read, I argue that all of these teachers, albeit in different ways, use their priority of serving and connecting with students to filter how they think about and enact science curriculum. Within the discourse of the supremacy of curriculum and the prevalence of testing, these teachers enact hybrid practices which focus on covering content – to help ensure the success of students – and on relevance and interest, which has more to do with

teaching styles and personality than disciplines of science. Thus, ideas of good teaching are not very focused on science which contradicts the type of support they seek and utilize around science content. This presents a challenge to pre- and in-service education and support to question what student success means, what concern for students entails and how to connect caring and concern for students with science.

Chapter 1 Making stories: Investigating constraints and resources

Research Agenda

Borrowing from Britzman (2003), the over-arching goal of the study became to *investigate what constrains (and to some degree enables) early career teachers in developing and enacting their visions of the practices that constitute "good" science teaching, and to investigate the discourses that legitimate or challenge such visions and practices.* I take the concept of discourse, which I will define more fully in the next chapter, to mean something like taken-for-granted ways of thinking and acting, produced through interaction and embedded in social institutions that help shape the theories through which people understand themselves and their worlds.

Thus, I saw my task as two-fold:

1. *Describe* the thinking and practices of five beginning high school science teachers; and *analyze* how their stances toward and ideas about students, teaching, science and schools are manifested in their practices. Some guiding questions were:
    a. What goals of (science) teaching are most important for each teacher? Why? How did these beliefs form?
    b. How does each teacher enact the BC curriculum – what activities, forms of instruction, and types of assessment does each teacher utilize and prefer to meet the goals and needs of their classrooms?
    c. How would they change the curriculum if they could? Why?

d. How does each teacher try to build relationships with students and for what purposes?

e. How does each teacher aim to meet the needs of their students?

f. What are each teacher's primary concerns about their teaching and how do they plan to address these concerns around their own practice?

2. *Describe* the nature of the discourses and associated expectations that these beginning science teachers respond and contribute to; and *analyze* how these different discourses contribute (legitimate or challenge) their theories about students, teaching, science and schools and their practices.

    a. What does each teacher see as constraints and resources for teaching how they want to teach? How do they use and/or respond to them?

    b. What communities of support exist in their schools and how does each teacher use them?

Methodological considerations and practices

The questions I chose to explore above both dictated, and are dictated by, methodology. The purpose of this study is to describe and analyze how different discourses, writ large, constrain and enable my participants in developing and enacting their visions of "good" science teaching. In doing so my goal was to make substantiated claims about how teachers, teacher educators, administrators, and policy makers might better support early career teachers in developing thoughtful visions of generative science teaching and the conditions needed to support such practice. This purpose is embedded in the research questions and guided the methodology of the study.

At the same time, the questions I chose to ask arise from my identity. As Denzin and Lincoln (2000) explain, we are situated researchers who approach our research with a framework (ontology) that specifies a set of questions (epistemology) that we examine in specific ways (methodology). I need to be clear, then, that I tried to encourage my participants to question their practices and examine what they believed, what they did and why they made the decisions they did, in order to hopefully have some small effect on their teaching, in addition to learning about them as science teachers. As such, I felt that it was my ethical responsibility as well as strategically necessary to be overt about my purposes with my participants, and readers.

Let me be clear, however, that this does not mean that I simply mined the data for the story I wanted to tell in the beginning. Whereas I recognize that other scholars certainly would have had somewhat different relationships with my participants, and thus would have collected somewhat different data and told somewhat different stories, I have made every effort to tell stories that are "real." Certainly I have played a big hand in writing these stories, as I am the one who interpreted the data and I am the one who designed the questions and asked them. However, while the data is interpretatively flexible – another scholar could have focused on different themes, or asked different questions – the data is not indefinitely flexible. I don't believe I tell stories here that are unsubstantiated or that others (most importantly my participants) would disagree with. I have also tried to open myself up to questioning my own agenda. In fact, as I mentioned at the outset of my writing, I had to shift my agenda, once I started talking to teachers. In addition, perhaps the effect I wanted to have on teachers' practices was not what they

needed. As such, I think it is my ethical responsibility as well as strategically necessary to be overt about my purposes with my participants (and readers).

Planning the study: sampling and setting

A small number of teachers

This study follows Florio-Ruane's (2002) suggestion for learning more about teacher practice. She writes, "to understand local knowledge in teaching and teacher education, we need in-depth studies of individual teachers at work and of the variety of ways that teachers think about and do that work." (p. 209). In order to achieve generative in-depth analyses, I chose to seek out a manageable number of teachers, hoping to attract between four and six participants. In the end I worked with five teachers. In addition to a limited quantity of cases, there were particular qualities that I felt would enhance both what I could learn from, and what I could potentially offer to, my participants. I will discuss each below.

Early career teachers of science 8, 9, 10.

I defined early career as teachers in their first five years of teaching. Most teachers who leave the profession prematurely leave within the first five years. I wanted teachers early in their career for a few reasons. First and foremost, I take seriously Lather's (2002) advocacy of research as praxis. I felt that I had the most to offer an early career teacher. I had taught this same BC curriculum (grades 8 to 10 science) a few times and I had the benefit of a lot of time to think about, read about and observe teaching practice. I thought newer teachers might appreciate more whatever help I could offer them in thinking about

their practice. They might be hungry for the community that their teacher preparation program no doubt encouraged them to find or make if they felt they did not have it. If they were in a mentoring program, that many school districts have some form of, it would be interesting to investigate the mentoring relationship as one source of support. Lastly, unlike student teachers who have the constraints of being in another teacher's classroom and a lot of evaluation and support already, new teachers are forging their own practice in the same conditions or at least the same school where they may spend a large part of their career, and they usually do this largely on their own. Therefore they might be especially open to avenues for learning about and from their teaching with a supportive outsider, especially in their first two probationary years on the job.

Teachers in secondary schools on the east side of Vancouver and in the municipality of West Vancouver.

Given that I wanted to study practices and beliefs about good teaching (including student relationships) and what constrains and enables those practices and beliefs, I wanted to compare two locations that had different student populations and potentially different constraints and resources. With only 52% of all students in Vancouver schools whose native language is English, language diversity is a given just about everywhere. Racial diversity is also extensive throughout the greater Vancouver region. However, according to the Vancouver school board website (http://www.vsb.bc.ca/schools), language and ethnic and social class diversity are higher in east side schools. Thus I targeted schools on the east side.

In contrast to the east side of Vancouver, the municipality of West Vancouver is much less diverse with respect to social class. As I have already mentioned, all of the greater Vancouver area is diverse with respect to ethnicities and language, including West Vancouver. However, whereas there is always some diversity of social class, West Vancouver is generally a very affluent community. In fact, it is consistently ranked as one of the most affluent communities in Canada. Therefore, West Vancouver presented a different context from the east side of Vancouver based on student population, and possibly school culture and resources, which meant a potentially (and a partially) different set of constraints (and resources) for beginning science teachers.

Gaining Access

As I have already written, one reason I chose teachers in greater Vancouver was because I had taught the same curriculum before, enabling me to be potentially helpful and seen as more legitimate. Another reason for choosing West Vancouver specifically as a research site was that I had taught there and I still knew teachers and some administration who worked there. I figured I had an "in." I asked either teacher friends or principals if any teachers at their schools fit my criteria. Only one school out of the three high schools in the district had science teachers in their first five years of teaching. I was instructed by the principal of this school to contact the district for approval. My "in" did turn out to work in my favour. The senior district administration I contacted told me she was supporting my request because I had taught in the district, and that she would normally refuse such requests (to approach teachers) out of hand due to the extra workload with committees and district activities that teaching staffs in small districts

experience. This left me with the impression that had I not had that "in" I would not have been able to even ask the teachers if they would be willing to be in my study. I also had an "in" on the east side. A fellow science teacher friend taught at a school on the east side and he informed me that there were three new science teachers at the school.

Of course I had to provide proof of the approval from my Institutional Review Board (IRB). I did have approval for my study and my consent form, but I needed letters from the principals of the schools where I would be conducting my research, before the IRB would give me final approval. However, the district or board level approval had to be given before the principals would write a letter and the school district and school board wanted proof of my IRB approval. This was a catch-22. Fortunately, upon hearing the situation, both principals were willing to write me a letter, with the stipulation that IRB approval was given. I knew I would have approval with those letters, so I was finally in a position to talk to the teachers.

In West Vanvouver, the vice principal set up a meeting with the three teachers who fit my criteria in the school I call Saunders. They all agreed to be in my study with very little hesitation. It seemed ironic that it had taken me months to get to the position to present my ideas to the teachers, and they all agreed within about half an hour. The district personnel I was in touch with warned me that she thought that it might be a "tough sell" for me. It seemed that this could not have been further from the truth. I had designed my ideas of my relationships with the teachers as one of trying not to take up too much of their time and of trying to provide some service. I think I was able to convey that message adequately, and I believe I lived up to it. At the school I call Turner on the east side, my friend set up an information meeting over lunch with the new science

teachers so I could tell them about my research and what being involved would mean for them. Of the three teachers there who fit my criteria, two agreed to participate.

My participants

The teachers in the study are all young women, though this was not by design. It just happened that all the new junior science teachers at the two schools I approached were women. All names are pseudonyms. Anne and Jaelyn taught at Turner Secondary, on the east side. Anne was in her first year of teaching and taught at Turner half time, splitting her load at another secondary school nearby. She taught one block each of grade 8, grade 9 and grade 10 science at Turner. At her other school, she was in an "extended skills position" teaching science, math, and English. Jaelyn was in her second year of teaching, this being her first full year at Turner. She had come to Turner the previous January in a short-term position, which ended up lasting until the end of the school year. She taught science 8 and 9 as well as grades 11 and 12 chemistry.

Of the three teachers at Saunders Secondary, in West Vancouver, Delia was in her first year, and Jun and Susanne were both in their fourth year of teaching. Delia taught one block of science 10. She also taught chemistry 11 and 12, planning 10, and math 8. Susanne taught science 8 and science 9 as well as choir and planning 10. Most of her junior science classes were part of a program called computer immersion, where students all have laptops and take notes and do most assignments with the computer. This was true of the grade 8 class I observed. Jun taught science 8, 9, and 10. Her grade 10 class was a pre-AP science 10 designed to prepare students to take Advanced Placement courses in the sciences in the future, such as AP biology.

Data sources

Just as my questions for this dissertation come out of my identity as a science educator, the identities of these teachers are central in understanding their practice and their learning to teach. The questions they ask themselves and what they care about frames their burgeoning practice, what they learn from it and how it develops. Those questions, beliefs and practices are generated through their own contexts, their school, their students, their histories, their challenges, and to some degree, the teacher education programs they completed.

Many scholars, for example, Linde (1993), Mishler (1999), and Ochs & Capps (2001), draw connections between narratives and identities. Sfard & Prusak (2005) define identity, which is salient for learning (in this case to teach science), as *an ensemble of narratives about a person* that originate from actions, which become ascribed to the actor themselves. Therefore, the stories that teachers tell about their practice, their disappointments, successes, hopes and concerns was a primary data source. I had two taped conversations with each teacher.

In addition to the two taped conversations I had with my five participants, I also had numerous day to day short conversations, some of which became part of the my field notes for that day. I took field notes whenever I sat in on their classes. I observed Anne's grade 8, grade 9 and grade 10 science classes. With Jaelyn, I sat in on one block of science 8 and one block of science 9. I observed Delia's science 10 class, one each of Suzanne's science 8 and science 9 classes, and one each of Jun's science 8, 9, and 10

classes. For each class I observed, I sat in and took field notes four or five times during the second half of the school year.

In addition to my field notes and transcripts from our conversations, I also collected course outlines, examples of tests and classroom activities to augment the field notes. To get a better picture of the discourses of the "context," which can constrain and enable particular practices, I also looked at provincial curriculum documents and provincial policies and operations, as well as the newsmagazine of the BC Teachers Federation, and local newspaper articles.

Data gathering& analysis:

Positioning myself and participants

Since it is widely accepted that it is impossible to be completely absent from one's own study – to be entirely objective and neutral – I had no concern about being an unobtrusive observer, limiting my engagement with "subjects" for fear of altering results of the studied. Clearly I am actively present as the editor of others' words and decisions about where to include my own. It was not always easy to decide to what degree I should inject my interpretations and theorize about what others have said or not said, and to what degree my participants should be allowed to speak for themselves. In saying this, I recognize the "crisis of representation" (Denzin & Lincoln, 2000) – that I cannot hope to portray my participants exactly as they would portray themselves; that I cannot directly capture lived experience. As Geertz (2000) writes, "[t]he truth of the doctrine of cultural (or historical) relativism is that we can never apprehend another people's or another period's imagination neatly, as though it were our own. The falsity of it is that we can

therefore never genuinely apprehend it at all" (p. 44). Still, how much to "point out what [my participants] could not see, would not do, and could not have said" (Britzman, 2000, p. 37) was a struggle as explicated by Britzman and Lather (1997). And as Weis et al (2000) discuss such decisions inevitably depend on what the participants say and who they are. The positioning of myself, then, is coupled with the positioning of my participants.

There are no easy answers to this dilemma of positionality. As a participant-observer, the part of me that is an insider may have something to say as a participant and the part that is the outsider may feel compelled to theorize for and frame the words of my participants in certain ways in order to tell the story I saw developing. The best I could do was to try to be overt with my participants and readers about my theorizing and contextualizing. I like Segall's (2002) strategy of including participants' responses to my use and interpretation of their talk and actions. After all, if I am also a participant and an insider, why shouldn't everyone in the study get a chance to interpret or analyze for themselves? Couldn't these potentially differing interpretations make the study richer and more interesting? This would be one more strategy to enact research as praxis, and to research *with* as opposed to *on* others.

However, given the timing of my actual writing, and the commitments of the teachers in the study, this did not turn out to be the most practical approach. No one had the time (ultimately because I didn't really give them enough of it) to read and comment on my interpretations of their words, prior to the completion of the first draft of this study. However, I have stayed in touch with my participants and invited them to comment, and so, these comments may be something I can add prior to completing pieces

of this work for publication. Given the responses I have had, however, I think Anne may be the only one who would take me up on it. These teachers are busy with their jobs and lives and despite what I perceive as a good relationship, my impression is that they feel they have better things to do. They have already done me a great service. I want to give them the opportunity to have more of a voice in a study about them, yet I have to respect that they may not want to.

Interviews/Conversations

Given that the conversations I had with the teachers – the stories that they told – were a primary data source, I want to discuss this process with regards to data generation, analysis and positionality. While I did have a semi-structured format with questions which attempted to get at their thoughts around a shared event (a classroom observation, for example) or their thinking about a particular topic, what came out of the interview or conversation was a joint endeavor between me and the teacher. The clarifying questions we asked each other, the examples we gave, the volume of experiences talked about and the topics that teachers wanted to talk about varied with each participant. I had my agenda – things that I wanted to ask each teacher – but I was also flexible. And so the conversations with each teacher were unique, and some participants certainly provided much more information than others.

In addition, what the teachers conveyed to me was in part dependent on the interaction and conversation that we shared. As I have already mentioned, I'm not saying that the teacher would tell a completely different story to someone else, but that they would tell a somewhat different story. They might focus on or emphasize different

things, or speak in a different way. For example, even though I had no direct or consequential power over them, and I believe they felt quite comfortable talking to me, they know that I have an agenda (from agreeing to participate and from the interview questions themselves) and thus they likely had ideas of what I wanted them to focus on and talk more about. In this way, the interview was not only about gleaning information from the teacher, but it may have acted as a tool for the teacher to construct that information. Therefore, by having the conversation, a participant may have come to some different understandings about their teaching than if they had not had the conversation with me. I certainly had a few instances where teachers said they had not thought of something before. Perhaps our conversation helped them think about science literacy or weighing the costs and benefits of assessments (two examples that come to mind) differently. This is part of how I envision research as praxis.

Holstein and Gubrium (2000) write that "rather than searching for the best or most authentic answer, the aim [of active interviewing] is to systematically activate applicable ways of knowing – the possible answers – that respondents can reveal, ... [The active interviewer] does not tell the respondents what to say but offers them pertinent ways of conceptualizing issues and making connections – that is, ...it is the active interviewer's job to direct and harness the respondent's constructive storytelling to the research task at hand " (p.123). I think this happens even without the interviewer being consciously active about it, by virtue of who they are or the range of answers they anticipate and thus probe further to elicit. I think it is necessary to acknowledge this collaborative element in the construction of information, but as Holstein and Gubrium point out, "[b]ias is a meaningful concept only if the subject is a preformed, purely

informational commodity that the interview process might somehow taint" (p. 123). Therefore, it is not an acknowledgement of bias per se, but an acknowledgement of the inevitably collaborative nature of knowledge construction.

Positioning participants as those researching with me does not mean, however, that I can unproblematically consider their voices as liberatory expressions. Baker (1999) notes that such notions are complicated by the researcher choosing and framing the words as well as eliciting them with a particular questions, in addition to the recognition of the effects of social history and experience on the possible thoughts and words evoked. That is, at Foucault's (1984) suggestion, we need to examine the historical terms that enabled particular utterances and ask if we speak discourses that we are born and/or socialized into, then who is speaking? In other words, I needed to acknowledge the problems and explore the contexts of voice, as part of my interpretations.

Participant Observation

As I have already mentioned, I sat in on certain classes of grade 8, 9, and 10 science that were taught by my participants. This part of the data collection was something that I talked to potential participants about when we first met, and was also in the consent form. This aspect of the research drew concern from the district-level administrator I sought approval from in West Vancouver. She told me that she believed that if the teachers did not know me, they would find the classroom observation piece threatening. This did not turn out to be the case ultimately, but Susanne (at Saunders) and Jaelyn (at Turner), both voiced concerns of feeling they were being evaluated. Luckily, it was not enough of a concern for Susanne or Jaelyn to not consent, but it was something we talked about in the

early stages of data collection. I reiterated, as I had in my consent form, that the purpose of the observations was to get a sense of who the students were, and how the teacher interacted with them, as well as to fill out the story of each teacher's pedagogical approach. And in this way, the observations served as topic generation for our conversations, as I could ask about events or practices, which took place while I was in the classroom. I believe that I showed them through our interaction and conversations that the purpose of my presence in their classrooms was not evaluative.

Part of not being evaluative, was my role as the *participant* in what qualitative researchers call participant observation. While I was in classrooms, I took field notes as an observer, but I also talked to students, helped them with activities or questions, talked to the teacher, and was sometimes invited to be part of classroom discussions. The students seemed to quickly get used to my presence and treated me as another teacher at times. I was an insider and an outsider at the same time. Participant observation in general is an important piece of data gathering because, observations take place in settings that lack the controlled artificial feel of interviews. According to Lofland and Lofland (1995) , "participant observation refers to the process in which an investigator establishes and sustains a many-sided and relatively long-term relationship with a human association in its natural setting for the purpose of developing a scientific understanding of that association" (p. 18). Moreover, participant observation is directed at action more than language, and thus serves as a corroborator, so to speak, for the stories teachers tell.

Participant observation in classrooms, also gave me a sense of the context within which my participants taught. Being in the schools, and the classrooms, seeing the students in the hallways and in classes, sets the stage for the teachers' stories. Given that

I am looking at the discourses that teachers contribute to and operate within, the "context" is not the background or set, but part of the story, and part of the analysis of what constrains and enables their practice. In addition, I fill out (or triangulate) the story of "context" with an analysis of documents such the BC curriculum, provincial testing policy, BC school funding practices, the newsmagazine of the BC Teachers Federation, and local newspaper articles.

Transcription

I agree with Wortham (2001) that interpreting the meaning of utterances requires attention to how that meaning unfolds in interactions. When transcribing audio-taped conversations I transcribed verbatim the turn-taking by myself and the teachers in order to foreground that interaction. This inclusion of my role, I believe, assists in my interpretation since a chunk of a teacher's response is not abstracted from conversation, and thus is not de-contextualized more than it already has to be for the purposes of writing a dissertation. For example, including my talk helps to guard against interpreting a teacher's response as disclosing elements more salient to the teacher than they really were.

Narrative researchers argue that how researchers transcribe utterances depends on what research questions and theoretical frames they bring. In other words, transcription is an analytical step (Mishler, 1991; Ochs, 1979). Since I am mostly concerned with the *content* of what the teachers are saying rather than the way they say it (I am not interested in the structure or performance of their stories), I have transcribed their (and my) talk as verbatim prose. However, I do not deny the claims of scholars such as Jakobson (1960)

and Baumann & Briggs (1990) that meanings of utterances reside not only in what, but also in how, something is said – that the form and the function of speech creates a meaning unit. For example, words which were emphasized or pauses where I or a teacher sought for the right word, contribute to the overall meaning of the text and were included in the transcription. Thus I included a system for conveying how words were spoken as a part of the verbatim prose. These are explicated in the figure below.

Figure 1: Transcription conventions (adapted from Wortham, 2001)

–	breaks in speech (like interjecting a thought or starting a different way to say something)
__	(underline) notable emphasis on a word
( )	descriptions of speech e.g. (softly)
(.)	pause
(?)	unintelligible recording
(( ))	researcher comment
=	interruption or next utterance following immediately, or continuous talk

As Gee (1991) asserts, "interpretation ... is an amalgam of structural properties of texts and creative inferences drawn on the basis of context and previous experience" (p. 16). My interpretations of these transcripts, then, were focused on how and mostly what was said in light of cues provided by me, and my knowledge of the contexts of the school, the students in their class, and the teacher's previous experiences. Much of this contextual information was gleaned from previous conversations as well as the other forms of data collection such as classroom observations, and the documents listed previously.

Ethnography and constructivist grounded theory

What I have been describing here I think would best be called an ethnography by Creswell's (1998) description, involving participant-observation in which the researcher is immersed in the lives of a group (of beginning science teachers) through one-on-one interviews to describe and interpret the group (especially behaviour, language and interactions). To make sense of my data generated in this ethnography, I have used most closely the tools of constructivist grounded theory as explicated by Charmaz (2000). Charmaz starts with the ideas of Glaser & Strauss (1967) regarding grounding theory in data by using systematic inductive guidelines for collection and analyzing data to build theoretical frameworks that explain that data. She then critiques that their approach takes an objectivist stance which assumes there is an external reality that can be discovered, in order to come up with her more interpretative approach.

Thus, whereas I try not to force my data and analysis through my preconceptions, frameworks or hypotheses, I believe it is impossible not to do so to some degree. As I have already written, I am the person who has come up with questions to form this study and I am the one asking the questions of my participants, and observing their classes. I am the one analyzing the data that I helped to generate. Therefore, in using constructivist grounded theory, I am not trying to discover the real world, but tell the story of " a world made real in the minds and through the words and actions of its members" (Charmaz, 2000, p. 523). Thus, in the chapters that follow I tell a story which attempts to interpret how five science teachers construct their realities. The theories I develop seek to help explain these realities, and hopefully provide a useful tool for other researchers with similar questions.

Constructivist grounded theory is an inductive approach in which data gathering, analysis, and theory development occur simultaneously. I will describe my approach briefly below. After sitting in on between 1 and 3 classes, I had my first taped conversation with each teacher. These conversations ranged in length from 48 minutes (with Susanne) to an hour and 54 minutes (with Delia). Also, for Delia and Anne, the conversation took place in two parts since we ran out of time the first time we got together to talk. I continued to go to their classes and take field notes, and then after reviewing those notes and listening to conversations again, we scheduled the second taped conversation. The second taped conversations all took place in June near the end of the school year and was my last time with each teacher. These conversations ranged from 37 minutes (with Delia) to an hour and 11 minutes (with Jun).

As I looked over the field notes and re-listened to the conversations, I jotted down ideas that came out, and used what Charmaz calls the constant comparative method. That is, I compared across the teachers with regards to their views, situations, actions, accounts, and experiences. I also compared what they said in the first interview with my field notes about what they did and what their students did in the classroom, and compared the themes or ideas I jotted down for each teacher. I made notes on the themes I felt might be emerging across the data and I explored those more deeply in the second conversation. Charmaz calls this theoretical sampling, where you go back to collect more data to shed light on emerging theories. For example, in my field notes and in my first set of conversations, I noted the centrality of testing in the interactions between students and teachers as well as in the conversations about teachers' practices. This was an aspect of practice I asked further about in the second taped conversation.

After the second conversation I transcribed all the conversations verbatim, using the transcription conventions I described above. Charmaz advocates line by line coding, in order to remain attuned to participants' views of their realities, rather than assuming that the researcher and researched share the same view or worlds. I did use the spirit of line by line coding in that I recorded ideas about all applicable lines in my first re-reading of the transcript. However, I found that there were some lines that didn't warrant a code, and so I did not literally code line by line. Again, I compared across the teachers, and with the same teacher over time to help me establish categories for the themes I was identifying. I want to be clear that these categories do not just emerge, but come to the surface through my particular lens in aiming to answer my questions. Charmaz calls establishing categories in this way in order to synthesize and explain data, focused coding. The analytical framework then is shaped out of the categories. Throughout this process I would write short memos about the themes and categories I identified as a way of keeping track of what I might eventually write about.

For example, when I compared what the first year teachers in particular said about support for their practice, I identified a theme of wanting more feedback and more of a community to share resources. At the same time, I identified a theme of new teachers feeling that they had to appear self-sufficient. There appeared to be a tension between what they wanted and what they felt was legitimate in terms of support. These themes eventually fit into a category I labeled self-sufficiency and support. The framework for exploring and explaining the teachers' thinking and actions within this entails placing these within the discourses of new teachers that circulate in school communities and the educational community more broadly. I discuss this more fully in the next chapter.

Validity

My explanation here of how I analyzed the data is part of my attempt to convince my readers that my interpretations are valid. There are many facets, and meanings to terms such as 'valid' in the context of research. Traditionally, internal validity (the credibility of conclusion or how/whether other explanations could explain results) and external validity (if results can be generalized to other populations and contexts) have been the primary concerns. You likely understand by now that by valid I do not mean that my story accurately represents the exact stories my participants would tell. Nor does it mean that any researcher would come up with same themes and conclusions. And there are limits to generalizations in all research, and perhaps especially in education because what happens in any one classroom involves teachers interacting with students, both of whom have varying beliefs, motivations, experiences, etc. (Berliner, 2002) and in such social analysis the same curriculum, for example, can produce different outcomes (Erickson & Gutierrez, 2002).

In addition, construct validity refers to how well a test or some other measurable entity represents a construct a researcher is interested in studying. How credible can conclusions be and what good are generalizations if the measurements taken do not actually measure the construct of interest? The multiple data sources (stories, actions, curricular materials, policy documents, etc) are certainly beneficial in getting at something as all encompassing as the demands and responses of discourses. Construct validity here (or anywhere) is not a matter of proving that a measure correctly identifies a construct (since this is impossible, discussed below), but a matter of making a rhetorically effective argument that it is a reasonable and useful measure. Construct

validity is, however, impossible to prove (as it is impossible to exactly match reality with representation, concepts with objects, and words with things); and there are multiple interpretations of how well a construct is measured due to the fact that research discourses are shaped by ideologies, cultures, language, politics and power; and thus different research discourses produce different "truths" (Cherryholmes, 1988).

However, as many scholars (Kvale, 1994; Carr, 1995; Howe & Eisenhart, 1990) point out, claiming a postmodern stance does not grant the researcher freedom from validity concerns. Abandoning positivist epistemology does not entail abandoning standards of objectivity and rationality – though what these mean and what they look become more sophisticated, and more bound up in ethics and politics. Thus, I do intend to convince my readers that I have written a reasonable and valid argument that is supported by the data, and contributes productively and ethically to the conversation about how to better support teachers, particularly beginning science teachers.

Anfara, Brown, & Mangione (2002) suggest that qualitative research would be more rigorous and valid if the research questions, data collection and analysis were made more explicit in order to show how the context of the research setting and the researcher affected the data gathered and the interpretation and triangulation of that data. In addition, Kvale (1994) points out that bias is unavoidable, but unintentional bias can be counteracted by researchers making their presuppositions and views explicit. I have tried to do this throughout the project.

This explicitness is connected to the most important aspect of validity. I believe validity is not just ruling out alternative explanations, but involves the purpose and ethical implications, which are certainly effected by the assumptions of the researcher

and community and the research design. Lather (2002) emphasizes that any criteria for validity must be situated, relational, and temporal-historical. The crisis of representation – that researchers cannot hope to portray their participants exactly as they would portray themselves; that they cannot directly capture lived experience – is best dealt with by contextually relevant practices. Given the political nature of knowledge generation, contextual relevance always involves questions of ethics, blurring the lines between ethics and validity. All research is really about making an argument, using data as evidence and thus rhetoric and validity become blurred. This does not mean that because a study aims to do the right thing, that it is valid. I think Lather wants research to move away from tests of validity that obscure purposes and contexts and reconfigure a meaning of validity that highlights these aspects instead – with the purposes of research recognized as political and ethical. Given this focus on ethical purposes of research, it is pertinent to examine those purposes and the harm and good that potentially results from research for the research participants, and the communities of which they are a part. Again, I have tried to stay cognizant of these priorities throughout the project.

Chapter 2 Discourses affecting and produced through teaching practices

In order to make sense of data produced in this study, I employ a framework that I have melded out of the similar ideas of several researchers/theorists in a way that provides analytical purchase for investigating my participants priorities for and enactment of their teaching practices. Central for me to what constrains and enables both notions of good practice and the enactment of teaching practices, are the "contexts" (curriculum, schools, students, personal histories, experiences and beliefs of teachers, etc) such intentions and actions inform and form within. However, the term "context" does not capture fully the dynamic nature of the practices and intentions of teachers situated in particular socio-cultural and material circumstances. Thus I employ the concept of *discourse*. Discourse is a construct which is used a great deal in social science research, and which carries many meanings. Below I will explain what I take this construct to mean, and why and how I use it.

The socio-cultural turn

Geertz (2000) argues that social scientists, among whom educational researchers are usually classified, have shifted in how they conceptualize investigating learning or behavior away from (seemingly) tidy cause-and-effect explanations of the natural sciences towards interpretative explanations, borrowing analogies from the humanities. This turn taken in the social sciences (p. 34) places a greater emphasis on the significant role of the cultural, historical and social contexts affecting and being affected by the actions and thinking of people.

Making sense of the thinking of particular teachers (or whomever), entails having access to evidence of such (talk, for example) in light of the context. Thought as a process may be individual, but it is enabled and mediated through symbol systems (language) of discourse communities; thought as a product, then, is always social and cultural. Like Cole (1996), Geertz (2000) conceives of cognition, emotion, motivation, perception, imagination, memory, whatever ...as social affairs (p. 153).

Sfard and Prusak (2005) similarly refer to "the general sociocultural turn in the human sciences," (including educational research) as a reason for a great interest in the notion of *identity* as created and recreated in social interaction (p 15). Likewise, the notion of *discourse* – with various definitions, and discussed in more detail below – takes up the salience of cultural, historical and social contexts. Britzman, like countless scholars, draws on Marx: "[People] .... make their own history but do not make it just as they please" (Marx in Britzman, 2003, p. 40). Thus teachers' goals, interpretations, thinking, relationship-building, action, etc – can only be understood situated in their contexts – the discourses of schools, teaching, learning, knowledge and science from their personal life experiences and society more broadly. These discourses, both internal (personal histories, teaching experience, etc) and external (expectations of teacher behaviour, support, accomplishments, etc) constrain and enable particular thinking and action. Let me now be more explicit by what I mean by *discourse*.

Discourse

Contributing to and precipitating from the socio-cultural turn is the notion of discourse. Many scholars draw on the work of Foucault for building tools of inquiry to help answer the hows and whys of thinking and actions of people, especially historical contributions that legitimate or challenge such thinking and action. For example, Britzman (2003) uses the idea of discourses to investigate the voices of student teachers. She draws on Foucault's notion of discourse as *taken-for-granted ways of understanding, speaking and acting*, as she "questions the consequences of the taken-for-granted knowledge shaping responses to everyday life and the meanings fashioned from them" (p. 35). She also quotes Thomas Popkewitz's definition of discourse as "set[ting] the conditions by which events are interpreted and one's self as an individual is located in a dynamic world" (Popkewitz in Britzman p. 39).

James Gee also draws on Foucault, but uses somewhat different vocabulary. For Gee, these ways of understanding, speaking, and acting which set the frame for how individuals interpret themselves and the world, is closer to what he calls Discourse, with an upper-case D. Gee (1996) defines Discourse as ways of knowing, doing, talking, reading, and writing, which are constructed and reproduced in social and cultural practice and interaction (as opposed to "discourse" with a lower-case d, meaning a stretch of language). This notion of Discourse is similar to how Erickson (1996) defines culture, as implicitly learned standards of ways of thinking, speaking and acting within a group or network of people, shaped by shared values and knowledge, which are aligned with power and thus political divisions between groups.

For Gee (1999), recognition is central to Discourse. To be recognized as a particular someone we use Discourses – language, actions, interaction, values, beliefs, symbols, and tools, which are embedded in a medley of social institutions. Gee (1999) likens Foucault's notion of discourse to his own idea of Conversations (with a upper-case C). Gee writes about Conversations between and among Discourses which involve controversy or debate, which are connected to values and ways of thinking that are historically constituted and often taken-for-granted (i.e. people involved in Conversations using Discourses are unaware of the historical events that helped to create or shape the themes and values involved in the Conversation).

One common thread among these ideas of discourses is that these ways of understanding, communicating, valuing, and acting (which are taken-for-granted) are always, in some way or another, within a community and through interaction. Lave and Wenger (1991), who focus on what they call situated learning, write about communities of practice, within which learning involves the construction of identities (p. 53), constituted through participation in a community, where such participation is increased with seeing and engaging the sociopolitical organization of practice (p. 91). Using the ideas of discourse above, Lave and Wenger's communities of practice might aptly be termed discourse communities.

As Gee (1999) points out, there are many scholars who employ similar ideas to those laid out here.[1] With this quick review I have intended to point out the similarities or core of the notion of discourse as I see it and thus why I feel it is a generative tool for

[1] Gee notes that his term "Discourse" is meant to cover important aspects of: discourses (Foucault 1996, 1969, 1973, 1977, 1978, 1980, 1984, 1985); cultural communities (Clark, 1996); discourse communities (Berkenkotter & Huckin, 1995; Miller, 1984); practices (Barton & Hamilton 1998; Bourdieu 1977b, 1985, 1990a,b; Heidegger 1962); cultures (Geertz 1973, 1983); activity systems (Engestrom 1987, 1990; Leont'ev 1981; Wertsch 1998; among others (p. 38).

inquiry. I take discourse to mean something along the lines of *taken-for-granted ways of thinking, communicating, acting, values and tools, constructed through shared language, practice and interaction embedded in social institutions that help shape the theories through which people understand themselves and their worlds.* Gee (1999) notes terms such as discourse are thinking devices that guide us to ask certain sorts of questions (p. 37). For me, then, using the tool of discourse helps to focus on how taken-for-granted language, beliefs, practices, and institutions affect the way my participants envision the work of teaching science and how they form their teaching practices.

For many educational researchers, particularly in the area of literacy, the framework of discourses has been helpful. Of particular interest for this study is Moje (1996), who studied literacy practices in a secondary school chemistry classroom. She draws on Gee's (1990) notion of literacy as discourse as well as Erickson's (1986) ideas of classroom culture, where teachers and students define and negotiate rules, norms and values. And thus, the thinking and practices that inform reading and writing and oral language use of any content area like science "are embedded in the unique social and cultural discourses of the classroom, school and larger culture, as interpreted by the people who interact in school settings" (p. 175).

Moje conceptualizes classroom culture as defined by teachers' and students' beliefs about the nature of knowledge; philosophies and knowledge about the discipline, teaching and learning in that discipline (in this case, chemistry) and teaching and learning in general; past school experiences and their role in schools; home and community experiences; and feelings and emotions about school and themselves in general (p. 175). Thus with a similar frame I hope to shed light on my participating teachers' beliefs,

philosophies, experiences, and emotions, and how aspects of these are in response to their students.

Teachers' stories, discourse and identity

Often linked to the notion of discourse is identity. Britzman examines the meanings that people (student teachers in her study; early-career teachers in mine) produce "through their theories, practices, routines, discourses, contexts, and reflections on educational life" and "how such meanings produce identities" (p. 37). Gee avers that we use Discourses to be recognized as a certain kind of person. Lave and Wenger write about constructing identities through participation in communities of practice.

So identity, as I and many other researchers see it, is not akin to some extra-discursive unchanging essence of being, as is attached to terms such as personality or character. Rather, identity is fully discursive or collectively shaped. In order to operationalize this slippery concept, Sfard and Prusak (2005) define identities as "collections of stories about persons" (p. 16). They equate identity-building with story telling. Thus, stories that people tell to others (which is a primary data source in this study) or themselves, or those that others tell about them (which I am doing), are not windows into or reflections of identity. Rather, these authors argue, these stories themselves are a useful way to operationalize identity.

As Sfard and Prusak point out, identities originate in daily activities and experiences, but they claim "it is our vision of our own or other people's experiences, and not the experiences as such that constitute identities." They present narratives as "*discursive counterparts* of one's lived experiences" (p. 17). Clearly then, actions,

experiences, and practices are integral to one's identity, and narratives help to shape these actions. Recognizing this, Sfard and Prusak focus on stories and "the activity of identifying, rather than the end product ... on the complex dialectic between identity-building and other human activities " (p. 17). Specifically these authors and I are interested in the co-molding of narratives and deeds, and in the interaction between community and individual levels (p. 21), and thus the interplay between discourse and identity.

We must keep in mind that not any story counts as a narrative, nor a narrative which forms and informs identity. Sfard and Prusak (2005) specify that such narratives must be "reifying, endorsable, and significant" (p. 16). Reifying statements indicate repetitiveness, using verbs such as be, have or can, rather than do, or adverbs such as always, usually, generally or never. Endorsable simply refers to stories that are taken to be true by the individual in question. And these authors suggest that a story is significant if a change in the story affects the story-teller's feelings about the person of interest.

In addition to this criteria, Labov (1972) defines a narrative as a recapitulation of past experience. In Juzwik's (2006) discussion of Sfard and Prusak (2005), she notes that Linde (1993) defines narrative as requiring an *evaluation* from the point of view of the teller, and that "Ochs and Capps (2001) reframe evaluation as *moral stance-taking*" (Juzwik, M.M., 2006, p. 16). Thus, I will use the criteria of evaluation or stance-taking – describing what is good or right or desired – as a necessary part of narrative which helps to form and inform identities of the teachers in this study.

Analyzing teachers' stories using discourse (and its connection to identity)

The notions of discourse and identity, then, help me to ask particular questions and analyze these teachers' stories from a particular angle. In my conversations with my participants, in my observations of their teaching, I looked for evidence of their ideas of good science teaching, and what (perhaps taken-for-granted) practices, policies, situations, and language appeared to constrain or enable those ideas in their practice. In the chapters that follow, I present stories of these teachers' thinking and practices and how I take this thinking and action to respond and contribute to particular discourses.

In the following two chapters I write about these teachers stories centred on ideas and practices inside their classrooms and what and how discourses constrain and enable these ideas and practices. In chapter three I put together the stories of teachers' ideas of the goals of teaching science – stories that help to shape their practices, and come out of their daily activities and experiences and carry evaluation of what is important in what and how science is taught. I hypothesize about the discourses that help to shape (specifically constrain) these goals. In chapter four, I discuss their views and enactment of relationships with students, and how those affect and are affected by their vision of good teaching and how both interact with discourses of teaching.

In chapters five and six I focus the teachers' stories around their interaction with larger communities and discourses originating outside their classrooms. In chapter five I explore the discourse of curriculum and testing (and specifically of accountability) and how each teacher's notion of "good teaching" informs, contests, and is constrained and enabled by such a discourse. In chapter six I discuss the teachers' stories of learning to teach, and support for their practice, both in terms of their experiences and their desires.

I explore how discourses of new teachers, self-sufficiency and community interact with those experiences and desires. Thus, in these broad areas of teaching and testing science, relationships with students, and learning and developing teaching practice, the interaction of beliefs, practices and discourses is the analytical angle used.

Chapter 3 Classroom Stories: Priorities and practices of "good" science teaching

In order to better understand what and how discourses constrain and enable teaching practices and identities, I first had to get an idea of what my participants saw as what they were trying to accomplish. Like Ochs and Capps (2001) and Linde (1993), I sought stories which indicated evaluation or moral-stance-taking. Thus, I wanted to get a sense of their visions of "good" science teaching. I asked all of the teachers in this study in the first taped conversation, what their goals were in teaching science. Depending on the flow of the conversation, I just asked the question and then followed up on the answers (such was the case with Delia and Anne), or in some cases I suggested what I meant by goals of teaching such as students being successful in school, learning what they need to for adult life, or learning what they need to for a basis of a career (such was the case with Susanne, Jun and Jaelyn). In both cases I tried to build on the responses to get as full a response as possible without forcing teachers to talk about something they did not see as important.

This question and its follow-up elicited what they felt were the goals, priorities or big ideas for "good" science teaching. I felt the responses would carry evaluation of what the most important goals are; what the most important elements of science teaching are. In addition to the first conversation in which we talked about their goals, I asked them in our second conversation about how they would do things differently if they didn't have the structures that dictated, to some degree, what and how they taught. For example, I asked them to imagine there was no B.C. curriculum, no provincial exam or no common school tests. This helps to paint a fuller picture of their notions of good teaching – of

how they want to teach and how they feel constrained and enabled in acting on those notions.

I grouped themes I identified in the stories within the larger category of notions of good science teaching. These teachers' stories of good science teaching share a lot of elements in common. I believe this is partly because the themes came out of a conversation about goals, and thus tend to focus on *what* teachers want students to get out of their science teaching. In addition, in many ways the contexts and discourses within which teachers form these ideas are similar. *How* each individual teacher attempts to achieve these goals also has similarities (again not surprising given similar contexts), but there are differences as well, as there are of course differences in the stories and identities of teachers even in similar circumstances. For example, how a teacher tries to capitalize on or generate interest can be different, even though both see that interest as important.

I focus in the following sections on the themes associated with their goals for teaching science, both in terms of what science students need to understand and how best to help students achieve that understanding. Then I make an argument about how their ideas of good teaching, and their actual practices interact with discourses of teaching and motivations for choosing teaching as a career.

Relevance to everyday life

Helping students see the relevance of material to their lives was an element of teaching science that all of the teachers identified as significant. One aspect of seeing relevance is understanding or realizing how "science is everywhere" (Jun, Apr 18/06; Susanne, June 6/06). Jun felt this was important so that students "can see those real life

applications" (Apr 18/06). Likewise Jaelyn said "I think they [students] don't realize how much science we use in our lives. I think is our job to make them realize it is relevant"(Mar 3/06).

Jun conveyed that particular content was especially relevant. "I really like talking about things like that [climate change] and saying, 'you are the future voters, and decision makers and consumers.' ...the same when we talk about the respiratory system and smoking" (June 21/06). Anne also mentioned environmental science as "really important, especially living in a consumer society and a society which really does have the ability, by changing its ways, to impact the health of the whole world" (Mar 29/06). Anne further evaluated content based on how "practical" it was. For example, the body systems unit in grade 9 – learning how bodies work – "are things they are going to encounter throughout their life" (Mar 29/06). Similarly, Anne talked about specific content being both interesting and relevant. "It is really interesting knowing how simple machines work, and it can be very useful, especially for students who plan to go into professions like engineering or into trades where these things are really put into practice every day" (Mar 29/06).

Delia tried to infuse her lessons with real-life applications. For example, during the genetics unit in grade 10, she tried to initiate discussion around uses, consequences and opinions about genetic research and engineering, such as genetically modified organisms (e.g fish genes in tomatoes to help them withstand cold conditions) and in-vitro fertilization (May 9/06). When I asked her about the lesson afterwards, she said that her reasons for including that were "to help them realize they should know this and why"

and because biotechnology is a huge industry, particularly in B.C., with huge corporations making big decisions about practices like agriculture.

When we talked about her goals in the first conversation, she also talked about students building understanding which is useful in life. She talked about them understanding what people were talking about on TV shows like CSI (Crime Scene Investigation), or how taking an antacid is a simple neutralization reaction, or how to scrutinize claims made on shampoo commercials (Apr 11/06). Similarly for Jaelyn, one goal for the junior sciences was to provide "basic knowledge that every citizen should have" (Mar 3/06). She wanted her students to be "scientifically correct" in their everyday conversations and be able to use that knowledge in their lives.

When I asked Jaelyn how she would teach differently, how she would change the curriculum if she had the leeway, time and resources to do so, she said she would build a course based on concepts we use every day. As she put it, she would "try to bring the concepts into the life, not the other way around" (June 22/06). She gave the example of a refrigerator or a car and learning about how they are made and how they work, which requires learning about concepts like density, melting point, or gravity, rather than learning these concepts first and finding examples to illustrate them. Jaelyn said that sometimes she had a hard time thinking of intriguing examples and she complained that the textbook examples were not very realistic.

Similarly, Delia felt that she was "pretty good at trying to relate the criteria to their lives" and she gave the example that she was "not just preaching the textbook" but trying "to make them talk about it" (May 9/06). Here Delia is connecting a goal of good teaching – relating the concepts (criteria) to their lives – with a practice of discussion

(like she tried to use in the lesson I observed on genetics), presumably during which students can relate the concepts to their lives and experiences. Jun relayed a similar sentiment. Therefore, relevance is not just a goal and necessity for good teaching, but it is achieved through distinct kinds of practices such as discussion.

Interest and curiosity

Jaelyn saw interest and relevance as two sides of the same coin. She claimed that especially for the junior sciences, like grade 8,"to generate interest in science is the key" and "to generate any interest in anybody is to make it relevant" (Mar 3/06). She relayed her experience with students: "Once they can relate it to what they see in everyday life, I mean, they get more interested in it. Once they are more interested, ... well, why does that happen? I mean they were asking questions" (June 22/06). Just as Jaelyn desired to make her curriculum more realistic, she also said she would spend more time on "topics that generate interest" (Mar 3/06). When I asked about her greatest concerns in her teaching, the second one she mentioned was "making the lesson interesting" (Mar 3/06).

Student interest was a significant factor in Anne's job satisfaction and planning. "I get excited about being able to explain things that are kind of bizarre or mysterious." (Mar 2/06). She really tried to respond to student interest as well. "If it is what a particular class is interested in, then I do want to spend more time on it" (Mar 2/06). And this is exactly what she did. For example, I noted that she put a lot of time and effort into the astronomy unit it grade 9, even though this was a topic that Anne saw as the least relevant in the curriculum, and as a biology major she did not feel the most prepared to teach. However, because she anticipated student interest in the topic, she had gone to a

workshop at a conference for science teachers and incorporated concepts like active galaxies, which are not in the textbook or the PLOs.

It is not surprising that in any subject matter, a teacher's priority is to do her best to generate and capitalize on student interest. In science, this is often thought about in terms of being curious about how the world works and the processes of trying to answer the questions we are curious about. These teachers are no exception to that. When I asked Susanne about what was important that her students get out of her class, her first response was to "pique their curiosity. To get them thinking and go, 'huh, well why is that?" (May 9/06) She felt accomplished when her students showed they were excited about science. "The thing that gets me is when the kids come in and they go, 'ya, I got science class.' And it's not a joke. They are actually 'What are we doing today? What are we going to learn?' And that to me is a big thing" (May 9/06) Similarly, in our second conversation, when I revisited this idea she said she wanted to share her passion for and knowledge of science (June 6/06).

Delia shared her passion for science using a particular strategy of trying to convince or help her students see science like she does – as easy and fun. She fought the notion that science is hard or that it is "normal" to "hate science." She said, "I fight that, you know. And try to get them interested. That would be one of my main goals" (Apr 11/06). Delia wanted her students to see science, "even though it is taught as something academic, it really is this wondrous" world of "repeating processes," like looking at an atom and the universe and seeing the repeating pattern of things orbiting things (Apr 11/06). Delia wanted to get students interested and seeing the wondrous side of science.

Content

What is interesting here is that the importance of content was almost always filtered through a lens of relevance and to some degree interest. *What* content was worth knowing or important for students was content that was seen by the teacher as relevant for their lives and thus more likely to be interesting. I have already made note above about specific content seen as particularly relevant by some of the teachers. Anne's opinion about the astronomy unit in grade 9 was the one case where a teacher separated relevance and interest. She described the astronomy as "really neat, but right now I don't see it as a pressing issue ... It is one of those gee-whiz topics that draws a lot of kids in ... kind of glamorous but not as applicable" (Mar 29/06). Jaelyn felt that the "content" was important, but not at a high level for the junior sciences, and so the processes of science were more important.

I asked the teachers about what specific content was most important, or what they spent more or less time on and for what reasons. Aside from the arguments above about relevance (and interest), the other major determinants were their own knowledge of the curriculum, and time. As will be discussed below, teachers do tend to spend a little more time in areas of the curriculum where they are more knowledgeable and feel they can provide more interesting and relevant lessons. However, all the teachers in the study, were very diligent about following the curriculum closely.

At Saunders, Susanne, Jun and another colleague, Clarissa, all taught science 8 and 9, and they built together and shared tests for topics and unit exams. Thus all of them followed the PLOs closely in part to stay largely in sync with one another. I noted in my observations that Susanne even put up the PLOs for the students to see at the beginning

of every unit and discussed with the class what they were expected to understand by the end of that section. Susanne also said "we go pretty much according to the textbook, with variations here and there, obviously" (May 9/06).

Jun admitted that there were some physics concepts that she was less comfortable teaching, but she also said that she didn't feel like she was experienced enough to judge what she could cut corners on in terms of the curriculum (Apr 18/06). Her syllabus and her teaching revealed that she stuck closely to the PLOs. Whereas, there were not common tests at Turner, at least between Anne and Jaelyn, there was still the expectation of following the PLOs. Again course syllabi and my observations of teaching revealed a program that had variation, but did not vary in following the PLOs. In addition, aside from claiming there was far too much detail in the grade 10 curriculum, Anne said all the topics in the grades 8 and 9 curriculum were "really interesting" (Mar 2/06), and thus presumably she was happy from this perspective to engage in all the topics with her students.

Processes of science – inquiry and application

In talking about goals for student learning in science, all the teachers raised the idea of the processes of science as important. Later when I was trying to come up with categories within the theme of good science teaching, I thought some of the ideas raised by the teachers seemed to fit somewhere into what Anderson (2003) calls *inquiry and application.* Anderson nicely lays out inquiry as the process of finding patterns in experiences or phenomena to generate explanations. Application follows this process in

reverse: taking explanations already generated and using them to predict phenomena (p. 11-12). The ideas present below, I believe, are elements of inquiry and application.

Ideas about the importance of learning how science is practiced (i.e. inquiry and application) varied among the participants. Anne wanted her students to learn how interrogate methods and conclusions. She wanted her students to use the processes of science to evaluate claims. "People take everything at face value and don't evaluate what they are being told. So I would like kids, through science, to be able to make their own decisions about stuff. ...They need to know how to do research. ...how to find information and ...how to evaluate information. ...They are great at finding stuff usually, but suck at evaluating it" (Mar 2/06). Anne's emphasis, then, was mostly evaluative – are the explanations generated from patterns in data justified? She gave the following example: "they are being told that there is no scientific truth about greenhouse gas emissions causing global warming. I'd like them to be able to look at some of the things that are happening and make a decision based on their scientific evaluation skills." (Mar 2/06). In addition, Anne wanted students to be able to form a hypothesis and decide what technique would work for their question.

Similarly, though less thoroughly, Susanne talked about students learning to question claims as being important (June 6/06). Susanne did not elaborate on what she meant by students learning to question what they are told, but she did feel that if there was "less stuff in the curriculum" she would have more time to focus on it. When she spoke of what she felt students really needed to understand, Susanne talked first about "the scientific method – lab formats and stuff like that" as important for "the upcoming

years" (June 6/06). Here Susanne brings up the ideas of how to investigate – find patterns in data – especially for the one purpose of preparing students for the senior sciences.

Jaelyn also focused on the processes of investigation. "I think the important thing is how to question stuff. How do they go about investigating stuff? How do they go about finding answers to whatever they are curious about? ... How do they go about experimenting, researching, sharing, comparing?" (Mar 3/06). When talking about this she referred to a research assignment she had given her students, which was to be on any topic that interested them. This kind of assignment, she felt, helped them to build that capacity.

Similarly, Jun talked about "the processes of investigating for sure" in terms of what was important for students to understand, adding "I always tell them you have to record what you observed or measured" and "if it doesn't come out to what you had expected or what all the theories say, they you need to think about what went wrong or what was the possible source of error" (Apr 18/06). Here Jun is highlighting the importance of understanding how the patterns in the data construct the explanations, and she is guarding against making the data fit into explanations or theories.

Jun also talked about really understanding theories and patterns in order to apply them. For example, in her grade 10 class on May 23/06, she was taking up homework on calculating probabilities of offspring using Punnett squares. When doing the question with the students she called the male and female possibilities sperm and eggs, so students would not get lost in using the theory of recessive and dominant genes for traits in figuring probability, but keep in mind where these probabilities were coming from – combination possibilities of particular sperm and eggs. Jun was concerned about the

ideas and understanding getting lost in calculations. She gave the example of many of her grade 9 students in the work and energy unit of the course: "Okay, the mechanical advantage is six. What does that mean? A lot of them can't tell you" (June 21/06).

Similarly, Delia stressed in her classes understanding over memorization. "If they understand there is actually less information that they need to know" (June 27/06). During our first conversation she said, "I want them to understand the processes. And I don't want them to go home and memorize" (Apr 11/06). She recalled her students asking her if they had to memorize certain kinds of chemical reactions: "I'm like, no. Please understand why they happen," like why one element is more reactive than another. (Apr 11/06). Delia compared "memorized facts" with being told you can't do something "because I said so" rather than being given a reason. She wanted her students to understand the reasons for phenomena.

The filtering of science

To summarize, a big part of teaching science for these teachers was helping students really understand some of the world around them, and helping them realize how that understanding could make a difference in their lives, from preparing them for future school and careers, to making lifestyle, political and consumer choices. Their convictions for relevance and interest are similar to ideas teachers of any subject matter might hold. For example, an English teacher might talk about choosing books that relate to students lives and engage them in moral dilemmas that are a part of everyday life. The importance of relevance is a generic idea that applies to all subject matter, not just science.

Good science teaching is also seen as a vehicle for encouraging wonder and curiosity and teaching youth how to investigate phenomena and question and investigate the claims of others. In my conversations with teachers, and in my observations of their practice, it is hard to say conclusively which of these aspects of good teaching were the highest priorities for each teacher. Some talked a lot more than others. And I do not want to make the assumption that the first thing they said is what is most important. Also, these priorities may very well have varied according to which class each teacher had foremost in their mind, or recent events in their classrooms. So this priority in science teaching, which is more specific to science, is less well articulated. And even though the idea of inquiry can certainly be firmly linked to science, the more generic notions of curiosity and investigations can be aspects of school in general and many disciplines. For example, in history students may investigate different sides of stories to try to determine perspectives, motives and events. In math students may investigate different ways to solve a problem. Thus, again, important science content is filtered through a lens of more general service to students, rather than connected to the structure of science as a discipline.

I would like to note here that, when I asked every one of these teachers what their strengths were, all but one responded that they had productive relationships with students. I think all their commitments (including Jun, who talked about it as something she needed to work on rather than a strength) to this aspect of their practice was evidenced in their emphases on interest and relevance. The prominence of igniting interest and engaging in relevant material may very well demonstrate as much a desire to develop relationships with students as to provide useful quality science teaching. Developing

relationships with students was clearly a very significant aspect of their identities as teachers. I have not included this aspect here in this section on good science teaching because I felt this warranted its own category, which I will explore more thoroughly in the next chapter. I was originally focused on good *science* teaching, although I have come to the conclusion that science is secondary in the minds of these teachers with regards to good teaching. Their priorities for their practices focused more on serving students with "good teaching" and their teaching happens to be in science.

Jun provides a poignant example. When I asked about goals of teaching science or what was important for students to understand, she responded "preparing them for future studies; but not just in science. ...I almost think the content is not the most important part" (Apr. 18, 2006). She suggested that work habits, working in groups, following instructions and things like that were important since anyone could use them later in life. Similarly, Anne talked about "a lot of what I'm doing is not having anything to do with the academic requirements of the course" (Mar 2, 2006). She noted that especially in grade 8 she was training them how to be students, respect each other, listen, think and bring their books to class.

Part of the reason for good teaching to be secondarily about science may stem from motivations for teaching. Jun had wanted to be a teacher since she was in elementary school. She earned a degree in education with minors in math and science to teach in those areas. Anne had known since she was in grade 10 that she wanted to be a teacher and she had had several jobs working with youth like in camps. Her father had been a science teacher and she had been "encouraged to go into the 'harder' fields" (Mar 2, 2006) and so she ended up with a degree in sciences. Delia too had wanted to be a

teacher for a long time, but due to family pressures she had tried the avenue of pursuing a career in chemistry first, which she hated. She correctly describes herself and an extrovert and she did not feel a job as a chemist was for her.

Jaelyn, on the other hand had not had her sights on teaching for a long time. She talked about "debating" between a laboratory job and teaching. She decided to get her teaching degree and in the course of her program she discovered that "I love chemistry. I love teaching. And both of them can be combined in this profession..." (Mar 3, 2006). Susanne talked about considering a career in pediatric nursing since she wanted to work with kids. She decided to teach in part because a friend talked to her about "all the things you could do as a teacher in terms of helping kids" (June 6, 2006). Thus, overall primary motivations for teaching had more to do with working with students and helping people than the disciplines of science. Passion for the subject matter is there, but it seems to take a back seat.

This makes sense since if passion for and interest in science was primary, these women might have pursued careers as chemists or biologists rather than teachers. And given that the five participants in the study are all women, it is not surprising that their motivations to teach revolve around helping students and connecting with students. Whereas this is a primary motivation for all teachers, women may be more likely to emphasize this social and caring component over subject matter knowledge and passion. Women are socialized to take up the care-giver role and be compassionate and understanding. They have also, more recently, been encouraged to pursue fields where women are underrepresented, such as the sciences.

The teachers in this study were chosen not because they were women but because

they all taught science at the junior level in secondary schools in B.C., meaning grades 8, 9 and 10 science. At the National Association for Research in Science Teaching (NARST) conference in April 2007, the keynote speaker, David Pearson of U.C. Berkeley opened his keynote address with a joke. He said everyone knew that elementary teachers love their students, secondary teachers love their subject matter and college or university teachers love themselves. My participants' views of good teaching, particularly the filtering of science content through connecting to students via relevance, interest, and maintaining curiosity and wonder, might be seen as more typical of middle school or even elementary school teachers. It is tempting to surmise that their views, if they are atypical of secondary teachers (which I am not sure that they are), are because they all teach junior secondary level sciences. However, Delia and Jaelyn also teach senior science – chemistry 11 and 12, and Susanne was going to teach grade 11 biology in the following year. And everyone in the study is certified to teach senior science in their areas of specialty. Thus, it may have something to do with the fact that they are all women with an emphasis on caring about and connecting with students.

These teachers did talk about passion for their subject matter, just as the joke projects. However, I believe it was these passions, the curiosity, and the reasons why they love the subject matter, which was what they wanted to get across to their students – even their students in grade 12, although they certainly felt more freedom to do this in grades 8 and 9. There is good reason to shift priorities slightly in grades 11 and 12 because students are taking these courses where the focus shifts to preparation for future studies rather than just future lives, and so particular content may take on a bigger role. I argue however, that while this contextual change may shift priorities, it does not change

to any great degree their ideas of good teaching, which affects the way they interact with students.

Whereas I can only surmise about the role of gender and motivations for teaching, I can conclude here is that there are these areas of similarity among all these teachers. I am not interested in describing each participant as a certain kind of teacher, but rather I want to get a sense of their visions of good science teaching in order to make arguments about how these visions and their practices interact with discourses. In the chapter that follows I will more fully describe my participants relationships with students, as I see this as central to all their practices. I will then turn to the ways in which these teachers' largely-shared visions of good teaching and practices interact with larger discourses about and within teaching in their contexts.

Chapter 4 Classroom Stories: Relationships with students

In the previous chapter I discussed how my participants ideas of "good" teaching interact with the discourses of which they are a part as teachers, and perhaps particularly as women teachers. I argued that their ideas of good teaching were most closely tied with a commitment to relationships with students than representing the disciplines of science. In part I believe this comes from what they saw as who they were as teachers and what they attributed as their strengths. Interestingly for the new teachers – Anne, Delia, and Jaelyn – this was the first response, as their biggest strength. Based on watching them interact with their students and listening to their stories, I believe this is a particularly central aspect of their identities as teachers – it is the main thing that makes them good teachers (although of course this is not the only element).

Whereas this aspect of teaching was still central to the more experienced teachers – Jun and Susanne – it was not as prominent in their talk, nor in their classrooms. When I asked each teacher about their strengths, all of them except Jun talked about their relationships with their students. Susanne and Jun's interaction with students in their classrooms and their stories of relationships with students did not take on the same feel as it did with the newer teachers.

Below I will discuss each teacher's stories and incidents of building relationships with students, to produce a picture of this aspect of their identities. One way to think of this is that a theory about the roles of teachers and students is part of a teacher's identity, which is formed and informed by the discourses within which they exist. Specifically, discourses affect and are affected by expectations that influence thought and action

within that discourse. I will look particularly, then, at what expectations, and associated needs and obligations, these teachers saw their differently conceived roles with and for students fulfilling.

The first year teachers

Anne

Anne talked about her greatest strength as her ability to connect with students. It is worth quoting her at length:

> I feel I'm best at making connections with students. ... I feel that I only very rarely in my 5 to 7 month career (laughing) have encountered a student that I couldn't make a connection with. I feel that is a big strength, because I can sit students down and tell them what I need or sit students down and ask them to tell me what they need. And we can have a real dialogue about it. ... Since I've been teaching [this grade 10 class] I have students who have shown up for the first time last week. And I've somehow been able to not discourage them enough that they are coming to class everyday (Mar 29/06).

Clearly Anne felt accomplished at getting to know her students in order to do her best to meet their needs. This is important for any teacher, but perhaps even more emphasized when working with particular populations of students. Even though she is brand new at teaching, she was already carving out a niche for herself in working with students with particular needs, be those learning disabilities or students defined as "at-risk." She had taken extra courses in special education and had a background working in municipal family services programs. She identified with being the kind of teacher who could relate to kids, who cared about them and who could teach students that other teachers did not know how to connect with.

She told me that she kept in mind that a lot of high school students' behaviour is often motivated by not wanting to be embarrassed. She also accepted that questioning authority was "an important part of this time in their life" (May 4/06). Thus, she tried to understand where these teenagers were coming from and why they act they way they do in order to respond in ways to build a generative relationship as a teacher. In general Anne tried to be flexible and to respond to the particular situations and needs of students.

> "I mean you have to understand that these kids' lives are hard. I mean some students at this school have harder lives than you or I could ever imagine. I mean I've got a student who is practically a mom. She's got a sister who has a baby and the sister is always at work, so her job is to look after the baby. And what can she do, right? So you can't – I mean to me, I think that if school fails to be flexible for the kids, the kids fail to be successful in life" (June 22/06).

Anne's flexible approach and her priority of "connecting with" students lead to what she called her "loose style" in the classroom. She felt that her loose style facilitated some great learning moments, such as the day she derailed her lesson to address a homophobic remark and have a valuable impromptu discussion about the rights and experiences of members of the GLBT community in Canada. At the same time however, it also facilitated moments when students would shout out inappropriate comments, as happened in one class I attended. Thus, she said she was "trying to find the balance between strict but loose enough to teach the way I want to teach" (Mar 29/06). Later in the year she also said she tried to be flexible, but that she had also been too flexible, which had caused more headaches than it was worth.

With her flexible, responsive, understanding approach, Anne was aware that other teachers, and other people in society have different ideas; that her tack may not be preparing these students for the real world where they can't show up and say they forgot. Anne struggles with this a little bit, as she said, "sometimes it does feel like we are coddling them, especially students like mine who couldn't get up for all of third semester. And then I let them do all the work in the last two weeks" (June 22/06). But in the end Anne identifies as a teacher who understands her students. She openly struggles with being too flexible, but in the end she teaches in ways that she believes in. She argued,

> "there is a reason they are not in the real world yet. They are students. There is a reason why they haven't graduated from high school. ... So yes, they are growing up and they are learning. ...When I present my rules ... they sound hard and fast. ...Then when students come to talk to me, I'll make exceptions. And, you know, I will, if a student has really blown their chances, they've blown their chances. I mean, I do draw the line somewhere. I just don't think we need to act like McDonalds here. This isn't a workplace. Sure their job is to learn, but we're not paying them for it" (June 22/06).

Anne definitely demonstrated to her students that she believed in them, and that she would not give up on them. She gave them lots of chances to make-up or re-do work. In her grade 10 class in particular – the one composed of students most likely to fail science 10 – she did bend over backwards to give them every opportunity. She felt that in a lot of their other classes, other teachers had given up on them and that many of her students had given up on themselves (June 22/06).

Above all else, Anne's priority in teaching was to be responsive to students. One way which I've already discussed was being flexible with due

dates and things like that if she knew something was going on in students lives. More generally, with all students, she tried to provide a wide variety of opportunities to learn and "different ways to express themselves" and "multiple ways of showing their knowledge" (June 22/06), in an attempt to mesh with how students learn, their attention spans, interests and strengths. She used a wide variety of learning activities and assessment tools, like writing stories, creating comics, and doing skits, as well as more traditional methods of laboratories and tests. She talked about and demonstrated that she responded when students were interested in something. As I noted previously, she learned more about astronomy at a science teachers' conference, since her students were interested in that topic even though it was a topic she was not particularly passionate about. She started a dissection club after her grade 8 students did their only dissection in the curriculum and were keen to do more. For Anne, her most important role as a teacher was teaching in ways that were responsive to her students.

Delia

After talking with Delia, I really felt that I could understand her motivations for the way she interacted with her students. She talked at length about her early experiences in school, and a lot of negative feelings, and how those were so detrimental to her. And so her approach was overwhelmingly for students "to associate these good feelings" with being in her class and the subject matter (Apr 11/06). She worked hard to convince her students that science (and chemistry) was something that was easy and fun. She talked about it this way:

> One of the reasons I tell kids how hard it was for me to read is because a lot of kids just decide they are bad at science in grade 8. ..I fight that. ..Because so many of the students' perceptions of how easy or hard science is, is what the teachers tell them. .. 'This is really difficult. You need to pay attention.' And a lot of teachers will do that just as a power thing. ... 'You can't skip this subject. You can't miss a homework assignment.' ...But I teach it like this: 'This is an easy subject. This is a fun subject. You are going to like this subject because you are good at it.' ...And so it is a different line (Apr 11/06).

Delia recognized that many or most of her students were motivated to do the work, and she surmised that this motivation came from pressure from their parents and themselves, to get good grades. Thus she did not feel she was struggling with students cooperating but she struggled with the idea that "internally they are not going to want to do it." And so she really tried "to get them to associate goofiness and fun with the subject." (Apr 11/06). She would think of funny analogies to relate something funny, like poking fun at herself, with concepts in the course. For example, she compared her bad luck at finding the right partner with chemical reaction mechanisms – she couldn't find a person with the right energy and orientation. She tried to get her students laughing so that they would have fun and remember the ideas they talked about.

Making her students laugh and doing her best to make a class that her students would enjoy was a primary way that Delia tried to connect with her students. She saw building that connection as a primary role of a teacher. Building that relationship was paramount to, almost tantamount to, good teaching. Connecting with students was intertwined with relevance of and interest in the subject matter. It is worth quoting her at length about this:

> If I feel connected to [my teacher], and I feel like that information is genuine ... I think that is what you need. You need to be connected to your teacher. ...It doesn't even matter to me that they are lecturing. ... I've had good teachers who lectured and gave lots of notes. ... The note-

> taking is not it. It's the connection. ... As long as you have this connection, and it's interesting, it hooks you. Not because it's an anticipatory set or whatever, an intentional hook, but you care about this person whose giving you the information. You believe in this person ...You respect them enough to listen, and you want to know what they are saying. ...And also, that you have this good experience" (May 9/06).

Delia believed that a big part of making that connection with students was to "come down" or "lower" herself. She recognized that being the teacher put her in a position of expected authority, but she felt that in order to connect with students she had to be, in some ways, on their "level." She talked about one instructor at teachers' college that she connected with because "he came down off his pedestal" and showed her that he understood where she was coming from. (May 9/06). Delia did the same in her teaching. She made efforts every day to just talk to students and get to know them so that they didn't feel threatened in asking questions and they would come to her and say "I don't get this." She appeared to be very successful in her efforts with most students. She was a teacher who kids would go to with personal problems and students would raise their hands and openly ask for help with problems, even in front of their peers in her classes.

Despite her success, Delia worried a little bit about her informal relationship with her students. She gave them a lot of freedom, and would chastise them jokingly most of the time if students veered in inappropriate directions. Some of this approach, she supposed, came from her high school experiences in a mini-school program, where there was a lot of freedom and she felt she learned just as much from the other kids in the program as she did from the teachers (Apr 11/06). Yet even though she had her own rationale, she worried

that other teachers might say she was not very professional. She recalled one evaluator in her student teaching telling her she had to sound like a teacher, not a student. But Delia thought, "who cares want I sound like?" She didn't want her students to take her "too seriously." She felt, "you can't be all doom and gloom and like 'you know this or you fail the provincial exam,' because a lot of them will just turn off. If you walk in and you're like, 'close your books, bring out your paper, get a blue pen, underline in red, you know. I'm going to come around and check. I don't think that is how they learn" (May 9/06).

In watching her classes, Delia certainly did have a connection with most of her students. Her other worry, besides appearing unprofessional, was connecting with her students whose second language was English. Most of the English language learners who Delia taught were Korean students who come to Saunders in grades 8, 9, or 10, with limited English instruction before they arrive. The other international students at the school were from Germany, Mexico or Brazil and they came in their senior years and from international schools with far more English instruction[2]. Delia advocated for a bilingual Korean teacher for these students because she felt they were so ill-served in general at the school, including in her own class. She would talk to these students individually and talk to their counselors when she was concerned about how they were doing. The counselor told her that their main goal is to learn English and not the science. Even so, Delia did not absolve herself of her responsibility to do her best to teach

[2] In order to offer special programming (such as Advanced Placement courses and Super Achievers, which is a program for nationally ranked athletes or high-calibre performing artists who attend school in the mornings and have their afternoons to train or practice), Saunders enrolled international students who paid tuition.

them the course material. However, she found it difficult because her identity as a teacher depended so much on her connection with students, and she could not rely on her usual strategies to connect with these students.

Jaelyn

Like Anne and Delia, Jaelyn also felt her biggest strength was the relationships she built with students. In response to my question about her strengths, she said,

> "I feel confident that I can connect with all the students. ...I think I'm a good teacher because of that fact. .. Because if they don't connect with me, if they don't value what I do, if they don't appreciate what I do, if I don't appreciate what they do, then I don't think anything productive will come of that lesson or that year" (Mar 3/06).

Like Delia, Jaelyn made an argument that the most important element of teaching is connecting with students. She is a good teacher *because* she can connect with students. And if a teacher and her students don't have that connection and appreciation for one another, their time together is not productive in terms of student learning. It is not surprising then that Jaelyn exerts significant effort at building a good rapport as the foundation of her practice.

She certainly exhibited friendly and respectful interaction with her students in her classroom. With her individual greetings and her joking and talk with her students she tried "to let them know I'm here and I care about you" (Mar 3/06). She didn't have the "loose style" of Anne, nor did she talk like her students act like a "nut" as Delia did. She had clear and consistent expectations and she held her students accountable to meet those. At the same time, it was evident that she walked her talk: "I think I genuinely like the students, in whatever backgrounds they are coming from, or different levels they are at,

in science, or in school in general, or in life...I really do respect them...I really appreciate them putting an effort into my classes (Mar 3/06).

Like Anne, Jaelyn tried to understand what motivated her students. She said, "I believe that no matter how they act, they all want to do well in school. ..And I give them encouragement, applaud them for trying, and all those things I think will motivate them to do well" (Mar 3/06). As all the teachers talked about in terms of good teaching, Jaelyn tried very hard to come up with learning activities and assessments that would be fun, interesting, and motivating for her students, as well as getting at the prescribed learning outcomes. Whereas she did not have the same degree in variety as Anne had in terms of assessment types, she did assign projects occasionally instead of tests. She felt that teachers, herself included, use tests as the only way they know to evaluate students. Jaelyn experimented with other methods because the students enjoyed things like projects more and she recognized that sometimes a test is "not the best [evaluation] for certain students" (June 22/06).

In her daily routines she did her best to meet the needs of all her students. She would give extensions on assignments and have individualized homework protocols. She saved the notes from the overhead for some students to use later in the class. However, she was very cognizant of doing these sorts of things discretely and privately because she recognized that some students needed to "act cool" and she wanted to respect their need to fit in or not be treated differently. Thus, respecting students, and attending to their needs as best she can is key to Jaelyn's identity as a teacher.

The fourth year teachers

Susanne

When I asked Susanne about her strengths, she said, "I think I am able to relate to a lot of the students and come up with little things to help them remember" (May 9/06). How Susanne related to students shared some similarity with the new teachers discussed so far, in that she would talk to them outside of class and was involved in extracurricular activities such the school musical and the badminton team. However, in her teaching, she was somewhat different, especially from Anne and Delia. Her interactions with students had a more formal feel. This is not to say that those interactions weren't friendly; they were. Students would chat with Susanne and she had students who confided in her, just as Delia did. However, she nor I would describe her style as "loose" like Anne did, or that she would "lower" herself, as Delia did. There was a more distinct boundary between teacher and student, and this worked for Susanne.

On one occasion in April, I observed Susanne's class and had part of a recorded conversation with Delia on the same day. This day stuck out in my mind because it provided such a striking comparison of the difference in the ways Susanne and Delia interacted with their students. I had observed Susanne teaching science 9 that day, and they reviewed naming of chemical compounds based on the formula, and writing the formula, based on the compound name, prior to the lesson on balancing chemical equations. After taking up the homework, and just prior to launching into the main lesson, Susanne said, "If you did these and you got them correct, you won't have problems. Because as I told you, it doesn't get any easier and today will be the hardest of them all." This class occurred right before my conversation with Delia, where she

disparaged teachers telling students that the material was hard as way to get them to pay attention to and/or do the work. Delia claimed teachers did that "as a power thing" and that she wanted to portray science as something that was not hard, but fun and easy.

Clearly, Susanne and Delia had different ideas about this aspect of good teaching. Yet both approaches fit with who each woman is as a teacher. Susanne gave the example of one day when one of her classes had a teacher-on-call in a previous block and were talking about getting in trouble as they came into her room. "When they came here they were just talking about it and I was like, 'but you guys don't talk that much.' And they go, 'that's because we know what we can get away with.' (laughs) So in that sense, yes, they have that respect for me." Susanne also felt that her students in general liked her as well, "because they come in, 'Hi Ms. H., bye Ms H., have a good day'" (May 9/06). Thus, Susanne had clear boundaries, but she was not overly formal.

I would not say that Susanne was on her pedestal (to use Delia's term). She joked with students, but not as part of the lesson; and she would admit when she didn't understand something herself and she would seek assistance from another teacher. This happened in one class I observed, where one of the review questions students had been assigned asked them to explain why something would look magnified under a drop of water. Susanne found her own explanation lacking and later in the class asked the physics teacher and came back to the students with an explanation. The students' understanding was the most important thing, and Susanne didn't mind that she had to admit that she wasn't sure and she would get back to them on that.

Like all the teachers here, Susanne's interactions with students depended on her ideas of how best to help them learn and succeed. When she first spoke of relating to

students, Susanne also mentioned coming up with mnemonics or other tricks to help them remember. For example, during one class, in order to help her grade 9 students remember which molecules were diatomic, she gave them this phrase: "Henderson's seven bright ideas or clues" (her pseudonym last name is Henderson) to represent H_2 , S_2 Br_2 , I_2 , O_2 and Cl_2 . She also talked about telling them "little anecdotes or stories" in the same breath as talking about relating " to the kids quite well" (May 9/06).

The other strength Susanne mentioned was being organized. This helped her relationships with students, especially in the area she felt she needed to work on, which was being more patient. She explained it this way: "I think the thing that has helped me become a bit more patient and a bit more understanding is my organizational skills. Because I'm organized, it is one less thing I have to worry about" (May 9/06). I believe her emphasis on organization also stems from her desire to be fair to students. As I will discuss in the next chapter, one rationale Susanne had for so much assessment was to be fair to students. She had given an example of a student who had dropped her marks for three or four assignments, because she was dealing with a personally stressful situation at home. Susanne's frequent assessments allowed her to see that trend, address the student, and it did not affect the student's overall mark very much since it was only a few assessments out of so many.

Another reason for the focus on organization, and its connection to being fair to students, comes from fact that several of Susanne's classes are in a special program called computer immersion, where students each have a laptop, on which they take notes and do assignments. Susanne talked a few times, both in recorded conversations and casually after class about how computer immersion tended to draw kids who were super

keen about computers and students who had special learning needs, particularly with written output of information. Thus, she catered to students who might need organizational help such as always putting the itinerary on the board, and posting homework on the message system on the web. Susanne also talked about coaching students on how to write tests, advising them to "do the test twice" by going over each question and making sure before handing it in.

Thus, Susanne identified with and was a teacher who was very fair and did her best to help her students be successful in her courses. Her tactics to motivate her students were particularly different from Delia's and Anne's strategies. Some of this was her take on good teaching, and some of it was in response to the particular students she was teaching. With the bulk of her students in computer immersion, and her previous experiences as a teacher in Delia's shoes, she found that being organized was as a key aspect of her practice which enabled her to meet the needs of her students as best as she could.

Jun

Jun's interaction with students was most like Susanne's, of the other teachers in the study. Given that Jun and Susanne worked closely together and shared and developed resources between them, it is not surprising that their practices had elements in common. Jun noted, like Susanne, that organization was a strength in her teaching. I could see this from being in her classroom. She always had the agenda on the board, and other information like the next test or assignment due date, names of students who needed to make up work, things like that. Also like Susanne it was very important to her to be fair.

She commented, "I think most [students] would say that I am fair. ... So I think that is a big deal to them, and to me too - is fairness. So if they see me as fair, then I think respect sort of goes along with that" (Apr 18/06). I think Jun's comments are telling of her understanding of her students. She recognized that a teacher's fairness is very important to them and she responded by setting consistent rules and by being organized so there would never be any surprises for them.

At the same time, Jun depicted a dilemma in her practice of being strict enough to garner respect, but also being more easy going to facilitate helping students, especially those who were struggling. She described herself as being "kind of strict" and that students "don't necessarily say 'science is fun.'" However she also said she needed to work on " being a little more personable." She was trying to find that balance because she felt, "as a new teacher," that she had "to be strict to maintain that respect" and she didn't "want to be too easy on them" (Apr 18/06). This dilemma sprang from two places. One was being a new teacher, which Jun mentioned. The other related reason was that Jun felt she needed to create distance between herself and her students. "I'm pretty casual but I don't wear jeans to school and things like that because I want to be separate from the students. And I think because of being fairly young and maybe being a small-stature female has something to do with it too. So I want to be different." (Apr 18/06).

Thus, Jun felt she had to act in certain ways to maintain that distance and respect from students. Yet, she recognized the potential benefits of getting to know her students better. Therefore, within being 'kind of strict' she was "trying to be a little more easy going." She talked about it making connections with students by talking to them "one on one and just tell them if you feel like you don't understand this or you feel like it is too

much, come and talk to me." She talked about trying to touch base with students one on one, particularly for students who were struggling. She wanted to open up a better dialogue between herself and her students so that she could adequately accommodate special circumstances or difficulties students had.

Just as Jun tried in her teaching and interactions to respond to her students, their desire for fairness, and their occasional special circumstances, she also responded to the needs of parents. She mentioned that in some cases she had quite a bit of contact with parents. Likewise, at Saunders there were a number of international students and she did her best to meet their needs by trying to explain things in simpler words and stress certain words in questions. She tried to sit them apart from one another so they would practice their English, but she also let them talk in their home language with classmates to get ideas in science across to one another. She wished for more information and advice about teaching English language learners, as well as students with special needs in her classroom.

Just like the other teachers in this study Jun was concerned about developing relationships with her students. She felt the least confident of the teachers here at doing this. She openly struggled with a balance between being strict and respected the meeting the individual needs and responding to the individual situations of students. Her struggle, I believe revolved around being fair. She needed to be organized and consistent, but she also had to know if and when to make exceptions in order to be fair to everyone.

From first year to fourth year: practices and personalities

Whereas each teacher has their own priorities and practices when it comes to

building relationships with students, there are interesting differences between the first year and fourth year teachers in the study. At one end of the spectrum, Anne and Delia, as first year teachers, share much in their "loose" approach and reliance on personality. I think of Jaelyn as somewhat in the middle, with a very friendly but a little less flexible style. She was actually in her second year of teaching, although this was her fist full year, so she was also in the middle in terms of experience teaching. Susanne and Jun were the other end of spectrum, with practices that emphasized fairness and organization. I hypothesize that this pattern of difference between the more experienced and less experienced teachers is not random, but grounded in the discourses of teaching and student-teacher relationships, which I will discuss below.

One myth prevalent in popular culture and public sentiment about teaching is that "anyone can teach." Undergirding this notion are two connected ideas. First, the often-cited "apprenticeship of observation" (Lortie, 1975) means that teachers have spent most of their lives learning to teach, by watching their teachers as students. As Lortie's respondents indicate, student teachers and new teachers underestimate the difficulties involved. This is not surprising given that when students make judgments about their teachers' performances, they do so without the benefit of knowing what their teachers did behind the scenes – what were the goals, preparations, strategies, reflections, etc.

Second is the idea that what makes a good teacher is their personality, or that teachers are born rather than made. Despite the fact that several hundred studies contradict this myth (Darling-Hammond, 1998) its prevalence is truly staggering. For example, there have been countless Hollywood films about a person (perhaps a certified teacher but often not) who with enough personality and passion (and noticeably without

much thought or attention to pedagogy or often even subject matter) successfully changes the lives of their usually troubled students. And there are programs in the U.S. like Teach for America that take college graduates – presumably for their energy, drive and commitment (and not for evidence of knowledge of pedagogy) – to teach in the most needy areas of the U.S. In the transcript of John McCain's speech to the NAACP in July 2008, he states, "They don't have all the proper credits in educational "theory" or "methodology" — all they have is learning and the desire and ability to share it. If we're putting the interests of students first, then those qualifications should be enough" (McCain, 2008). I take Mr McCain (or his speech writers) to mean that if one has learning (subject matter knowledge) and desire that they automatically have the ability to share it.

Thus, it is perhaps not so much that anyone can teach, but that teaching is a job that requires little specific education or knowledge (beyond subject matter knowledge) but a lot of drive, passion and ability to connect with students. These are of course important aspects of teaching but they are not the whole story or even in most instances the key to teaching success. I am not suggesting here that my participants hold these views. I am quite certain they do not. However, they have grown up watching their teachers without understanding what they did behind the scenes. And they have been exposed over and over in the way public figures, ordinary people, popular culture and the media depiction of teachers, which glories and emphasizes passion and personality in teaching. They are affected by this discourse. And their careers as teachers are very limited at the moment and that limited experience and learning has not enabled them to form and try out a lot of ideas and strategies for serving students with pedagogy and

practice. Thus it is understandable that their notions of good teaching, tied up in their relationships with students, relied more on using their personalities and passions for the newest teachers.

Delia emphasized connecting with students and using humour to engender a sense of fun and goofiness with her subject matter. Anne focused on connecting with students through flexibility in making the content suit students – their interests, needs and behaviours. Jaelyn saw connecting with students as a foundation for practice and she aimed to build connections through friendly and respectful interaction and strategies like positive reinforcement, variety and differentiation in assignments and assessments. Jaelyn is in the middle in terms of experience and in terms of her approach using her personality and practices to connect with students. Susanne and Jun on the other hand, with more experience, had had more time to consider the relationship between their practices and their relationships with students. They emphasized aspects of their teaching practice that were fair for students (such as clear expectations, being organized and multiple assessments). Thus the more experienced teachers relied more on practices to connect with and serve students and the newer teachers relied more on personality and day to day interactions. It may also be that the newer teachers they more closely associated their priorities of good teaching which informed their practices with the reasons they had just become teachers – to work with youth.

From urban to suburban: connecting in context

As I have already mentioned all the teachers in this study were very concerned about and I think very successful in "connecting with" students. Whereas I argue that the

amount of experience in teaching seems to matter most with respect to relationships with students, the context and the students matter a great deal as well. These teachers respond to their contexts – that is, the discourses around the students who they teach. For example, Anne takes on the role of advocate for her largely lower class and previously unsuccessful students. She struggles with the balance between coddling and providing appropriate opportunities for 'at risk' youth. She takes up the cause providing them every opportunity as she sees these students as having diminished opportunities in their lives to succeed in school. She also advocates for them as she rallies against what she interprets as other teachers giving up on these students. She is determined to do everything she can think of to not give up on them. And so her emphasis on flexibility stems in part from her newness and reliance on her convictions for connecting with students as well as who those students are: those who have not succeeded with conventional opportunities.

Anne and Jaelyn teach two of the same courses at the same school. And whereas they shared a belief in connections with students as the foundation of good teaching, those relationships looked somewhat different. Jaelyn had a friendly rapport, like Anne, but she also had a focus on a clear and consistent expectations, rather than flexibility as Anne had. This is part who these teachers are, that Jaelyn has a little more experience (as discussed in the previous section) and also who their students are. Anne and Jaelyn both teach a grade 8 and a grade 9 science. However, Anne also has the grade 10 class of "most likely to fail" students. And Jaelyn also teaches grade 11 chemistry, which is not a required course. Thus, on balance, Jaelyn has more students who have previously experienced success in school and school science than Anne has. This affects their

approach to students.

Delia's emphasis on fun and humour in connecting with students stems from her personality and past experiences and her newness as a teacher relying on what she knows and who she is. We can also aim to understand Delia's ideas and commitments in her context. The students in Delia's suburban classroom generally had every opportunity to succeed in school. Delia tried to counter the emphasis on the external motivation of marks she saw in her students, in part through relevance and interest (discussed in the previous chapter) and in part through fun and a connection to her.

Jun and Susanne's emphasis on being fair makes sense within a student population that cares greatly about marks and their performance. They shared an emphasis on being organized and having clear expectations as an important aspect of being fair to their students. And they had a lot of assessments in an effort to be fair and give students many opportunities to demonstrate their understandings, as well as be rewarded for effort. This makes sense in a context where students are very focused on their marks. Clear expectations, ample opportunities and no surprises enable students to do well if they want to. Like Delia, Jun and Susanne also recognized the external motivation of marks. They too tried to combat it with relevance and interest in their curriculum. Yet they also used this motivation. For example, Susanne saw part of her success in finding ways to help her students remember things that would be on a test (such as how to remember the three classes of levers). And Jun, who taught Biology 10 for students who intended to take advanced placement, understandably spent a lot of time preparing her students for the provincial exam to be fair to them in their preparation.

Concluding remarks: relationships with students

In the above discussion, I argue that relationships with students are central to how these teachers envision good teaching and how they teach. Connecting to students is an organizing thread for each of these teachers in building their priorities and practices. This makes sense as most teachers (perhaps especially women) choose the career because they see the importance of, feel they are good at, and genuinely enjoy working with youth. In addition, students are not talked about as constraints in teaching. Although the external motivation of marks is mentioned, particularly by Delia, this is seen as much or more of a problem of curriculum and testing (discussed in the next chapter), than a problem of student attitudes or aptitudes. Perhaps because these teachers are early in their career they are not cynical about students and believe all students can learn.

The similarities among and differences between these teachers arise out of their relationships to cultural discourses of teaching and students, as well as their unique life experiences, their experience teaching and their contexts. I have argued that a heavier reliance on personality for the newest teachers is in part a manifestation of the cultural discourses of what makes a good teacher as well as less experience at using pedagogy and curriculum to connect with and serve students. The differences in relationships with students based on context – class composition and surrounding community – are primarily based around serving a particular type of student, such as providing opportunities to get good marks versus opportunities to complete all assignments and pass a course. Thus, what kind of curricular experiences and emphasis on testing and other assessments is closely linked to relationships with students. In the next chapter, I further explore these teachers' practices and priorities around curriculum and testing.

Chapter 5 Stories within discourses of curriculum and testing

In the previous two chapters I argued that connecting with students was central to the practices of the five teachers in this study, although what their relationships with students looked like depended on their teaching experience, context (the students and school they were serving), cultural discourses about teaching and their personal histories. This shared commitment to students, however, results in very similar ways of filtering science curriculum such that their ideas of good science teaching are linked to their ideas of connecting with and serving student more than representing the disciplines of science. In this chapter I argue that this shared over-arching commitment to students also influences how teachers respond and contribute to the discourses of curriculum and testing.

Discourses of testing and accountability

Of particular interest at the time of this study (spring of 2006) is the discourse of testing and accountability in education. I am taking discourses to mean taken-for-granted ways of thinking, communicating and acting, constructed in community, derived from theories and knowledge dominant in the larger sociopolitical milieu. In our society, the discourse of accountability is borne out of our sociopolitical milieu, which is currently dominated by a neo-liberal agenda and a register of the economy, with resulting emphases on measurement, transparency, accountability, self-sufficiency, and competition. Teachers working within this discourse both adopt and challenge it.

In education, the primary manifestation of a neo-liberal agenda is an increased focus on testing and accountability in schools. Let us first consider, then, a little background regarding the new grade 10 exams in British Columbia specifically, and provincial and state testing more generally. In Canada, education is a provincially controlled service, just as it is state-run in the United States. In both locations, provincial or state mandated testing has increased in recent years. For example, the Michigan educational assessment program (MEAP), which began in 1970, tested students in grades 4 and 7 in reading and mathematics. Due to the mandate of the No Child Left Behind Act (NCLB) that students must be tested in grades 3 *through* 8 starting in the 2005-2006 school year, the MEAP is now taken in English and math in grades 3 through 8, adding science in grades 5 and 8, and social studies in grades 6 and 9. In addition, grades 11 and 12, students write MEAP tests in the English, math, social studies and science courses in which they are enrolled (www.mi.gov/mde). Other states have similar stories. New York, for example, increased its' testing of English and math in grades 4 and 8 in response to NCLB, to testing in English and math in grades 3 through 8, adding science in grade 4, social studies in grade 5, and science and social studies in grade 8. In addition, high school students take the Regents exams in grade 12 level English, languages other than English, maths, social studies, and the sciences (www.emsc.nysed.gov/osa).

Thus, states have been increasing testing regimes to comply with NCLB, signed into law by Bush's Republican government in 2002. Provinces have also employed an increased focus on testing, and this has also been in response to changes in government and government policy. However, by comparison, provinces in Canada are still much

slimmer on testing overall than states in the U.S. For example, in Ontario (the most populous province), the Education Quality and Accountability Office (EQAO) was formed in 1996, after Mike Harris brought Progressive Conservative rule to Ontario when he was elected premier in 1995. This office is responsible for testing all students in reading, writing and mathematics in grades 3 and 6, maths (applied and academic) in grade 9, and the Ontario secondary schools literacy test in grade 10 (www.eqao.com).

In B.C., the foundational skills assessment (FSA) was designed to test students in grades 4, 7 and 10 in English and math. The grade 10 FSA was replaced with the new grade 10 exams in English, maths and science (and grade 11 exams in social studies) in the 2004-2005 school year, under Gordon Campbell's Liberal government who took office in B.C. in 2001. These new exams are worth 20% of a student's final mark in these courses. In addition, grade 12 provincial exams have existed for decades and are worth 40% of a student's final grade in English courses, math courses, science courses, and social studies courses such as history.

The rationale behind all this testing is usually couched as "achievement of high standards" and "accountability." The tests are supposed to measure achievement of students and the reporting of results holds schools accountable for students meeting high standards of achievement (NCLB, 2001, p. 3). With regard to B.C. exams in particular, the only B.C. ministry of education document I could find that mentioned the rationale for the exams, was the Handbook of procedures for the graduation program, which offers:

Purpose of the Graduation Program Examinations

The British Columbia Graduation Program Examinations, created in 2004, were implemented to:

• ensure that Grade 10, 11 and 12 students meet consistent provincial standards of achievement in academic subjects

• ensure that graduating students from all schools in the province are treated equitably when applying for admission to universities and other post-secondary institutions

• respond to a strong public desire for improved standards of education

(B.C. min of ed, 2006, p. 20)

You can see in the first of these three points the idea of meeting standards of achievement, and the idea of accountability in the third point. The second point speaks to what I, as a former teacher in B.C., always thought was the purpose of the grade 12 exams. Adding the grade 10 (and the one grade 11) exams to the established grade 12 exams ignited a storm of controversy in B.C. in 2004 and 2005, as opinions varied about what achievement these exams measured, what standards were being met, how such exams might benefit or hurt students and schools, and whether this was a productive way to spend money on education.

Arguments about testing in B.C. newsprint

As one way of learning the tenor of the debate about increased testing in B.C. I analyzed a sample of newspaper articles throughout the province between Dec 2, 2004 and April 14, 2005, as the first set of grade 10 exams were administered in January 2005. Several arguments are raised on both sides of the debate. Tom Christensen, who at the time was the Minister of Education said the goal is to "increase student achievement" and ensure accountability. He noted that this doesn't change the grade 10 curriculum, but ensures that the curriculum is being taught (Edmonds, Richmond News, Dec 18,

2004). Similar notions were echoed by a few school trustees. A couple of parents and students also wrote in favour of the new exams stating that the results could be used to modify curriculum and that students need to get used to wide-scale competition and thus they need practice exam writing, because test-taking is a skill in itself, and because students need to practice in high-pressure situation before the marks really mean a lot.

Central to members of the B.C. Teachers' Federation (BCTF), was the concern that the new grade 10 exams would be detrimental to lower-achieving students, because students who struggle with courses like science 10 have other options in grade 11, such the Science and Technology 11[3]. This position, adding that ultimately drop-out rates among vulnerable students may increase, was taken up by some school trustees.

Sandra Mathison and E. Wayne Ross, professors in the Faculty of Education at the University of British Columbia (UBC) encapsulated much of the debate against more testing by acknowledging that "the use of high-stakes tests is an effort to treat teaching and learning in a simple and fair manner." However, they note that this does not work "in a world where education is complex and with inequitable distribution of opportunity." Instead they suggested that the proven way to improve schools is through curriculum, teachers, and involvement of the community and cited the problem of the test becoming the curriculum at the expense of teaching in ways that are response to student needs and interest. They note that the most often cited rationale for increased use of testing is to provide information to help decision-makers shape policies and practices that enhance

[3] In B.C. all students must pass science 10 to graduate from high school. Science & technology 11 is a course designed for students who do not wish to take sciences (earth & space, chemistry, physics, or biology) in grades 11 or 12.

academic success for students. However, research indicates that high-stakes testing does not lead to better policies or practices. In fact, benefits are usually outweighed by negative effects on learning and teaching, such as promoting superficial understanding of subjects, and transferring control over the curriculum to people who create the exams, rather than the teachers (Apr 4, 2005, Vancouver Sun, p. A11). Much of their argument was echoed by teachers, parents and students.

Another detrimental effect occurs when the Fraser Institute, a conservative think tank based in Vancouver, uses provincial standardized tests (the FSA in grades 4 and 7, and provincial exams in grades 10, 11, and 12) to rank schools. Every year they produce an elementary and secondary school "report card" (www.fraserinstitute.ca). Greg Ponart, assistant superintendent with the Richmond school district, cautioned that provincial exams are only one of many measures that school districts rely on to indicate student achievement and thus, the problem with tests is that they can be seen by some as all encompassing. "Our concern is when groups rely solely on that data to determine the effectiveness of schools." Once the Fraser Institute's rankings hit the news, "schools get calls," he said. Al Klassen, president of the Richmond Teacher's Association, added "you can explain all you want, parents and groups like the Fraser institute are going to jump on those quick- and-dirty rankings - it's like a top 10 list" (Richmond News, Dec 18, 2004).

Along the same lines, Dr Mathison and Dr Ross also cautioned that "when test scores are central to decision-making, people tend to treat test results as the major goal of schooling, rather than as a potentially useful but fallible indicator of achievement." They note that "despite efforts to create tests that are reliable, scores on standardized tests can

be surprisingly inconsistent; that's why every major standardized test publisher tells schools not to use them to make decisions about grade retention or graduation." In addition, these scholars note that "recent studies suggest that standard test scores more accurately indicate family income than students' educational achievement" (Vancouver Sun, Apr. 4, 2005. p. A11). It is worth noting here that in the Fraser Institute "report card," with results from the year of my study, that of the "top" 15 schools in the province, 13 were private schools, and the two public schools were both on the far west side of Vancouver near UBC, where there is a high concentration of people with PhDs and a concentration of wealth (not necessarily the same people). In this instance, the correlation of wealth and education with standardized test achievement appears strong. It is also worth noting that a main goal of the Fraser Institute, according to its' website (www.fraserinstitute.ca), is to promote private education.

After the results of the first set of grade 10 exams were out, the Vancouver Sun reported: "According to the Ministry of Education, 88 per cent of students passed English 10 exams, 79 per cent passed science 10 and 90 per cent passed the exam for principles of math 10" (Apr 2, 2005, p. C6). The Ministry of Education press release noted that province-wide, 91 per cent of English 10 students, 90 per cent of science students, and 89 per cent of principles of math 10 students would have passed the courses if their mark were based on classroom work alone. When provincial exam marks are factored in, those numbers increase to 93 per cent, 91 per cent and 91 per cent, the release states (Jonson, Brian, Penticton Western News, Mar 30, 2005, p. 10).

I would like to do a quick analysis on this reporting to illustrate rhetorical strategies used in the media by the government. For clarity I will use a chart.

Table 1: Percent of grade 10 students who pass

	exam (20% of final mark)	course w/ out exam	course with exam
English	88%	91%	93%
science	79%	90%	91%
math	90%	89%	91%

What the Ministry of Education press release should really convey is that an additional evaluation, coming at the end of the year raised students' passing rates by between 1 and 2%. The Ministry can't have data on what course passing rates would have been if some other form of final evaluation had been used other than the provincial exam. Teachers would have used some other form of evaluation in place of the provincial exam, and therefore their claim of passing rates without the exam are completely hypothetical and not likely accurate. What they could accurately report, but do not, is that more students passed their courses than passed the provincial exams. In science, which is of particular interest in this study, 79% of students passed the exam. And for approximately 13% of students who failed the exam, their course mark was high enough that it allowed them to pass the course, resulting in a 91% passing rate.

However, Education Minister Tom Christensen said, "Many parents and teachers had concerns about how these exams would affect students' course marks. Overall pass rates show us that more students are earning credit for required courses than if final grades had been determined by school work alone." (Jonson, Brian, Penticton Western News, Mar 30, 2005, p. 10). Again, the problem is that Mr Christensen cannot know what the passing rate would have been if determined by school work alone, because teachers did not prepare final evaluations as part of that school work.

Whereas the debate around testing that the new grade 10 exams sparked is not raised daily in the newspapers across B.C. anymore, this issue has not died. It peppers the newspapers at the time of FSA administrations or provincial exams, or when the Fraser Institute "report cards" are published. On October 27-28, 2006 the B.C. Teachers' Federation, together with the faculties of education at Simon Fraser University (SFU) and the University of British Columbia (UBC) put on the "What really counts! Rethinking accountability" conference in Vancouver. In his keynote address, Paul Shaker, SFU Dean of Education, warned that society should be "suspect of any accountability system that neglects the full dimension of life" and uses pencil-and-paper tests in a simplistic attempt to apply a certain kind of science to education. He argued that accountability or assessment models must be much more comprehensive and complex than a multiple-choice test designed to sort rather than assess. (BCTF, 2006, p. 1) The reference to sorting no doubt drew images of the Fraser Institutes' ranking of schools in B.C., based on provincial exam and FSA results, discussed above. And so, the same arguments keep circulating, and the exams persist.

To sum up, the prevalence of standardized testing for purposes of accountability has recently increased, with the provincial government arguing the benefits and mandating compliance. These practices, and the new grade 10 provincial exams in B.C. in particular, have both supporters and critics in the general public, higher education, parents, teachers, and students. The heightened use and acceptance of a discourse of accountability, are in part based on knowledge and notions derived from fields such as economics and psychology that inform the current liberal-democratic political project

which envisions people as resources to be optimized and education as an apparatus for that goal.

Therefore, it is not my intent here to make a complete argument about the new grade 10 exams, or standardized tests in general. Rather, I am trying to paint a history of standardized assessment in B.C. (and briefly compare it to other provinces and states in the U.S.), and point out the rhetoric, and rationalities circulating within, informing and challenging the discourses contributing to the increasing pertinence of testing and notions of accountability. The object of this study is to better understand how such discourses influence and are influenced by the actions and thinking of the teachers in this study. What is most pertinent in this landscape of escalating testing, for my participants, is the new grade 10 provincial exam in science. I will now turn to their stories about the exam in particular and testing and notions of accountability in general.

Contesting and attesting to the discourses of curriculum and testing in context

The five teachers in this study had a range of feelings, both in strength and opinion, about the new grade 10 provincial exam in science and an increased presence of achievement and accountability practices and rhetoric. I use their thoughts about the exam as a springboard to examine how the discourses of curriculum, especially of accountability and testing, functions and interacts with their convictions for connecting with students. Whereas in the previous chapter, I argued that the differences in student teacher relationships vary more greatly based on years of service than by context (and individual factors), here I argue that context matters the most with regards to how teachers interpret, respond and contribute to discourses of curriculum and testing.

The urban context: Teachers at Turner

Anne

Anne was the most outspoken against the new exams. This is not surprising given that her grade 10 class, which was formed in February with money the province saved when teachers went on strike for two weeks in October, was composed of students who were all identified as most likely to fail science 10. Opponents of the grade 10 exam as a new graduation requirement claimed the exams would hurt students like those in Anne's class by potentially increasing their frustration and drop-out rates. Anne certainly identified with this opposition to the new exams. She spoke of getting her students through the course and of her fears the provincial exam could jeopardize their chances of passing.

> All but three [students], I would be surprised if they passed the provincial. I'm not saying that they don't understand anything. I'm just saying that the provincial is written in a language that is very difficult for them to understand. And these are students who get discouraged easily. A lot of these students are students who are not the strongest readers, who are not good at taking rote information and problem solving with it. They are weak students for a reason. And it's because they can't do well on standardized tests (June 22/06).

Anne echoes the concerns of the voices in the news when the exams were first administered. She takes on the identity of an advocate for her "most likely to fail" cohort of students. She points to the language of the test as a central problem for these students and a reason why they are not good at these kinds of tests. I believe she forms her opinion based on both her experience with these students, and what others say about "at risk" youth. It is pertinent to keep in mind that despite the fact that this is Anne's first

year of teaching, she has a fair bit of experience with students who struggle in school for a variety of reasons. At her other school, she teaches in an "extended skills" program, which she was hired to do based on her coursework in special education, as well as her work experiences in family services and youth camps.

In addition, Anne strongly associated herself with the BCTF – the teachers' union – more than any first year teacher I had encountered, and more than any other teacher in this study. She attended the BCTF's annual general meeting that year and she knew things like "conduct unbecoming a teacher" off the top of her head. Part of this may come from the influence of her parents who are both teachers in B.C. I believe it also comes from her strong sense of social justice, which she demonstrates in the way she talks about her students and her teaching. For example, she spoke of a time in class when she addressed a homophobic remark, and it became a teachable moment and supplanted the lesson. Issues like these are important to her and she will use time and energy to address them. I believe part of her admonition of the exams comes from her knowledge of the union's opposition to them and her strong affiliation with the union, as well as the effects she sees on her "at risk" students.

Anne felt that with this grade 10 class a big part of her job was help the students pass. She did not want to give up on them, as she felt other teachers had. She worried that many of her students had given up on themselves. Some of her students were in grade 11 and so this was already their second time in science 10. Anne felt strongly that repeating science 10 was not what these students needed to be doing. Therefore, she provided multiple opportunities to make up and re-do work and accepted that work until the day before she had to hand in her final grades, taking on extra work for herself. Anne

felt that the exam worked against this central purpose in her teaching of this particular group of students.

She said she found it "very frustrating" that in order to graduate, grade 10 students had to be able to determine things like the radioactive decay of substances, the poles of electromagnets, and the probability of different phenotypes. She questioned whether these sorts of things would be important to their lives. She said, "It feels like gate-keeping. I feel like we've set the standards too high. And I know the B.C. government set the standard high because they thought that would make the students smarter because they would have to learn more, but really it's just making students frustrated" (June 22/06). Here, Anne nicely separates what she sees as the intentions or goals behind the practice of mandating these exams, and the actual outcome of requiring them, especially for the population of students she taught.

Anne's questioning of what is in the grade 10 curriculum and thus her criticism of the exam, stems from her notions of good science teaching, which arises from her commitment to students. She felt that students needed to learn to evaluate claims, and learn about issues that are of interest to them and have relevance to their lives. She resented defining student success in part as passing tests that did not have relevance. She sees some of the curriculum and thus at least some of what is tested on the exam as too esoteric. She criticizes that there is too much emphasis on details that are more in-depth than they need to be and not so important for everyone to understand. Whereas she agrees that all students should take science 10, she feels the curriculum should be "enough that they can understand the world – like understand, oh that's an oxidation reaction, it's rust. Without having to say, I can balance that reaction" (June 22, 2006).

She felt that in this respect the exam was too hard to be a graduation requirement for every student. She gave the example of getting questions for the geology unit test from earth science 11 test bank, because "[t]he grade 10 material is actually so high now that they're actually covering half of earth science 11" (June 22/6).

Anne claims that most adults who have a degree in science, or teachers who are not familiar with the science 10 curriculum, would score about 50% on the exam. She pointed to the common experience that most people don't remember the science that wasn't in their area of specialty. She made the argument that the exam was gate-keeping because it was too hard and all students have to take and pass science 10 to graduate. "There's a lot of students who just need to get through high school and they'll be completely successful in the real world. It's just such a stumbling block to expect them to pass science 10. Like you can't make the cow fatter by weighing it." In this vein she felt that the exam was a waste of energy and money.

Despite Anne's feelings about the provincial exam presenting an obstacle for her particular students, she must accept that exam and it does affect her teaching. She said, "The other thing governing what I choose to spend time on, unfortunately, is the grade 10 exam" (Mar 2/06). In this sense the exam does help to ensure that teachers are teaching the curriculum, which is one reason cited for its existence. As Anne argues above, however, some of the details of that curriculum are unnecessary and she would prefer the discretion to focus on what is most pertinent for her students. Anne likely would not have gone into as much detail in topics such as radioactivity or reproduction and focused on the larger ideas she felt students needed to understand as well as "the doing and the enjoying" (Mar 2/06) of learning science. Anne complained that the exams were part of

what she called the "culture of academic achievement" which is so pervasive and encourages students to have an "externally motivated, marks-driven way of looking at science" (Mar 2, 2006).

Thus, in Anne's urban context, and especially with her grade 10 class of students most likely to fail, the exam conflicts with her notions of good teaching and how best to serve students, but it also has one of the largest impacts. It is a larger factor in her circumstance because she has a group of students for whom passing the course has very real consequences, and not doing so is a very real possibility. In addition she has not taught the class for the whole semester and thus must make up for gaps in their different experiences. For example, Anne put together a physics packet the end of the year in order to be sure students had all covered that material prior to the provincial exam since she had not been responsible for teaching them that section of the course. So whereas I do not see the expectation and practice of more testing as necessitating great changes in teaching practice alone, when it is coupled with extenuating circumstances, the effect is more significant.

Jaelyn

When I asked Jaelyn about her greatest concerns in her teaching, her first response was keeping up with marking (Mar 3/06). During that same conversation we talked about the large volume of laboratory reports she marked. I asked her if she was getting enough information about how her students understood the concepts or the processes of investigation, or if her feedback to them, in terms of their learning, justified all the time and effort she spent marking. Jaelyn said that while that was a good question,

she couldn't give me an answer right away, as she "never took the time to actually stop and think about things like that" (Mar 3/06). This is an example of the taken-for-granted idea that teachers need to mark everything that students do. I'm not claiming here whether Jaelyn should mark every lab or not, but I do want to point out the pervasiveness of the acceptance of a large marking load and the *assumption* of its usefulness, rather than an argument for its usefulness based on the function and benefits of those assessments. This assumption stems from the taken-for-granted discourses of measurement and of accountability in schools.

This is not to say that teachers do not think about and hold opinions about assessment practices. Jaelyn also recognized the "culture of academic achievement" that Anne did. She talked about the perennial question, "is this going to be on the test?" and added, "Those questions I really don't like – but the students are trained in that way. ...And I think it is even more now with the grade 10 exam" (June 22/06). She argued that the government should get rid of the grade 10 exam. She concurred with Anne that it is a mechanism that puts more pressure on teachers to get through all the curriculum. She also noted how it affected her teaching of grades 8 and 9: "Because when they get to grade 10 they have to write this provincial exam ... there is no way around it. So in grade 8 and grade 9, as a teacher, we have to prep them on how to write tests, how to do well on tests" (June 22/06).

Jaelyn gave a poignant example of the exam negatively affecting her practice. The previous year was her first year of teaching, and she started her job at Turner at the end of January. Jaelyn took over for a teacher who left in the middle of the year and, by the sounds of it, had taught only the physics portion of the science 10 curriculum. The

knowledge that her students had to write the new provincial exam forced Jaelyn to teach in ways that she felt badly about. When she arrived at the end of January, Jaelyn had about four and a half months to teach the biology, earth science, and chemistry portions of the course. She felt impelled to make up packages of information for the students with notes and diagrams and a few blanks to be filled in. She said, "I felt really bad that they had to do that ... but I had to do what I had to do .... because they have to write the exam and some kids are scared that they are not going to get everything covered. And um, I didn't like that at all. I didn't like that experience. I don't think the kids enjoyed it either because it was so boring" (June 22/06).

Clearly Jaelyn made a decision about how to teach that compromised her ideas of good teaching and she felt that it was a disservice to the students. However, she would have felt that she was doing her students more of a disservice, if she had not "gone through" the packages and covered all the material on which the students would be tested. Jaelyn's case was not typical in that she was taking over for another teacher (who seems to be an anomaly) in the middle of the school year. However, the exam does not allow for unusual or extenuating circumstances such as her situation in the previous year. I think this is a most central point. One could argue that if a teacher teaches well and covers all the curriculum that they do not have to teach differently or teach to the test. However, in unusual circumstances like Jaelyn's the previous year, or Anne's discussed above, the exam does affect teaching in ways that can be argued as negative.

The reality is that teachers often have to make decisions about what to spend more or less time on in a class, even though the vast majority of teachers try very conscientiously to engage students with all the concepts and practices in the curriculum.

Jaelyn stated, "I try my best to cover everything in the IRP[4] but sometimes you spend less time on certain areas. But I only had this time to cover everything. But I don't feel that pressure with the grade 8's and 9's, but with the 10's I did" (June 22/06). She gave the example of her current grade 8 class, not spending as much time on rocks and minerals as other topics, and thus not putting that on their final exam. Jaelyn disagreed with the exam because she felt pressured to teach in ways that didn't match her ideas of good teaching. She did not feel that she needed that exam to keep her to the curriculum – she tried her best to do this already – but she wanted the freedom to match assessments with her teaching, and to teach in ways that she felt were most effective for her students.

The suburban context: Teachers at Saunders

Delia

Delia, like Anne, taught a class that was put together in February with money saved from the teachers' strike. Unlike Anne, her class was not overtly put together as "most likely to fail," but Delia made a convincing argument that many of her students were "cast-offs", with nine English language learners, and four students identified to receive learning assistance in a class of seventeen students. However, this teaching situation did not cause Delia to hold particular distain for the exam like Anne. Rather, Delia was the only teacher in the study who overtly supported the exam.

Delia takes up the discourse of the provincial government and the media in suggesting that one reasonable rationale for the new grade 10 exam was to keep teachers

[4] IRP stands for integrated resource package. The province provides a list of resources to go with the prescribed learning outcomes (PLO) which make up the curriculum

accountable: "I do really think we all should be accountable. I think it is accountability. So I don't have a problem with it [the exam]" (May 9/06). Delia's idea of accountability, however, is specific to her experiences in teaching science. "I think it is good to have the provincial exam, hold us responsible for it. I think it is important that all the sections are gone through, just so these kids know where their strengths are. ....so they have a good sense of what the sciences are. Cause that is all those first three years [grades 8 to 10] are, is a preview of all those subjects" (June 27/06). We must keep in mind that Delia's concern regarding adequately preparing students for future study, especially in terms of choosing which senior sciences to take, makes sense given the context of her school. Most of her students will go on to take senior sciences. In addition, keeping teachers accountable is also more fair for all students since she believes "it is not the bright students who are ever affected. It's the lower end student who is always affected" (June 27/06) by having less sufficient preparation.

Thus, Delia felt the exam helps to ensure that all areas of the curriculum are taught sufficiently, particularly in areas that are not the areas of expertise of the teacher. Teaching a junior science course (grades 8 to 10) means teaching in the fields of biology, chemistry, physics, and earth and space science. This can require teachers with little background in a subject to teach that subject. Delia, a chemistry major and biology minor, said she didn't care much for earth science or electricity and magnetism. She claimed that she would concentrate a lot more on chemistry if she didn't have to follow the curriculum. "We'll teach what we know, what we feel comfortable in," she said. She is right at least up to a point. All these teachers admit to lingering in their strengths. However, even though teachers say that they probably won't go into the same depth in a

topic they don't know as well, they also express the desire to get support in these areas, and the commitment to teach these in these areas as best they can. I investigate these teachers' thoughts and practices regarding such support in the next chapter.

What is very interesting is that even though Delia accepted that a legitimate purpose of the exam is to push teachers to cover all the material, she complained that the grade 10 curriculum was too packed. She told me that she had enough time for two weeks of review in her chemistry 12 class and a week and half of review for her grade 11 chemistry students. However, "I finished my science 10 the day before. We had one day of review. One day. And I pushed." (June 27/06). Like Jaelyn in the previous year, she had taken over the class from another teacher and was catching-up to some degree so this added to that push and the time constraints. Even so, Delia assessed that the grade 10 science curriculum "is insane. And if there wasn't a provincial exam, I would omit sections" (June 27/06). She questioned if all the material makes sense for grade 10. She wondered aloud why genetics was taught in grade 10 and then not in grades 11 and 12 biology. She noted, "That seems skewed ... like why aren't we concentrating on building their knowledge?" (June 27/06).

It may appear that Delia's support of the exam as a legitimate means to hold teachers accountable for teaching curriculum, becomes somewhat specious given that she feels some material should be omitted from that curriculum. Why hold teachers accountable for something you don't believe in, in the first place? But what Delia is really arguing, I believe, is that junior science teachers need to be accountable for teaching all major areas of science – biology, chemistry, physics, earth and space science

– well enough that students gain a good understanding of what these areas of study look like. She is not arguing that all the material is important for students to understand.

Delia's main support of the provincial exam, like arguments made in the newspapers, was that it gave the students a chance to practice writing an exam. Here again, it is not really important what is on the exam, but the practice of being tested on whole year's worth of information. She believed that students need practice at preparing for and writing a 2 to 3 hour exam, so they are better prepared for grade 12. The practice in writing the exam is a practice needed for the reality of higher education where most of her students are headed. Thus, like Anne, Delia's opinion of the exam is in part based on who her students are.

She only once briefly mentioned the comparison aspect of provincial exam, saying, "I think it is important for me to know and for them to know how they did on a test that everybody in the province wrote. I don't think it is harmful. But who knows." Here again I think there is evidence of Delia's opinions formed within her context. She has likely heard arguments that the exams are harmful to some students. While she is not sure about this, she doesn't see the harm in it, mostly because that comparison is generally not harmful to her students. Saunders was in the top 20 high schools in the province based on the Fraser Institute report card.

Despite her acceptance and even support of the provincial exam Delia complained about how focused on tests her students were in general. She commented, "especially at this school" student are "so marks-driven that their focus becomes the test" (June 27/06). She complained that this approach results in them learning the textbook, just rote memorization, and not really understanding the concepts so that they can manipulate

information to adapt it to fit an unfamiliar question or problem. She surmised that this comes from the "pressure on them from their parents" (June 27/06) and thus many students were very motivated – but motivated to get marks, not necessarily motivated to understand. Delia characterized her students as "not application kids" (June 27/06) because she felt they had a hard time applying what they had learned to a novel circumstance. Thus, she stressed with her students "if they understand there is actually less information that they need to know" (June 27/06). Delia's emphasis on understanding processes within science – to not memorize and understand why things happen, like a chemical reaction – may, in part, stem from working against what Anne called the "culture of achievement," which Delia sees as so prominent at Saunders.

Delia doesn't make a connection between the provincial exam and the discourse of accountability in schools, or the "culture of academic achievement" among her students. This is not surprising, given that most of the arguments against the new grade 10 exam were aimed at elucidating the unintended consequences for students who do not plan to go on to university. Such students make up a very small portion of Delia's classes.

Jun

Jun taught grade 10 science in the same school as Delia. Although it was her fourth year teaching, it was her first year teaching grade 10 and she said she still felt "kind of new" when it came to teaching (Apr 18/06). Jun had her class from the start of the year, which is not unusual, but in contrast to Anne, Jaelyn the previous year, and Delia. Jun's class was designated as pre-AP science 10, taken by students who intended

to enroll in Advanced Placement (AP) science courses in grades 11 and 12. It was at the opposite end of the spectrum from Anne's group, chosen as most likely to fail, (and to some degree Delia's "cast-offs") in that Jun's class was composed of students self-selected as most likely to be successful in science.

Like the other teachers teaching grade 10, and perhaps even more so with her pre-AP class, Jun felt pressure from the new provincial exam and found it "hard when you have no control over the exam" (June 21/06). She felt pressure to "get through all the material" even if it meant compromising her teaching strategies. Even though Jun was not taking over someone else's class, she still felt rushed towards the end of the year as she told me that she was doing more fill in the blank notes to "get through a lot of material in a short amount of time." She explained, "for grade 10 I think it's because of that exam. And it's my fear if I don't get through this, there's going to be a question on the exam about this and they are going to say, my teacher didn't teach me that" (June 21/06). Here I think Jun reveals that she is responding to her students' expectations, in that they expect her to adequately prepare them for the exam. Jun mentions twice that she feels she has a dilemma, because on one hand "all this stuff is important in a way, in terms of understanding how to do things and how things work" but on the other hand, "it always seems like there's so much stuff" (June 21/06). Whereas Jun wasn't willing to say what should be removed from the curriculum, she had feelings that there was too much material, and the presence of the provincial exam accentuated the pressure to cover all of it, resulting in some compromising of her teaching.

Like Delia, Jun believed that the purpose of the exam was to "make sure that by the end of grade 10 all students have covered these topics" (June 21/06). Like Jaelyn, she

questioned whether this was necessary, however, "because at least in our department at our school, I think we're pretty good about covering the material." She added that "maybe [another teacher] does earth science in more depth, because he's geology and maybe I would concentrate on biology more, but I think we're all pretty good about covering the material." I believed her. For example, when we talked about why she planned a particular project in grade 8, she said it was the best way she could follow the prescribed learning outcomes and not give the students straight notes (June 21/06). In our previous conversation Jun had said that other than lingering "a little bit" where she is more comfortable, or spending more time on ideas students find more difficult, she just follows "what the curriculum says" (Apr 18/06).

I agree with Jun. From what I observed with these five teachers, either in science 10 with the exam, or in science 8 or 9 without one, all the teachers were very diligent about following material in the curriculum. From my own years teaching the same curriculum, I know that my colleagues and I were very disciplined about engaging the students in all the curriculum as best we could. These teachers (like all I have worked with or observed) were probably most able to teach in ways that they wanted to in their areas of specialty, but they sought help in areas that were not their strengths, and never entertained the idea of just not teaching something. For example, Jun said she knew nothing about earth science when she started teaching and had to learn a lot. Even Delia, who claims she would teach more chemistry if the exam weren't there is speaking hypothetically. The discourses of teaching in schools revolve around content in the curriculum, and teachers do not treat it as something optional, even if they disagree with the volume or content.

Interestingly, the notion that teachers need the test in order to be held accountable to teach the curriculum seems to be one that teachers and the general public, and government accept and use, but one based upon little or no evidence. In addition, neither these teachers, nor the provincial government make arguments that tested curriculum is vital for all students to understand. In fact, the argument that the teachers in this study make above, have more to do with students needing to understand the processes in science and material that is relevant to their lives as citizens, rather than all the curriculum. Jun, in particular, identified "environmental issues and issues that depend on their future, our future" as one of the most important in science, but also that "if we are pressed for time, I'm going to cut that kind of discussion." These kinds of issues – what Bruno Latour (1991) calls "hybrids – ...imbroglios of science, politics, economy, law, [etc]" (p. 2) are not on the provincial exam. Thus, Jun claimed "those are things we are losing with all the testing. ... That is what is nice about grade 8, because there seems to be less pressure and we can get into some of those discussions" (June 21/06).

When speaking about the provincial exam, Jun added, "I guess the idea is then they go into those specialty courses – biology 11, chemistry 11 – and they all need to be on the same page going into those" (June 21/06). Since all this material may not be necessary for lives as citizens, a better rationale for the exam may be to adequately prepare all students for further science. Here Jun is revealing her very reasonable expectation, especially given the students in her AP science 10 classroom, that science 10 is primarily preparation for future science courses. Jun is not in this moment thinking about students who do not take these senior science courses but still need to pass science

10 with the provincial exam worth 20 per cent. Like Anne and Delia, Jun interprets the purpose of the exam through the lens of serving her particular students.

Thus, even though Jun was not sure the exam was necessary, she did not complain about the exam. She did, however, talk in retrospect about how she had gotten caught up in what Anne called the "culture of academic achievement." Jun admitted, "I'm embarrassed to say this but for my grade 10's I had over 1000 points. ...That's crazy. Like I don't need 1000 marks to decide how well they did ... I get so focused on, you know, if I don't collect this, they won't do it" (June 21/06). She talked about how she needed to "relax a little about that" and how a colleague had given her advice that teaching was only 30% about content and 70% about trying "to make a good person" and she needed to remind herself of that more (June 21/06). I interpret Jun to mean that her own focus on testing and marking might get in the way sometimes of helping to make a "good person" – perhaps one who understands the complexity of a local environmental debate and so has the knowledge to care and act, but who was not exposed to all aspects of the curriculum.

Susanne

Susanne did not teach grade 10 that year, but she had taught the course previously. We did not talk specifically about the provincial exam. Susanne talked of not enough time as a major constraint in her teaching. She mentioned being pressed for time eight times in the two taped conversations we shared. She believed this was even more of a constraint for teachers of grade 10, given the amount of material. "I know the jump from grade 9 to grade 10 is quite a bit just in terms of the material. I know in grade 10

there is more than – than people can teach it; more information that needs to be delivered than time" (May 9/06).

Even in grades 8 and 9, Susanne felt that if there was "less stuff in the curriculum" then there would be more time to focus on the processes of questioning, and getting involved in investigations outside school, such as science fairs or physics teams which Susanne associated with good science teaching. When we talked about her assessment, Susanne mused whether less assessment would actually be better. However, she felt that students needed many opportunities to be assessed so that one bad day would not affect their mark. She used this rationale for having a lot of quizzes, labs and other assignments. She used the example of one of her students whose marks dropped for 3 or 4 assignments during a personally difficult period for the student, but the overall mark was not affected very much because there were so many marks.

It is interesting that Susanne makes an argument for frequent assessment as a way to be fair to students regarding their marks, rather than as a way to gather frequent information about understanding. I'm not saying that Susanne is not using those frequent assessments to see how students are learning and adjusting her teaching accordingly, I am merely pointing out that when Susanne talked about assessment, it was from the perspective of students' marks, which fits right in with the discourses surrounding assessment in schools, perhaps especially at Saunders, and her own emphasis on being fair as a key component of building relationships with students.

At the same time, Susanne, like all the other teachers, provides evidence that her students are driven by marks. She recounted that her students always want to know what mark they got on a test or assignment, but they don't look at the feedback, and toss

assignments aside when they are handed back. She had experimented with having students hand in a group lab report once, but didn't try that again after a parent complained that her daughter was doing all the work, and the other students was getting the mark that her daughter had earned. It is nothing new to report that this "culture of academic achievement" exists in schools (e.g. Sedlak, M, Wheeler, C., Pullin, D. & Cusick, P., 1986). However, I am interested in how it operates as part of the discourses of schools (of which the discourses of curriculum and testing and accountability are influential) and how it contributes to the thinking and actions of teachers in general and these teachers in particular.

From urban to suburban: The consequences of curriculum in context

Teachers' thoughts (and actions) across contexts

Across both contexts there are complaints about the new grade 10 exam in science and what Anne called the "culture of academic achievement." Despite their complaints, these teachers perpetuate as well as respond in particular ways to the discourses of curriculum and testing. My participants, like virtually all teachers, define student success, at least in part, by marks and passing tests. It is understandable that they are committed to helping their students pass courses, complete assignments and do well on tests. They are without a doubt committed to their students. Yet, they could define student success, for example, as being able to evaluate claims about relevant issues and focus on practicing doing so with applicable information. And in the process, students should learn enough about topics in the prescribed curriculum to demonstrate their understanding on assessments they designed and have some degree of success on an

external exam. But as teachers and former students, I believe it is difficult for them to define student success without reference to marks as a proxy for the knowledge, skills, dispositions, etc, that they feel students need as current and future learners and citizens. This discourse of marks and grades is part of what we think of as school.

Just as the discourse of school mandates the practices of awarding marks, following the prescribed curriculum is sacrosanct. Teachers overwhelmingly do their best to cover curriculum although they also make decisions about small omissions based on their ideas of good teaching. The question that policy-makers and teachers should be asking is not how to hold teachers accountable, but what teachers and students should be held accountable for. All the teachers in this study, including Delia who supported the exam, felt there was just too much in the curriculum, particularly in grade 10. Even Susanne, who did not teach grade 10 at the time of this study, frequently commented that there was not enough time even in grade 8 and 9. However, there was an acceptance, or at least a resignation among teachers, that they had to do their best to get through it all.

I believe part of the reason that these teachers stick so firmly to the curriculum as a central practice, with or without an external exam, is because this is an aspect of teaching that goes without saying; it is taken for granted. Teaching the curriculum is the teacher's job. Jun didn't feel she had the knowledge to make a judgment about what curriculum should be cut out and she talked of her dilemma between teaching all that important stuff, and not teaching as well as she might if there was less of it. I also believe that because these teachers functionally define an important aspect of student success in terms of doing well on tests, that part of their commitment to students is to engage them in all the curriculum as best they can.

Thus, despite the complaints, I did not see that the new exam affected practice very much. In extenuating circumstances like Anne's and Jaelyn's the previous year, there may be very tangible effects, but otherwise I do not see much difference between the approach of teachers who teach grade 10 to those who teach grade 8, or between the curriculum and instruction I participated in some 10 years previously and the practice of these teachers. This is similar to Anderson (2009) who found that even though upper elementary teachers in his study complained a great deal about the restrictions of testing under No Child Left Behind, that practices in these grades in terms of time spent on particular subject matter had not changed much. I think the negligible impact of the exam is that the "culture of academic achievement" that already exists may be heightened for both teachers and students.

It is possible that the presence of an exam could result in minor shifts in curricular focus. For example, the provincial exam attempts to assess about 90% of content PLOs but only three out of eight "applications of science" PLOs, relating to what the teachers and I called processes of science above. This is understandable since these are difficult understandings to demonstrate on a test composed of multiple choice (up to 75%), matching (up to 20%) and true-or-false (up to 20%) questions. However, this does add credence to Jun's argument that discussion of such issues can get pushed out with a higher focus on testing.

These applications of science PLOs are *not* assessed by the grade 10 provincial exam, and are to be assessed in the classroom:

• describe some important scientific discoveries that resulted from scientists applying

their knowledge and creativity to explore unexpected events

• describe the interactions between scientific developments and the beliefs and values of society

• identify and consider ethical implications of scientific investigations

• analyse costs and benefits of alternatives in resolving socio-scientific issues

Interestingly, of the four content PLOs that are not assessed, one of them is:

• analyse implications of current and emerging biomedical, genetic, and reproductive technologies

These areas not covered by the exam are prime candidates for fruitful content in terms of relevance, interest, and understanding the processes of science – all identified as important goals in good science teaching by these teachers. And so, even if their practices do not change very much with the presence of exams, the exam may function as a barrier to re-envisioning practices that better fit with their visions of good teaching, and meet the perceived needs of their students. In other words the exam may act as an excuse of sorts for not imagining and enacting practices better matched to visions of good teaching.

Thus, overall teachers generally do not like the new exams but practices are not too negatively influenced except in extenuating circumstances. The differences in practices around, and arguments for and against, the new exams varied based on the context. At Saunders in the suburban context, the argument for practice at test-taking and the representation of all sciences for future study has legitimacy given the expected paths of the majority of students in the school. In the urban context of Turner Secondary School, Anne's concerns in particular to cover the material so students can pass or come

close to passing the exam and pass the course, or that the material is impractical and esoteric, are also legitimate. And it is out of concern for students and how success for students is defined differently in these different contexts that drives the concerns and complaints of the teachers.

One could argue that Anne should have higher expectations for her students, and that a provincial exam might necessitate and thus help her do that. But I believe that criticism is too simplified. Anne believes in the potential of her students to learn the grade 10 science curriculum. However, she believes that she understands their lack of motivation and concern to do well in school and she does not want to see that as an impediment to their lives. Delia, at the other end of the spectrum in supporting the exams, saw the benefit to her students in their preparation for their futures. Thus, there were many shared concerns with the exam in particular and curriculum in general as being too much material to know some of which may not be particularly relevant for students' futures. However, opinions were ultimately based on the degrees of service or disservice to students, and this varied notably by context.

Circumstances and outcomes across contexts

So is the exam more detrimental to students at Turner than at Saunders? We don't need publications like the Fraser Institute's "report card" to tell us that the best predictor of student success on standardized tests is their family's education and wealth. This is an already well-established correlation. For example, socio-economic status (and accompanying resources) is more closely correlated with SAT scores than any other factor (Hanson, 1993). In the Fraser report card for high schools released in April of

2007 (reporting on the some of the students of the teachers in this study), only two of the top fifteen were public schools, both serving communities in expensive areas of a big city near a major university – a pretty good indication that parents have high levels of wealth and/or education compared to the rest of society. What is useful about this correlation is not an indication of *where* (i.e. what schools and their teachers) 'improvement' is needed, but rather it indicates that schools may be better at rewarding cultural capital[5] rather than teaching it. This then would suggest that teachers need more support in teaching all students, particularly those who have had less positive experiences with school, or who come with different Discourses (Gee, 1999) than typical in wealthy well-educated settings (Lemke, 1990; Heath, 1983). Lemke (1990) argues that "those from social backgrounds where the activity structures, preferred grammar, rhetorical patters, and figures of speech ...are least like those of science and the classroom do least well" (p.22).

Even though the intent (or at least the rhetoric of the intent) is to identify schools that are struggling and to help those schools, the result is the opposite. In my study, the school district in which Saunders is located has experienced growth in the student population in part because it attracts students from a neighbouring district. That neighbouring district has a decreasing school age population, which has lead to closings of neighbourhood schools. While the school age population is shrinking anyway in this area, the perception that schools in Saunder's district are better has contributed.

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[5] Bourdieu (1977a; 1985; 1986) describes cultural capital as something like ways of thinking, acting, talking, skills, and knowledge that are learned from experiences in a cultural setting(like a family, neighborhood, classroom, workplace, etc.). Some scholars argue that schools reward children who come to school with the expected cultural capital, rather than teaching those ways of acting, skills, etc to children.

In addition, schools like Turner, are not running at capacity, whereas schools are overflowing on the other side of the city in this large district, where house prices are higher. Rather than providing help for struggling schools, publications like the Fraser report card contribute to perceptions that schools are better in certain places than they are in others. This perception can be an impetus for parents who have the means and inclination to leave, taking their student dollars with them.

What is most pertinent and interesting is that I saw no compelling evidence to suggest that schools like Saunders are indeed better than those like Turner. This is not to say that there are no differences. There are both stark and subtle differences. Yet, in my evaluation these differences do not translate into a significant differences in learning opportunities for students. The two major differences between the two are in the buildings themselves, and in the student population.

Saunders is a newer building with more modern rooms, and newer furniture like desks and chairs. Saunders also had a few more computers available for teacher use. At both schools each teacher had a computer for their use in their classroom. In Delia's case, where she did not have her own classroom, she had computer in her office area. Anne was the only one in the study who did not have such easy access to a computer. Since she was allocated in February to a classroom that was previously not used, it did not have a computer, and she never got one, despite asking. There were two computers in the staff room, but one was not working, so Anne usually used another teacher's computer in their classroom, when she could. Thus there was a small (and for everyone except Anne) inconsequential difference in resources, that could be easily observed.

Both schools are diverse linguistically and racially with respect to the student population. The socio-economic status of Saunders' students is definitely on the high end with little diversity. Turner, in contrast, has a population that is diverse socio-economically, with a higher than average numbers of low-income families within the school district. Thus, the major difference is the social class of the students. As I have already written, these differences in social class translate to differences in comparisons like the Fraser Institute's report card. Saunders was in the top 20, whereas Turner ranked around 150.

I believe these different rankings, which we must keep in mind reflect test scores which are not particularly good measures of learning or understanding, stem from differences in social class, rather than in differences in the quality of education offered at these two schools. First, both schools, like all in the province, use the same provincial curriculum as their basis for instruction and testing. These two schools use the same textbooks, and many of the same activities associated with those books. For example, in both settings, teachers often used the same laboratory activities to confirm ideas already learned. Additionally, teachers at these two schools have similar ideas of good teaching (as discussed in a previous chapter) and often use similar strategies as a part of their practices. For example, Jaelyn and Susanne both talked about their strategies of "pre-viewing" vocabulary at the beginning of a unit.

So if curriculum, teaching strategies, and teacher ideas are so similar, what causes the difference? How does social class translate to higher scores? One theory is the idea of cultural capital mentioned earlier. Students coming from middle to upper class backgrounds are more likely to come to school with the skill set, and expectations for

themselves to please the teacher and succeed in school. In addition, I believe the discourses and associated expectations of both parents and students of the middle and upper classes affect teachers' strategies and emphases, particularly with regards to testing. As I've documented above, teachers at Saunders felt their students were under pressure from their parents (and themselves) to do well on tests. This translated into greater pressure on those teachers to prepare students for tests. While this existed at Turner as well, no teacher at Turner mentioned pressure from parents, and sometimes, preparing students for tests was focused on students passing, like Anne talked about, rather than performing at high levels.

Whereas at both locations the discourse of testing and accountability was prevalent, teachers at Saunders seemed more consumed with marks and marking and may have taught more to the test. For example, the three teachers who taught science 8 and 9 (of which Jun and Susanne were two) all shared their tests among one another so there would be consistency between their classes. In addition, they collaborated on "unit exams" for the biology, chemistry, and physics units in the course. I believe that it was this slightly ratcheted-up focus on testing that led teachers at Saunders to make decisions such as using a conversion factor for the force of gravity as 10 X mass, rather than deriving the force of gravity from force = mass X acceleration due to gravity (mass X $10m/s^2$), as the teachers at Turner did. Newton's formula, F=ma is not in the grade 9 curriculum. For teachers at Turner it made sense to introduce it and use it since using the force of gravity in problems is in the curriculum, and this introduces students to a fundamental concept in Newtonian physics. At Saunders, since it was not part of the

curriculum, teachers felt it would be easier for students to perform calculations without another formula to confuse them.

With this example, I believe it is arguable that the quality of teaching was no less at Turner (and with this particular example may have been better). Yet the focus on test preparation and consistency may have been higher at Saunders. And, certainly the expectations and pressure from parents and students was greater at Saunders in terms of test preparation and performance.

Cohen (1988) calls teaching the "impossible profession" because its goal is human improvement with clients (students) who are not chosen by nor choose the teacher. If the criteria for 'improvement' are at odds between students and teachers, or students do not want to or will not 'improve,' then teaching is certainly an uphill effort. There are students at both Saunders and Turner who are motivated and interested in school (by both marks and learning), and students who are not interested in school, who feel they don't excel there, and for whom school does figure prominently in their future plans. However, at Turner, there are more of the latter than there are at Saunders. Here is a quick comparison of provincial exam results for Saunders and for Turner:

Table 2: Percent passing and letter grades for provincial exams in the sciences

	pass	A	B	C+	C	C-	F
Saunders – Biology 12 exam	94	35	30	9	11	9	6
Turner – Biology 12 exam	83	25	21	11	11	15	17
Saunders – Chemistry 12	94	24	33	18	12	6	6
Turner – Chemistry 12	100	19	21	13	17	30	0
Saunders – Physics 12	100	49	24	12	15	0	0
Turner – Physics 12	97	25	31	21	8	11	3

Table 3: Percent passing and letter grades for science 10 exam in 2005/6

	pass	A	B	C+	C	C-	F
Saunders	90	17	26	16	16	14	10
Turner	78	10	28	12	12	17	22

Anne's concern that the grade 10 provincial exam was frustrating for her students – those deemed most likely to fail – seems to be borne out in the provincial exam results. We can see that students at Turner did not do as well as those at Saunders on this assessment, with the greatest difference in the per cent of A's on the exam (Saunders 7% higher), and the percent of failures (Turner 12% higher). If we compare the grade 12 results in the sciences, the margins of difference between Turner and Saunders students overall are less, particularly in Chemistry and Physics. Thus, it seems to be those students who choose not to take senior sciences (or if they do, they take biology) like many in Anne's class, who struggle more with these types of assessments. I want to be clear that I am not blaming the students, rather than the teachers for lower scores at Turner. What I want to point out here is that such rankings are more a reflection of portions of school populations whose definitions of human improvement, goals and identities (related to social class) do not match with those of schools (or at least this kind of assessment in schools), than the quality of educational opportunities for students. Thus the rhetoric and intent of standardized testing to leave no children behind and help decision-makers aid low-performing schools, does not match the outcomes.

Concluding remarks: discourses of curriculum and testing

To sum up, the discourses of curriculum and testing and accountability result in teachers treating the curriculum as sacrosanct, despite a consensus that there was too much material and that some of it may be esoteric for a class necessary for high school

graduation. These discourses of school also function in teachers largely defining student success as performance for marks. Because these teachers define good teaching as intimately linked to their commitment to students, their opinions about the new external measure of the grade 10 provincial science exam varied somewhat by context, i.e. who the students are and the potential detriment or benefit the exam would have for them. Thus, there was a small degree of acceptance in the suburban setting and no acceptance in the urban setting. In both locations, however, the new exam did not have much affect on practice, except in extenuating circumstances. The outcomes of the exams, then, are to reify the perceived effectiveness of schools along lines of social class.

Chapter 6 Stories of new teachers: Stretched thin, self-sufficient and supported

Introduction

In the previous chapters I argue that all the teachers in this study intimately connect good teaching with relationships with students. Science content is thus filtered through ideas of service to students. How they connect with students depends more on their experience in teaching than on the context (although both are significant). Judgments and practices within the discourses of curriculum and testing (including the new provincial exam in science) are based on service or disservice to students and thus depend more on the context than years of experience. In this chapter, I explore discourses of being a new teacher, to which my participants contribute and respond, and the kinds of assistance they utilized and sought in order to support their practices.

Discourses of the new teacher: Pay your dues

It is taken for granted as usual for new teachers to have teaching loads that include a lot of different courses or "preps." It is not unusual to have to travel from classroom to classroom, or to teach a course or two outside one's area(s) of specialization. Whereas these situations are not ideal for any teacher, they are especially difficult for new teachers, who are preparing to teach courses for the first time, as well as learning school routines and practices, and developing relationships with other staff members. However, the discourse of new teachers is to pay your dues and feel lucky you have job, so it is seen as normal that new teachers work most waking hours of their week.

Delia and Anne, the two first year teachers in this study, both had teaching loads that were typical of my description above. Anne taught in two schools, and taught seven different courses. Delia described her job as the "dog's breakfast." This load resulted in little time for her to actually think about her teaching. "Oh, I don't even worry about getting better right now. ... I don't have enough time, I think, to reflect, like I did [in teachers college]. You know how you are supposed to have your little reflection after the class – what went well? Did I reach my goals? ...I have like ten minutes to pick my stuff up and get to another classroom with the materials I need for that class" (May 9/06). Toward the end of the school year, she voiced how tired she had become: "I look at this little office and I think, oh my gosh, can I do another year of 5 preps and 6 classes and early mornings and coaching 3 seasons, and all to go through this next year?" (May 9/06) Similarly, Anne understandably noted, "I've found that new courses, new preps, all sorts of stuff – just everything seems a bit overwhelming" (June 22/06). Jaelyn had a more reasonable load in her first full year of teaching, with one classroom and only four different courses, all in junior science or chemistry. Even so, just being a teacher, and especially a new teacher she spent many hours on the job. "Just the other day I was here the night before until 8:00 for two days in a row making solutions. I was thinking, oh my god, it's 8:00 I want to go home and eat" (Mar 3/06).

This situation for new teachers can be normalized by both themselves and those around them. Despite feeling overwhelmed, Anne implied that the expectations of her weren't completely unreasonable by saying, "and at this point I'm young and I have the time. Well, I make the time" (June 22/06). Likewise, Jaelyn felt "very lucky" because she knew "for a lot of young teachers to get that permanent job, it is long journey of all

these different various courses or the blocks that they have to teach" (Mar 3/06). She reiterated this in our second conversation saying she knew many new teachers had loads of seven or six preps, "because when you are a new teacher, you get whatever is leftover." Even though she recognized it as "the reality of it all" because "you're lucky to have a job" she felt that it was "unfair" and "there should be a limit to how many preps you are going to get as a new teacher" (June 22/06).

In their analyses of teacher induction programs, Britton, Senta, Paine and Huntley (2000) also suggest that initial teaching assignments should be better matched to the skills of new teachers, but that this runs counter to the discourse of new teachers (though they don't use this term). These authors recognize this same discourse as they point to "beliefs about school staffing that run counter to supporting new teachers" evidenced by the reality that new teachers often have the most demanding teaching assignments and that more experienced faculty often regard this as a "rite of passage – they went through it at the beginning, so new teachers should bear these hardships as well" (p. 6). Susanne, in her fourth year of teaching, recalled, "when I was in Delia's situation of having to run from class to class, I had a hard time" (May 9/06). This was exacerbated by the fact that only two of her blocks in that first year were science, but she explained that she didn't complain because "as a starting teacher you don't want to say no" (May 9/06).

The discourse of paying your dues as a new teacher does not always prevent new teachers from complaining about their workload. However, it normalizes the frantic pace of work as a new teacher and contributes to high attrition rates. Teachers, like everyone else, want to be adequately recognized for their efforts and skill. When I asked the open question of how they could be better supported, several teachers mentioned workload and

pay. Whereas teachers know they are not going into a profession in which they will get particularly wealthy, they also work harder than they imagined. Lortie (1975) points out that students and new teachers underestimate the difficulties involved, which is not surprising given that students make judgments about their teachers' performances without the benefit of understanding what went into their goals, preparations, strategies, reflections, etc. Susanne exemplified this as she noted, "I knew I was going into a field that I knew I wouldn't get rich on. But then again when I first started it was more than I had expected" (May 9/06). Jaelyn called the workload "unimaginable," but she hoped and believed that it would get easier (Mar 3/06).

Thus, teachers find out quickly that the job is harder than they may have thought. The consistent desire for more time to do a better job, and fair recognition and compensation for their work are common desires. Anne claimed, "definitely the more time I took to prepare, the more I felt like I was doing a professional job, the more I was able to respond to students' needs, and the more I felt that the students got out of each lesson. So if I'd had another block of prep, I think it would have made a lot of difference." Anne complained about this workload versus the pay: "If you consider that I'm working till 6:00 or 7:00 at night and getting back up at 6:30 in the morning to come back to work, I'm not getting paid much. So that is frustrating" (Mar 29). Likewise, Jun shared that it was "tough to think about all the hours and hard work you are putting in, especially as a new teacher, and what you get on your pay check." Like Jaelyn and Anne, Jun independently suggested that a reduced and controlled load of new teachers would be appropriate. She suggested that for new teachers, six out of eight blocks be considered full time, and that they should have only three different courses to teach, because "it

always seems like the new teachers who get stuck with more prep. ... like Delia being all over the school" (June 21/06).

Thus the discourse of new teachers putting in their time or paying their dues is both strengthened and challenged by the new teachers in this study. They expect and accept the workload (although it comes as a bit of shock at first). Yet at the same time they feel it should be differently. A similar conflict emerged as I looked into the kinds of support they utilized and sought, which I explore in the next section.

Conflicting identities: Self-sufficiency, mentors, and collaboration

Britzman (1986) discusses the roots and consequences of the cultural myths pertaining to the practice and development of teachers, one being that "teachers are self-made" (p. 448). This myth, operating as part of the discourses of teaching, butts up against some of these teachers' experiences and creates what I interpret as a conflicted identity. On the one hand these new teachers want to be seen as self-made and self-sufficient. On the other hand, some of them want more feedback and all of them have experienced valuable moments of working with others, and relying on them for resources, ideas, and advice. Thus, new teachers will draw on all support that is available, but typically only if it is easily or readily accessible. If that support is the norm, and especially if that support is not just a one-way street, but configured as sharing (where new teachers may understandably have less to share), new teachers may be more likely to participate because it provides them with the resources or ideas they want, while preserving some of their feelings of self-sufficiency, and it helps with their workload rather than adding to it.

The two newest teachers in this study, Anne and Delia, were the most outspoken about wanting more observation and feedback. This may be because they are the most used to this from their previous year in teachers' college. Delia said, "I guess because I was coming out of being a student teacher where people were always observing me and I got feedback after every class ...right into this. The first time anyone at this school came in and looked into my classroom was February ...[the new principal] came in and watched for 15 minutes ... And then she left and I wanted to say, 'so what did you think' but then I thought I would look too stupid" (May 9/06). Clearly Delia is open to feedback but she is also worried about appearing too needy or insecure.

Similarly, Anne surmises that most teachers don't want to be evaluated, and so she is probably an anomaly since she would really like more feedback. "I would love to have more in-class observation. I know that is probably what most teachers would hate but I would love to have someone come in ...like, that transition was really weak because" (May 29/06). These two teachers want feedback and want advice, but they do not see that desire or asking for it as the norm and so they are, at times anyway, hesitant to do so. I believe it is this conflict between what they want and believe could help them develop their practice as teachers and what they see as accepted that results in hybrid practices where they often work on their own, but at other times, with perhaps different opportunities such as a more experienced staff members' initiation, they seek out and/or accept resources or advice.

For example, Anne said, "I have been working in kind of a vacuum as far as finding test materials and hand-outs and stuff"(May 4/06). Likewise Delia shared, "I do everything myself. Like I write all the worksheets and everything like that" (May 9/06).

At another time, Anne talked about calling a lot on the department heads at both her schools for help, as well as counselors and a particular teacher at her other school. Delia's sphere of support was much smaller. "When I got these courses I really don't know what I assumed. Like someone to come over and go 'I'm part of the math department and I heard you just got a math. Well come over here and I'll give you -' Well, it didn't happen" (May 9/06). However, Delia recognized that "most teachers would share everything" and mentioned how one teacher told her to "just go through my binders." Yet Delia told me, "but you never really do" because "there isn't the opportunity to do it, and also you don't want to ... as a new teacher." Delia didn't want the other teachers to think, "she uses all our resources." Also, Delia didn't like the idea of "just taking things from other people. I want to feel like I have something [to contribute]" (May 9/06). I think this is why Delia felt that only one teacher – another chemistry teacher – really helped her. His approach to share between them, rather than to just offer his resources, made an impression on her. "Even though he has been here 12 years or whatever and I've been here one, he was never like, 'you should do it this way.' Although he could have at any point and I would have listened" (May 9/06).

Thus, for teachers who need support the most, that support can't just be casually offered, but should be seen as the norm, and offered in such a way that the new teacher is a contributing member of the community. To make feedback (not evaluation per se), resource and idea sharing part of the discourses of new teachers, these practices need to be institutionally supported. Anne wanted "more prep time – but not just for me, for more senior teachers so that they could take their time to help me learn things" (June 22/06). She felt lucky that, even though the science department head at Turner had a

class during her prep block, that it was a class with "fabulous kids" in which he could help Anne at times, if she needed it. "And if he hadn't had that particular class on that block, I would have been trying to figure it out after school, or before school, which is often times when I would like to meet with the kids" (June 22/06). Jaelyn had similar ideas. She too wished she "could spend more time with other teachers in the department" but "not during lunch time, not after school, but a time set for us to get together" because she had other commitments like yearbook and volleyball, "and you don't have time after school. And then you still have to mark and prep." She recalled, "I've been here since last school year and I don't think we have ever had the chance to sit down as a department and talk about different areas of science - how we do things in the junior sciences" (Mar 3/06).

I should note here that my participants mostly talked about mentoring from other teachers (particularly in subject-specific areas) and collaborative professional development opportunities when they talked about support for their practices. This was central to Jaelyn's recommendations for how to better support new teachers. She thought the best scenario would be an experienced teacher working with a new teacher so that they could share and discuss their ideas, as well as help new teachers learn "little things" like attendance and marking systems (June 22/06). She took advantage of the opportunities she had, as she relied on the department for physics help and a senior teacher upstairs for help in biology. She was still in touch with her sponsor teacher from her student teaching and her old high school chemistry teacher for ideas as well. Jaelyn was doing the best she could to fashion herself with mentors in an environment where that was not institutionally supported.

The idea of a mentor or some kind of induction program is not new, and is a trend that has been growing. In 2005-6 in the U.S. 80% of new teachers participated in some kind of induction program, up from 40% in 1990-91 (Russell, 2006). Programs are often organized and funded at the district level, but about 30 states require or provide funds for districts to offer induction programs (Britton, Senta, Paine & Huntley, 2000). The Northwest Territories has an induction program (which is not surprising given the added difficulty of retaining teachers in the northern Canada). Ontario began a new induction program in the fall of 2007 which includes mentoring for new teachers by experienced teachers, a protocol of professional development and corresponding performance appraisals of new teachers (Ontario Ministry of Education, 2006). This program was organized in response to a report that between1993 and 1999, there was an attrition rate of 22-33 per cent during the first three years for all new teachers in Ontario. The most common reason cited for leaving is lack of support to adjust to the demands of the classroom (Ontario Ministry of Education, 2005).

Saunders' district actually had a program for new teachers and had experimented with some informal mentoring. The major problem with the new teacher program was that new teachers saw it as adding to their workload, rather than helping them. Susanne complained that "going to those meetings at the start was an additional something. And they went on and on and on. ... It wasn't somewhere that you wanted to be after working all day." Delia explained that "there was this first year teachers' thing and they were always having these meetings and I could never make the meetings cause I was coaching every semester."

As Britton et al (2000) point out, any assistance is helpful to new teachers, and

virtually every induction program deals with what Jaelyn calls "little things" as well as general support such as maintaining relationships with students and handling stress. However, as Susanne and Delia demonstrate, those kinds of programs may not be very convenient for new teachers. In addition, given that the teachers in this study already feel pretty accomplished at connecting with students, coupled with the high workload for new teachers, they tend to desire support which can immediately make their lives easier, such as subject-specific resource sharing (discussed in more detail below).

Likewise Britton et al (2000) claim that more effective programs include a subject-specific focus on curriculum and instruction, which requires more time and resources. Other scholars have reached similar conclusions, such as Little's (1993) advocation for subject matter collaboratives, and Darling-Hamond's (1998) suggestion of the potential for curriculum-centred professional development, including induction. Jun relayed that a few years ago, when she was a first year teacher, Saunders had an informal mentoring program which was subject-specific, as new teachers "were paired up with other teachers in the department." Jun concluded that the program "was a good idea but we didn't actually get together very much to meet and discuss things" (Apr 18/06). Jun said her mentor was great "but we didn't have any decided times or discussion topics or anything. ...I never felt like I couldn't go and talk to him about anything, ...but, you know, you get so busy in the year" (June 21/06). Within teachers' busy schedules, it was hard to make the time to actually build or utilize a mentoring relationship. Reducing the first year teaching load, as Jun suggested and as happens in New Zealand where first year teachers are paid a full salary with an 80% teaching load (Britton et al, 2000) would be one avenue for providing more time. Release time for mentors would be appropriate as

well.

Of course more time, while certainly beneficial, cannot be the only institutional support. Whereas all the teachers here would appreciate more time to prepare lessons, more time searching the Internet or textbooks for activities is probably not the best way to spend that time. Time to work with colleagues on curriculum and instruction, was something that everyone wanted more of. And thus the conflict that arises between wanting a professional community (McLaughlin & Talbert, 2001) - and wanting to be perceived as an expert or contributing (rather than just taking) member of that community needs to be reduced by the norm of working together on goals, activities, rationales, and strategies.

The desire for including a subject-specific focus in terms of support or mentoring was evidenced by the kind of support my participants sought on the job. It was also something that everyone found useful, though it is far from the norm. What this support looked like, was largely based on sharing resources like test questions and activities. This makes sense given the daily pressures and time constraints of teachers in general and new teachers in particular. New teachers understandably desire support that makes their jobs easier.

One area where teachers in this study desired help in particular was in teaching content in areas of science that were not in their area of specialty. For example, Jaelyn wanted help with biology, "because I am not the master when it comes to biology. If I could talk to other biology teachers about my biology lesson, they probably have better ideas on how I should be approaching this topic" (Mar 3/06). Similarly, Jun talked about not spending as much time in earth science in grade 10 and how as a group of teachers

they tried to figure out how the one earth science specialist in the department might trade up units, so that he could teach the earth science. It would seem to make sense for that earth science specialist to act as an "earth science mentor" for the other teachers, and help them. Someone else might act as a biology mentor, or chemistry mentor.

When support in terms of resources and thinking about less familiar subject matter is given, the results can be significant. For example, Anne, a biology major, said in her first interview, "I don't go as in depth in astronomy as other teachers would because, quite honestly, I can't answer half the questions they [the students] are going to ask me." However, in May, Anne attended a science teacher conference and went to a session about teaching astronomy so she would be better prepared for that section of the course. She learned about some new things and came away with new resources. As a result when she was teaching the astronomy unit in grade 9, I was impressed with how in depth she did go and how much time she spent on this section.

Yet, this somewhat shallow version of subject-specific support does not address the root of these teachers' notions of good teaching. They all prioritized connecting with students, which translated into the filtering of science content through a lens of potential relevance (for citizens and consumers) and interest. Thus, discussion and resource sharing and development would be most useful for these teachers if the focus was on priorities, rationales and strategies for engaging students in relevant and interesting curriculum. This is not to say that these sorts of things are never discussed but what teachers talked about and what they produced together or shared was more often focused on being on the same page with activities, worksheets and assessments in following the curriculum. As discussed in the previous chapter, these teachers were diligent about

following the curriculum. And as stated above, they were pressed for time. Thus it is not surprising that rather than questioning what aspects of the curriculum best fit with their notions of good teaching or how to best fashion their priorities to fit with the curriculum, these teachers mostly shared ready-made resources or sometimes developed resources together, sharing the work.

By far the best example of a collaborative norm was exemplified by Susanne, Jun, and another colleague (who was also in her first five years of teaching but did not participate in this study because she taught science in a language other than English). This relationship was clearly built around subject matter as these three teachers all taught science 8 and 9. Susanne talked about this group helping each other out "in terms of worksheets, handouts, or activities" (May 9). She really valued this relationship, commenting, "the three of us, we make such a great team, we are so collaborative, and where one of us is weak, the other is strong (June 6/06). Likewise, Jun said, "I do talk to other teachers in the department. I feel lucky for the people that I work with ...because I think we are all very willing to share ideas and offer help" (Apr 18/06). I believe because this relationship was valuable to her, Jun wished for more time together, and to widen that norm to the department: "I think more time to get together would be good. ..We say we should have a binder and all the activities you do in science 8 ...so we always have these ideas but we never do it" (Apr 18/06).

Even though Jun and Susanne's group is not a model of a professional learning community, it is certainly a better model than working alone searching for subject-specific resources. Even if the focus of the group is to share tests and activities, that act of sharing opens the door (both in the moment and in setting a new norm) for discussion

of why certain test questions are useful in understanding how students make sense of ideas, or what policies should be in place, or how to better teach a unit so that the content is more relevant and interesting for students and their future lives as citizens. Thus, a norm of working collaboratively does not automatically mean meaningful collaboration in terms of questioning practice in light of priorities, but it provides better avenues and opportunities for doing so.

Concluding remarks: foci for discussion, debate and collaboration

The discourses of new teachers in terms of paying your dues and being self-sufficient both work against supporting the continued learning and development of new teachers' practices. The former normalizes a workload which virtually prohibits thinking about practice and latter conflicts with teachers ideas of how to improve their practice. However, these discourses are contested. Reduced workloads for new teachers and institutional support, largely in terms of time, for programs such as mentoring are ideas gaining momentum and being tried. Whereas the existence of such programs is growing rapidly, the quality is uneven.

We can learn from the conflicting facets of new teachers' identities, to be self-sufficient and wanting help. Induction programs need to connect to the needs of new teachers, by providing subject-specific (as well as generic) support in terms of feedback and ample opportunities to share resources and discuss ideas. However, collaborative opportunities are not automatically more than a forum in which to share resources. Norms of working together need to be refashioned around bigger questions of teaching science to students that are aligned with reform efforts, such as how to best help students

build knowledge, skills, and habits of mind necessary for personal enrichment as well as the abilities to engage in science-technology-society debates and be productive members of global society (NRC, 1996; B.C. Ministry of Education, 2006). New teachers (and experienced ones) would benefit from ideas and discussions framed around science such as what content is important and why; why particular strategies are promising for teaching certain concepts; which assessments reveal student understanding and why; or how to incorporate more meaningful student discussion. Ideally subject-specific support could be an avenue for connecting teaching priorities and content and contributing to new discourses of teaching, which pick apart myths and build norms of collaboration and discussion among teachers.

Like Britzman (2003) suggests, such collaboration might entail contemplating what theories or discourses we operate within, how they have been historically constituted, if they are beneficial or harmful and for whom, and how we might think and act differently. Likewise, Dewey (1929/ 1988) advocated a skepticism that draws from the "practical reasoning" of Aristotle. Such reasoning comprised the study of the structure of argument and the functions of those arguments, which could only be studied on a case-by-case basis, i.e. including the context. Since Dewey, many others have concluded that it is essential for teachers to recognize and examine their own theories about teaching, learning, knowledge, and roles of education. For example, Cochran-Smith (2000) argues that teachers should "frame these questions [of knowledge, learning, and outcomes] and teachers' work as fundamentally interpretive, political, and theoretical *as well as* strategic, practical, and local" (p. 18). This kind of support for new teachers

might not only assist them to be successful and survive in current conditions, but to have the tools to change and improve those conditions as well (Feiman-Nemser, 2001).

Finally, my participants suggest that a central feature of a community designed to support new teachers must have the norm, expectation and opportunity for new teachers to be contributing members, as well as have access to accepted avenues to seek help and resources. New teachers would benefit from participating in and witnessing the struggles of more experienced teachers. Rather than being given a good worksheet or some nice test questions, such resources must be accompanied by the work behind decisions about curriculum. New teachers (and more experienced ones) would benefit from the time and expectation to discuss their, priorities, purposes and practices.

Chapter 7 Recommendations for (science) teaching

As Luft (2007) points out, even though beginning teachers' practices and thinking are conceptualized, constructed, and perhaps crystallized in the first years of teaching, the importance of this period is often overlooked[6]. Luft argues that among the kinds of research needed are studies that investigate the development of new teachers' knowledge, beliefs, thinking, learning and decision making and studies that situate new science teachers in the educational system and explore the interaction of new science teachers and their contexts such as policies (e.g. new government tests or curriculum, or induction programs) or student populations. The purpose of such studies should be to inform policy decisions around new teachers such as fashioning induction programs. Thus, it is my intent that what I have learned about the thinking and practices of these five new science teachers in their different contexts can help to inform policies to better support them. Whereas Luft and I are both writing about new science teachers, what she suggests as well as much of the experiences, practices, struggles, commitments, concerns, expectations, and policies that are explored in this study are common to teachers in general. Thus, here I will recap what I believe we can learn both about supporting new teachers in general and science teachers in particular.

Recognizing and understanding the priorities of new teachers in context

Part of the reason that I feel it is appropriate to write about new teachers in general

[6] Part of the reason for the dearth of studies of beginning teachers is that new teachers are exhausted and conspicuously lack time and are often advised not to take on participation in research because of this. In my approach to this study, as I stated at the beginning, was to position myself as some assistance to balance the time I needed from my participants.

is that my participants most closely associated good science teaching with forming relationships with students. They filtered science content through a lens of relevance (mostly to everyday life) and interest for students. Thus they filtered science content through a commitment to serving students, which makes sense since I argue that the primary motivations for teaching had more to do with working with students and helping people than the disciplines of science. Passion for the subject matter, while certainly present, is not primary

This is at odds with much of the reform efforts in science education which focus on how thinking about science content frames pedagogy, or on pedagogical content knowledge (see Barnett, J. & Hodson, D., 2001; Loughran,J., Mulhall, P. & Berry, A., 2004; Van Driel, J.H., De Jong, O., & Verloop, N., 2002; Zeidler, D., 2002) There has been less attention paid to how science teachers develop their practices in response to their views of students – what they need to know about them, how to learn this, how and what students should learn, and why – and the relationships they try to form with students. This study suggests that connecting strategies for relationship-building with students and strategies for teaching the sciences is an avenue that must be better explored and utilized.

In addition, the newest teachers in this study relied more on their personalities and passions to connect with students. This is in part a response to the cultural discourses of teaching that circulate in popular media and myth. The more experienced teachers had had time to develop priorities in their practices that they felt served students such as having a variety of activities and assignments, clear expectations and multiple assessments. In other words the practices of being organized and above all fair, helped

the more experienced teachers develop relationships with students. The pedagogical strategies for building relationships with students also depended on the student population, with more emphasis on opportunities to get good marks in the suburban context compared to opportunities to pass a course in the urban context. In both cases an emphasis on being fair or being flexible comes out of defining student success as success in school, which is in line with the larger discourses of school, curriculum and testing, but conflicts somewhat with ideas of good teaching revolving around relevance, interest and curiosity. I will discuss this in more detail below.

Recognizing and understanding discourses and contexts of teaching

The framework of discourses focuses on how thinking and actions are shaped by, contribute to and challenge taken-for-granted ways of thinking, communicating, acting, values and tools, embedded in social institutions. This focus helps me to ask what and how taken-for-granted language, beliefs, practices, and institutions affect the way some teachers envision the work of teaching science and their teaching practices.

In chapter five I discussed what I called the discourses of curriculum and of testing and accountability (derived from theories and knowledge dominant in the larger sociopolitical milieu, particularly economics in a neo-liberal political era). We might think of the discourse of curriculum as educators taking for granted that the prescribed curriculum is sacrosanct and defining student success, at least in part, by marks and passing tests. It is understandable that despite feeling that the curriculum was too packed, and decrying the culture of academic achievement, that in service to their students, the teachers in this study were committed to engaging their students in all areas of the

curriculum and to helping them pass courses, complete assignments and do well on tests. Opinions about the new grade 10 provincial exam were based on service or disservice to students and thus mostly dependent on context and student population. Despite a majority of complaints about the new exam, I did not find evidence that it had a lot of impact on the way teachers taught, except for extenuating circumstances such as taking over for another teacher or working with a unique population of students, both of which had occurred in the urban setting.

In chapter six I examined the discourses of new teachers and the kinds of support they sought and utilized. Given the frantic pace of teaching, especially in the first years, the forms of support I witnessed and heard about mostly consisted of sharing ready-made resources or sometimes developing resources together, sharing the work. This act of sharing, even if it is just focused on exchanging tests and activities, opens the door (both in the moment and in setting a new norm) for deeper discussion such as what aspects of the curriculum best fit with their notions of good teaching, such as how to better teach a unit so that the content is more relevant and interesting for students and their future lives as citizens; or why certain test questions are useful in understanding how students make sense of ideas, or why particular strategies are promising for teaching certain concepts. Thus, a norm of working together does not automatically produce meaningful collaboration in terms of questioning practice in light of priorities, but it could provide an avenue for doing so. Below I will share some ideas of how to better connect priorities of serving students and the needs of new teachers with science teaching.

Possibilities for connecting the needs of new teachers and their students with science

The contribution of this study lies in the in depth understanding of what makes these teachers tick, and how their convictions and practices interact (are constrained, enabled, challenged, bolstered, etc) with larger discourses. Serving and forming relationships with students is at the heart of their practices and identities as teachers. Thus, the challenge for supporting them as science teachers is to provide avenues to connect this core of their teaching practice to the teaching of science.

This means more than defining student success as getting good marks in a science course. It means helping new teachers define student success in ways that fit with their priorities for *science* teaching and not just teaching. These teachers have ideas of good teaching in relevance, interest, curiosity and the processes of science that fits well with reform documents and efforts in science teaching. The motivation behind these ideas, however, is serving students, and less so in accurately representing the disciplines of science. Thus, if support for their practices is framed as helping them serve students in ways they feel are important, it is more likely to be generative. Engaging new teachers in meaningful thought and discussion that has a real impact on practice has to speak to their deepest priorities and convictions, as well as institutionally supporting the time and resources for them to do so.

A greater focus on Science Technology Society Environment (STSE)

Above, I argue that the discourses of curriculum and testing, encourage teachers to define student success in terms of doing well on assessments, particularly tests and

exams. However, if they were to define student success in ways that fit with their ideas of what students needed to learn or understand, success might mean being able to evaluate claims, understand processes such as how our bodies function or how simple machines make work easier, or consider ramifications of current practices in biotechnology. Focusing too narrowly on curricular material that is testable (in the case of exams, on standardized multiple-choice, matching, and true-false questions), especially within an over-packed curriculum, reduces the likelihood that students will engage in many aspects of science highlighted by these teachers as relevant (and interesting) and in science education reforms, particularly the history and nature of science, and the complex relationships between science, technology, and society (NRC, 1996; B.C. Ministry of Ed, 2006).

Such aspects of science are singled out by these teachers because they are particularly relevant in today's world. I and many other scholars concur. Some of the most significant issues citizens are and will be faced with involve science such as climate change, loss of habitat and biodiversity, genetically modified organism (GMO's), or antibiotic resistance. It is probably more important for any individual to have the skills and knowledge to critique scientific findings (e.g. claims of the effects of nutra-ceuticals) and the technology developed out of science with regards to purposes and ramifications (e.g. that seeds from Monsanto-engineered plants are infertile and what that means for farmers' and Monsanto's productivity and profits), than to balance a chemical equation.

Likewise, other scholars (Roth, 2002; Pedretti & Hodson, 1995; May, 1992) advocate what Roth (2002) calls "citizen science" (p. 4) where citizens need to know aspects of science in order to act, such as how to critique science practices and policies

based on and in spite of scientific findings. This vision of what we might call science literacy has a prominent place within science education policy documents in Canada, such as B.C.'s curriculum guide. For example, B.C.'s science curriculum lists four over-riding goals for science 8 to 10, the first of which is "students will develop an understanding of the nature of science and technology, of the relationships between science and technology, and of the social and environmental contexts of science and technology." Following goals for developing scientific skills and knowledge, the fourth goal suggests "students will be encouraged to develop attitudes that support the responsible acquisition and application of scientific and technological knowledge to the mutual benefit of self, society, and the environment" (B.C. Ministry of Education, 2006). Similarly, the National Science Education Standards (NSES) in the U.S., from which most state science curriculum documents draw, states one of its aims is to "guide the *science education system* toward its *goal of a scientifically literate citizenry* in productive and *socially responsible* ways" (NRC, 1995, p. I-1, italics added).

Thus a greater emphasis on the processes of science within society not only better meets the goals of the B.C. curriculum, it also better matches teachers' ideas of good teaching. A greater focus on STSE then seems a promising avenue to engage new teachers in developing practices that fit with who they are as teachers and with reform efforts in science education. Of course I should not paint all reform efforts in science education with the same brush. What I highlight out of reform is in line with Carter (2008) who notes that "the main purpose of science education should be to help students understand and make critical judgments about science in ways that can enhance their engagement to work for a more socially just, equitable, and ecologically sustainable

world" (p. 628) in her essay re-conceptualizing science education in an age of globalization. Similarly, Cunningham and Helms (1998) argue for and provide examples of using sociological understandings of science to fashion pedagogical approaches that mimic practices of real scientists – specifically networking, peer review and skepticism – to engender more authentic and inclusive teaching practices. Such examples of priorities and strategies seem to be rich places for debate and experimentation that would be welcomed by my participants, provided they had the support to do so.

Forms of institutional support

So what form should this greater focus on STSE take and how can it be supported? Virtually every report and scholarly publication that addresses improvement of instruction and learning in schools, points to the teacher as the key. Research reviewed in such publications share certain elements with regards to productive avenues for the support and development of teachers' practices. I summarize these as elements as collaborative, subject-specific support that places practice in the larger context of the purposes of schools, and builds norms of experimentation, mutual aid and leaves room for informed dissent (Little, J.W., 1993). As I report in chapter six, the teachers in this study concur that they desire more time to prepare for teaching and suggest that the time be productively spent in collaborative, mutually- supporting discussions of curriculum and sharing of ideas and resources. Reducing the teaching load for first year teachers and possibly even for all teachers (and certainly those who act as mentors) seems a necessary step. It is worth noting that in Ontario, a secondary teacher is full time teaching six courses (where eight is a full-time student load) plus 15 blocks of on-call time. In B.C.

full time is teaching seven courses out of eight. Thus, simply matching B.C. definition of full-time to Ontario's would help all teachers in B.C., particularly the new ones. In addition, it has been recognized time and again that faults in education systems stem from failing to support teachers (part of that systemic failure are discourses of new teachers that normalize surviving difficult work by largely by themselves), and that professional development and induction programs which include these elements would be a wise use of improvement funds (Cochran-Smith, 2004; Darling-Hammond, 1998).

In her discussion of conditions in which teachers can teach, Darling-Hammond (1998) notes the importance of structures that enable sustained relationships between students and teachers. Such structures are atypical of high schools in both Canada and the U.S., where teachers often teach between 150 and 200 students at one time. Yet, even under these conditions, the participants in my study underscore the importance of relationships with students and are largely successful of forming relationships with students that are productive. What those relationships looked like were somewhat different and dependent on teachers' past experiences, convictions, and notions of their roles in order to meet the needs of the students in their particular contexts, such as finding a balance between coddling and providing flexible opportunities for 'at risk' youth, or emphasizing being fair within a population of students who generally cared greatly about their marks and performance.

Concluding thoughts

We must applaud these teachers for their commitment to students and the fact that they do not see students as a constraint to their practices. We need to recognize and

capitalize on the resources they bring and find ways to better match their commitments with science and science teaching. I believe this can be accomplished with a greater focus on citizen science and new research into how to build new norms in science teaching with this at the center. This will entail recognizing the discourses we operate within and the constraints and resources those provide and encourage. And it will require institutional support. Both are possible if we are open to questioning why we do what we do and we have the opportunities to build the tools with which to change our practices and priorities.

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