

Portraiture in the Large Lecture:
Storying One Chemistry Professor's Practical Knowledge

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ABSTRACT

Practical knowledge, as defined by Freema Elbaz (1983), is a complex, practically oriented set of understandings which teachers use to actively shape and direct their work. The goal of this study is the construction of a social science portrait that illuminates the practical knowledge of a large lecture professor of general chemistry at a public research university in the southeast. This study continues Elbaz's (1981) work on practical knowledge with the incorporation of a qualitative and intentionally interventionist methodology which "blurs the boundaries of aesthetics and empiricism in an effort to capture the complexity, dynamics, and subtlety of human experience and organizational life," (Lawrence-Lightfoot & Davis, 1997).

This collection of interviews, observations, writings, and reflections is designed for an eclectic audience with the intent of initiating conversation on the topic of the large lecture and is a purposeful attempt to link research and practice. Social science portraiture is uniquely suited to this intersection of researcher and researched, the perfect combination of methodology and analysis for a project that is both product and praxis. The following research questions guide the study.

- Are aspects of Elbaz's practical knowledge identifiable in the research conversations conducted with a large lecture college professor?
- Is practical knowledge identifiable during observations of Patricia's large lecture?

Freema Elbaz conducted research conversations with Sarah, a high school classroom and writing resource teacher who conducted much of her teaching work one on one with students. Patricia's practice differs significantly from Sarah's with respect to subject matter and to scale.



Dedication

For my friend, Patricia,
my husband, Craig,
and my father,
excellent parents all.

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Prologue

Dear Reader,

By whatever method Schrödinger's cat meets its demise, or not, possibilities for its condition exist so long as no observer enters the scene. Possibilities collapse with observation until only one reality remains: that which is observed. Inherent in the focus on any one observation lies the slip of a grasp, the inability to fully express, other contributions to that very reality. Schrödinger's thought experiment expresses his concern, not for the well-being of the animal, but rather acceptance by the scientific community of probability as a valid model of reality (the Copenhagen interpretation) and with the concept of reality as independent of that which is experimentally established. Heisenberg's take on the same notion: that what we, as humans, see is not nature, his substitution for Schrödinger's reality, but only nature as interpreted by our method of questioning it. Both physicists were consumed with what they saw as the proper philosophical basis for the expression of quantitative data, data taken from the subatomic realm, a place where classical mechanics fails to successfully reveal reality as it exists on the macroscopic scale.

Similarly concerned, I have chosen portraiture as a qualitative research methodology well-suited to capturing the intricacies of teaching practice. Portraiture melds the empirical and the aesthetic, both fully necessary for a true representation of the complex intersections of circumstance occurring simultaneously in any instance of classroom activity. While the goal of most academic work is to impact the intellect, I believe it is equally, if not more,

important to forge connection with the heart, with a further imperative to deliver, when appropriate, a punch to the gut.

What follows here is no regular dissertation! Teaching is complicated! Practical knowledge is a complicated theory through which to examine teaching practice; and portraiture is an appropriately inclusive methodology with which I have attempted to render readable the description of one teaching practice, a practice that has for years been highly regarded and many times rewarded by students, faculty, and administration. Portraiture is a unique methodology in that it seeks to capture goodness; in addition it is explicit in its revelation of researcher bias.

Search for no well-defined problems nor solutions to same within this document. Read to enjoy, in order to understand this one practice. It is my hope that, upon reflection, the intricacies of this one practice will serve to inspire the reader, the teacher perhaps, in the course of their professional practice.

Chapter One

Introduction

Practical knowledge, as defined by Freema Elbaz (1983), is a complex, practically oriented set of understandings which teachers use to actively shape and direct their work. The goal of this study, an amalgam of sorts, is the construction of a social science portrait, a story, one that illuminates this marriage of theory and practice, in truth two entities that are impossible to separate, that is Patricia's practical knowledge in her professional role as a professor of general chemistry at a large public research university in the southeast. This study continues Elbaz's (1981) work on practical knowledge with the incorporation of an intentionally interventionist methodology, social science portraiture, a qualitative methodology which "blurs the boundaries of aesthetics and empiricism in an effort to capture the complexity, dynamics, and subtlety of human experience and organizational life." (Lawrence-Lightfoot & Davis, 1997) This collection of interviews, observations, writings, and reflections is designed for an eclectic audience with the intent of initiating conversation on the topic of the large lecture.

As Elbaz further defines the term practical knowledge, she moves well beyond the special skills and personal qualities of all teachers to teacher as agent exhibiting firsthand experience of students' learning styles, interests, needs, strengths and difficulties, and a repertoire of instructional skills and techniques and classroom management skills. The teacher knows the social structure of the school and what it requires, of teacher and student, for survival and for success; she knows the community of which the school is a part, and has a sense of what it will and will not accept. This experiential knowledge is

informed by the teacher's theoretical knowledge of subject matter, and of areas of child development, learning, and social theory. All of these kinds of knowledge, as integrated by the individual teacher in terms of personal values and beliefs and as oriented to her practical situation will be referred to here as 'practical knowledge' (Elbaz, 1983, p. 5).

Elbaz (1983) chooses the term *practical knowledge* because it focuses attention on the action and decision-oriented nature of the teacher's situation, and construes her knowledge as a function, in part, of her response to that situation. Thus, whatever utopian models of curriculum creation are possibly imagined, their result cannot be a product but only a lived experience in which the efforts of individuals to disclose meaning are critical. For good or for ill, there can be no teacher-proof curriculum. The teacher is no mere instrument, but the agent responsible in large part for either the success or failure of authentically derived curricula. A major implication of Elbaz's work for curriculum reform is the view of the teacher in the effort.

Patricia's and my conversations and the portrait to be drawn from them is a purposeful attempt to link research and practice, an explicitly activist and interventionist process dedicated to further developing the body of research on teachers' practical knowledge, begun by Elbaz, with a focus on one teacher in her large lecture. Social science portraiture is uniquely suited to this intersection of researcher and researched, the perfect combination of methodology and analysis for a project that is both product and praxis.

"The universe is made of stories, not of atoms" wrote Muriel Rukeyser (2005, p. 970). I believe this universe can be expressed as a marriage of the two, that such allusions to science need not be such either/or propositions. The account that follows, then, is an

opportunity seized, a chance to create a story about a teacher, Patricia, who teaches college students about atoms, a unique opportunity since I am both author of this document and a college chemistry teacher. My life too is full of teaching stories and atoms, and serves as the lens through which Patricia's stories will pass. Stories are absolutely central to the kind of work those in the teaching profession do (Witherell & Noddings, 1991); they can be a profound form of scholarship "moving serious study close to the frontiers of art in the capacity to express complex truth and moral context in intelligible ways" (Lawrence-Lightfoot & Davis, 1997, p. 11).

Purpose of the Study

A near-total public and policy silence exists regarding what any contemporary college graduates need to know and be able to do (LEAP, 2007); so we send inexperienced, untrained doctoral graduates into lecture halls and classrooms as college teachers with little or no curricular guidance: acts of professional irresponsibility (Gaff & Pruitt-Logan, 1998). Structures do exist to prepare college teachers for teaching (Klomprens & Beck, 2004; Nyquist, Woodford, & Rogers, 2004; Pruitt-Logan & Gaff, 2004; Walker, 2004; Weisbuch, 2004), but their availability is dependent on initiative taken by the individual university, and even then usually by individual faculty members within those universities. Existing strategies to prepare the future professoriate have impacted the national conversation on the topic; but, their implementation in an organized and wide-spread fashion continues to challenge current and future generations of faculty (Wulff & Austin, 2004).

For 2000 years students have filed into and out of lecture classrooms; little has changed structurally from the classical Greek academy. A lecture is an exposition of a given subject delivered before an audience especially for the purpose of instruction, but the stern

parent can offer one as sober admonition or reproof; a reprimand, often at length. Plato's pupils, students at medieval European universities, and undergraduates at modern colleges can relate to all of those definitions and have experienced them in classrooms. When written manuscripts were scarce and expensive, the lecture was the best way to share the knowledge inscribed on those pages with large numbers of people. But we continue to educate in this very same fashion though access to information is as efficient, as flexible, and as widely accessible to whole populations as never before. Faculty in the academy possess the hardware to probe the inner workings of individual atoms in their research labs and, via the internet and email, they consult easily and frequently with their research colleagues located a world away, but when they enter the classroom most replay a scene steeped in tradition.

Most college students find the large lecture less than the pinnacle of educational experience; most university graduates can recollect falling asleep or very nearly doing so (despite their best intentions) in cavernous lecture halls. Research seminar attendees can usually recall moments of inattention to even the most knowledgeable of presenters describing cutting-edge work. Indeed, number of hours spent listening to lecturers appears nowhere in National Survey of Student Engagement (2008) reports measuring student engagement, but higher education economy finds the large lecture hall an appealingly efficient classroom design; in fact, chemistry department specific academic spaces currently under construction at Patricia's workplace include a brand new large lecture hall. And interestingly, while it is not difficult to spot sleeping students in any ongoing lecture class, students regularly elect large lecture professors as their favorite teachers. And as one of those favorite large lecture professors has said, "In theatre, there is never the notion that a packed house will result in a less meaningful or less intimate experience. What a powerful

opportunity to have that many people in one room who might never otherwise have chosen to gather!" (Rinehart, 2004).

The fact is that what routinely goes on in most college classes is not teaching, learning, nor performance, but stenography (Felder, 1991). A lecture is a more or less continuous exposition by a speaker who, ostensibly, wants the audience to learn something. While the main objective of lecture should be student learning (Bligh, 2000), the common denominator is more frequently the professor talking, "sometimes with eloquence and sometimes with soporific deadliness, but always and continually talking (Schueler, 1951). All instructors have been actors in this scene at some point during their academic careers. Overwhelming familiarity with this teaching method leaves little to seemingly describe. The instructor professes. The students listen and take notes. Some slip into sleep in a posture of attention and against their will, others slouch, resigned to the anticipated lecture-induced coma (Eddleton, 2005c), but many descriptions exist that paint a much rosier picture of, and some even celebrate (Bartlett, 2003), life in the large college lecture hall (Wolfman, 2002).

"Don't give me theory: just give me something that works!" (Ramsden, 2003, p. ix) is an indication of a certain way of looking at teaching but it is approximately the reverse of the truth about how to address it (Ramsden, 1992). Indeed, much writing done regarding the large lecture, indeed about teaching college classes in general (Bartlett, 2003; Bauer & Snizek, 1989; Goldhaber, 2003; Martino & Sala, 1996; Sokolove, 1998; Wolfman, 2002) has been published in the form of teaching tips (McKeachie, 2002), but today's doctoral students need preparation for a broader conception of the faculty role. The study to be detailed here examines a classroom practice through the lenses of practical knowledge and portraiture, a

tangled mixture of methodology and analysis capable of providing a rich conceptual understanding of one large lecture teaching practice.

Practical Knowledge Defined

Practical knowledge (Elbaz, 1983) is a complex, practically oriented set of understandings which teachers use to actively shape and direct the work of teaching. Schön (1983) conceptualizes practical knowledge as reflection-in-action, prompted by experience and over which we have limited control, and fundamentally different from a similar sounding term, reflection-on-action (Schön, 1983), a process very much within the control of the practitioner. Ask any teacher how they learned to teach and the response is likely to be something along the lines of, "by teaching." While it is certainly true that experience is valuable and can be an effective teacher, there is limited understanding as to how this happens (Russell & Munby, 1991). In practical knowledge though we find both the method by which curriculum becomes classroom experience and the barrier to any curriculum reform that does not originate with the teacher; hence, interestingly, the limited number of future professoriate programs in existence and, even further, the limited degree to which graduate students participate even at universities where the programs exist (Deck, 2008).

And though practical knowledge certainly presents itself in any act of teaching, only the most obvious manifestations can be explicitly recorded by a large lecture student on a survey-type evaluation of teaching like the Student Perceptions of Teaching (SPOT) (2008) forms administered at Patricia's workplace and in its department of chemistry. Ramifications of practical knowledge in the classroom permeate far beyond that end of course evaluation. Patricia's teaching practice comprises a sufficient number of overt behaviors for her to have

maintained spectacular SPOT evaluations and to have consistently garnered teaching awards over the entirety of her career for a course regarded with trepidation by many students.

Background of the Study

This exercise in portraiture, my desire to describe Patricia's professional practice, derives from my cumulative experience as a graduate student of education at Virginia Tech. During the writing of my prospectus, as I reread documents prepared for the myriad graduate education courses I have taken over the past fourteen years, I was reminded of the personal transformation I seem to, at this point, have survived. Concepts, especially those quintessentially Freirean, kept, and currently keep, me awake at night. I grew to desire and wrote about such almost a decade ago (Eddleton, 2005a), an urgent need to undertake this project as an act of conscientização (Freire, 1999, p. 90). I hope to add a dimension to Patricia's professional practice, to initiate her reflection on the notion that "to surmount a situation of oppression, people must first critically recognize its causes, so that through a transforming action they can create a new situation, one which makes possible the pursuit of a fuller humanity" (Freire, 1999, p. 29). In her dual roles of general chemistry professor and Director of General Chemistry, Patricia is in multiple positions to initiate change in the education of hundreds of undergraduate and graduate students. I both produce this alternative form of research representation and offer it to an audience intending that it be subjected to testimonial reading (Boler, 1999) as my offer of alliance to truth's representational crisis.

Freema Elbaz's dissertation work (Elbaz, 1983), a case study of one Canadian high school teacher, began the conversation into teachers' practical knowledge that continues today. Almost a decade thereafter, in her commentary on the direction in which the field

should continue, Elbaz (1990) describes story as both methodological device and methodology, "the very stuff of teaching, the landscape within which we live as teachers and researchers, and within which the work of teachers can be seen as making sense" (p. 32p. 32). Clandinin (2003) notes that many more recent studies into practical knowledge focus on the language of the discourse within which it is discussed, resulting in "longer, more complex, less precise, and more context dependent accounts (p. 137). And, in opposition to the task of traditional anthropological research, storying a culturally remote setting, the challenging "task of the school ethnographer is to make the familiar strange" (Gordon, Holland, & Lahelma, 2001, p. 188).

While the formulaic structure of most academic pieces is intended to inform a small audience of people in the same disciplinary field, the portrait to be constructed here is designed to be read by (and will hopefully inspire) a broad audience and should result in no list of best practices, rather description that elucidates the culture of Patricia's large lecture chemistry classroom, and her practical knowledge therein. Golde (2006) posits that big ideas are likely to motivate "the lively and sophisticated minds that make up today's academic departments" (p. 8); motivation for change within departments of chemistry is highly desirable since the axiom "if it ain't broke, don't fix it" might well be applied to doctoral education in chemistry in the United States. If left largely intact, existing doctoral preparation in departments of chemistry would likely not hamper research advances in the field. (Kwiram, 2006).

Each fall approximately 4,500 newly-minted high school graduates join about 16,000 upperclassmen in classrooms at Virginia Tech in several dozen possible fields of study (Virginia Tech, 2012b). At the conclusion of the semester, the burden of evaluating teaching

on campus is borne by these students. The questionnaires they submit elicit ratings for a narrow range of overt teaching behaviors presumed characteristic of effective teaching. I do not wish to dispute that indicators of effective teaching exist and that undergraduates are capable of identifying some of them, rather the "partial picture" (Saroyan & Amundsen, 2001) of teaching captured by these students on said evaluations. There is consistency present in this scenario, though. College administrations treat college teaching training dismissively if they recognize it at all and administrators at all levels accept as evaluation of that teaching the results of an instrument based on classroom actions instead of seeking an instrument or instruments that would provide a measure of the myriad cognitive and affective structures known to influence teaching practice (Shulman, 1986). Weimer (2002) questions the evaluative emphasis on teaching practice and suggests instead that evaluation focus on learning that takes place.

Some might ask for evidence supporting any claim that there is anything at all wrong with college teaching and university education. Certainly at Virginia Tech there exists no lack of students applying for admission; a total of approximately 22,000 applications for admission are received each year from which a freshman class of about 5,500 students is chosen (Virginia Tech, 2012a). Indeed, Virginia Tech's Department of Chemistry "has a long history, a solid reputation and a bright future" (Virginia Tech Department of Chemistry, 2009). Why should we fix, or address, what doesn't appear to be broken?

A central fact is that protestors are few and the silent, many. I was a member of the silent population myself for four years at the university at which Patricia works, during the mid-1980s, and I have maintained contact with many and silent fellow alumni in the two decades since. As an academic advisor and large lecture instructor at Patricia's workplace

and as a faculty member with an office within earshot of constant hallway banter, I have the opportunity daily to listen, off the record, to the silent majority.

"If the first principle of education is to expend the minimum energy necessary to satisfy the ignorant client, so be it. It would be a mistake, however, to assume that to tolerate means to be satisfied with, to be pleased by," (Schwab, 1969a). Joseph Schwab follows that statement with a survey of resources available for what he expresses in medical metaphor as student protest as a presenting symptom of the evils of education, student ineptitude indicating neglect by the curriculum. He offers prescriptions drawing on these resources aiming to ameliorate the ills he identifies, but promises no provision of a satisfyingly direct response to any specific malady (Schwab, 1969a). Times have certainly changed since Schwab wrote his book; the 1960s era public violence and student protests once making headlines nationwide (and in Blacksburg, Virginia too) have vanished. Having had the opportunity for 25 years, though, to speak to students in the lobbies outside their classrooms and to listen to student conversation in the hallways of Virginia Tech, I fully believe that all is not well on this university campus nor on university campuses in general and that neglect by the curriculum currently manifests in more subtle, but no less destructive, ways.

The aim of this study, in keeping with Schwab's only indirectly prescriptive ideas with respect to student protest, is quality portraiture, which is of more practical and inspirational value than reductionist analysis and technical prescriptiveness (Clark, 1986).

Philosophy of the Methodology

Portraiture is both a narrative research method and method of analysis uniquely suited to this combination of researcher and researched, to this project which is simultaneously product and praxis (Freire, 1999). Portraiture as a research approach is eclectic,

interdisciplinary, and shaped by the lenses of anthropology, auto/ethnography, and auto/biography, a decidedly "unmethodological" (Van Manen, 1990) approach in a prescriptive or technocratic sense. It implies a melding of the hermeneutic (Josselson, 2004) and the phenomenological, requiring the suspension of what Husserl called the "natural attitude" (Schwandt, 1997, p. 114) the everyday assumption of the independent existence of what is perceived and thought about. Husserl's critique of his own work in his later life invokes a spatial, geographical metaphor of crossing over into the "new land" (Sawicki, 2005). Husserl conveys, as I similarly intend with this project, something of the pioneer courage that should accompany phenomenological work.

Elbaz (1983) remarked that research on teaching has generally "viewed teachers in a fragmented way, in terms of isolated characteristics, and from a negative stance" (p. 9). She could name no other field of endeavor in which there is a comparable gap between the value and importance attached to the work and the level of ability generally attributed to those performing it. The view of teacher as instrument, as the explainer capable of "giving understanding to someone else" (Brown, 1978, p. 7), and lecture as a "period of output by the teacher and a period of input or reception or perception by the audience" (Bligh, 2000, p. xiii) further reinforces the idea of teacher simply as "cog in the educational machine" (Elbaz, p. 10). Lawrence-Lightfoot (2000) believes that social science's focus on pathology encourages facile inquiry (p. 9), echoing Elbaz's concern with negative stance. For these reasons, portraiture, as a methodological stance with the goal of recording the complex evidence of goodness, was chosen for this study.

Research Questions

A portrait is a "life drawing" (Lawrence-Lightfoot & Davis, 1997, p. 4), the trace of connections between individual personality and organizational culture, a narrative form of representation that seeks to capture the fluidity and complexity of the living world (Lawrence-Lightfoot & Davis, p. 6). The following research questions guide the study.

- Are aspects of Elbaz's practical knowledge identifiable in the research conversations conducted with a large lecture college professor?
- Is practical knowledge identifiable during observations of Patricia's large lecture chemistry classroom practice?

Freema Elbaz conducted research conversations with Sarah, a high school classroom and writing resource teacher who conducted much of her teaching work one on one with students. Patricia's practice differs significantly from Sarah's with respect to subject matter and to scale.

Definition of Terms

Practical Knowledge

Practical knowledge in its many forms takes on subtle changes in meaning. Elbaz (1983) describes practical knowledge as a complex, and practically-oriented set of understandings which teachers use to actively shape and direct the work of teaching. Hockey (2004) defines it as routinely "unnoticed" (p. 1) mundane activity, one so subtle as to require embodied study.

Teaching Chemistry in the Large Lecture

The meaning of the terms teaching chemistry and large lecture vary, not just inter-institutionally, but also within existing academic departments. Large lectures in Patricia's department range in size from 200 to 560 students. The general chemistry course taught by

Patricia is a two-semester sequence of basic chemical principles intended to prepare students majoring in the sciences and engineering for further study in both chemistry and their chosen disciplines.

Portraiture

Portraiture is a social science methodology that pushes existing boundaries in its explicit effort to "combine empirical and aesthetic description, in its focus on the convergence of narrative and analysis, in its goal of speaking to broader audiences beyond the academy, in its standard of authenticity rather than reliability and validity, and in its explicit recognition of the use of the self as the primary research instrument" (Lawrence-Lightfoot & Davis, 1997, p. 14).

Organization of the Document

This document is divided into five chapters. The reader is introduced to the study in Chapter One; Chapter Two comprises the literature relevant to the concept of practical knowledge. Methodology is addressed in Chapter Three, followed by Chapter Four, the portrait, comprising Patricia's stories, and stories developed through observation of her classroom activities, in particular those that fall within the theoretical, situational, social, and experiential orientations of practical knowledge. Finally, Chapter Five focuses on the personal orientation of Patricia's practical knowledge, includes a description of Patricia's cognitive style, and contains implications for the immediate participants of this project, and in general for large lecture teaching practice in general chemistry. Also included are implications for further research on the subject.

Chapter Two

Introduction

Each semester, Patricia successfully guides a group of several hundred undergraduate students through a study of foundational chemical principles in the lecture hall. This qualitative research study aspires to construct a portrait of her practice, an amalgam of theory and action that is her practical knowledge in the teaching of her large lectures. This chapter introduces, describes, and defines practical knowledge and traces an evolution of practical knowledge to which this study is a cogent progression.

Introducing Practical Knowledge with a Medical Metaphor

Practical knowledge takes on many forms and is in operation in any endeavor. In some disciplines it is called expert knowledge. Tacit knowledge is also an apt descriptor.

University of Michigan's Brian Coppola (1998) uses the metaphor of the Hippocratic Oath, the colloquial expression of which is, "First, do no harm," to describe higher education's historical focus on the moral development of those to be educated. While I appreciate Coppola's emphasis on the deterioration of university faculty due to highly technocratic programs of study to the neglect of developing subject matter within a wider moral base, I take issue with his metaphor. For, we are teachers. And "real" (Sommers, 2003, p. 4) teachers function in infinitely more complex daily situations than do doctors of medicine. As an influential former professor of mine said, "Teaching's not brain surgery?! You'll wish it was only brain surgery!" (Garrison, 1998). We cannot make the decision to do no harm, to have no effect on our students. Our presence in the classroom as the teacher, even if, like Patricia, we are the miniature sage on the stage (Bartlett, 2003) to the student at the very back of a large auditorium, is going to have some effect on each and every student in

that class. The following stories serve as examples, exemplars really, of such effects. As teachers, the decision to have no effect on our students is not one in which we have a say.

Storying Advance Organizers to Practical Knowledge

In a Middle School

The headline read, "Mueller is a star in constellation of students," to announce Mark Mueller as a member of the USA Today's 2004 All-USA Teacher Team. Mallory Nordness saw Mueller put his theories into practice (C. L. Grossman, 2005) when his response to her mouthing off in his 8th grade classroom was to introduce her as a smart and insightful young woman. Mueller's expression of the marriage of theory and practice, the practical knowledge that I intend to illustrate in this document, in his practice is summed into, "Everything I need to know about classroom management I learned in the mud and muck of a Y camp," (C. L. Grossman, 2005). Mueller has a bright future in public education and a cash prize to share with River Bluff Middle School. It was just a short story buried in the newspaper; unfortunately, most stories of such dedicated teachers do not make the headlines.

In a Childcare Center

When he was three, my son James, in childcare since the age of six weeks, panicked at the scream of the fire alarm during scheduled drills. He was unable to recover from several unannounced activations of the alarm system during the spray-painting of new classrooms in his building. For months thereafter, his teachers simultaneously dealt matter-of-factly, but also patiently and lovingly, with his fear, his tears, and countless other challenges facing them in the form of his fifteen classmates. Some of his peers also feared that loud noise but were able to regroup shortly after the drill. Sometimes the alarm interrupted his friends in that important business of going to the potty; and some looked

forward to the excitement and an unscheduled visit to the outdoors! But in the interest of safety and at the teachers' direction, all had to learn to line up and march out with some semblance of order to the appointed fencepost amid the din.

This simple story, unlike Mueller's, is not unexpected nor out of the ordinary. It is, in fact, quite the reverse. This is an example of the humdrum, the mundane, the day-to-day storying of schooling, expressions of the simultaneity of theory and practice, practical knowledge, enacted by all teachers and ever-present in every classroom. There are, though, schooling stories so extraordinary that, with increasing access to translated texts, their significance in the teaching community can only grow.

In a Concentration Camp

Refusing passage arrangements to Palestine and the United States, Friedl Dicker-Brandeis, a Bauhaus-trained art therapist, packed art supplies, not personal items, into her luggage for her journey to Theresienstadt. There she gave art lessons, providing a respite from terror and doom, to Jewish children separated from their parents. She taught for two years until her deportation and extermination days later in the gas chambers at Auschwitz. The documentary film depicting Dicker-Brandeis' life, *What Remains Is Love*, is appropriately titled ("Friedl Dicker-Brandeis biographical web site," 2001); she acted out of love for her students. Dicker-Brandeis was known as a charismatic pedagogue; an art teacher who never shared her own creations with her students lest they feel compelled to copy her style. "She either loved something or she hated it. And she couldn't endure hypocrisy at all!" ("Friedl Dicker-Brandeis biographical web site," 2001). Freire states, "Love is an act of courage, not of fear, love is commitment to others," (Freire, 1999). Dicker-Brandeis'

practical knowledge, as an artist and as a teacher, is a marriage of the central, banal features of her immediate situation and the peripheral, the conditions in which she had to live.

Janusz Korczak devoted his life to educating orphaned Jewish children. He left a successful literary and medical career at age 33 to teach, and was with his children, until perishing with them in the Treblinka concentration camp during World War II. Earlier in the war, after Nazi Germany conquered Poland, friends offered Korczak asylum and arranged for his escape, but this teacher refused assistance and stayed with the children, sealing his fate. Korczak was a well-known and popular writer, physician, and radio personality before the war began for Poland. He was also a consummate researcher, keeping a lifelong diary of his professional activities and observations.

Both Korczak and Dicker-Brandeis carried out the enterprise of education in extraordinary circumstances; and while both perished, having explicitly chosen to do so, their legacies, their thoughts and actions, embody the integration of infinitely broad visions with the practical knowledge that belongs to teachers. They chose death over life; each was, at one point, situated in a position to save themselves from the concentration camps. They each made sacrificial decisions to remain in the most inconceivable of classrooms; practical knowledge is grounded in the practical but it is not common sense.

The lessons these lives and their stories still teach have an importance that can serve as inspiration for current teachers. Korczak is regarded as a martyr in some circles, but as a testament to his enduring influence as an educator and writer, it is appropriate here to focus on his contributions to the foundational base of practical knowledge. For, in many ways, Korczak's concept of the role of practice in forming a teacher's personal theory of teaching was a precursor to the current notion of teacher's knowledge. During the early 20th century,

Dewey shared Korczak's radical view but only conceptualized it; Korczak set his ideas into daily practice (Efron, 2005).

Childcare providers have this knowledge as well. They have college degrees in human development or related fields and have therefore "taken" a requisite number of courses in the theory of education and psychology but they have and use each day something far beyond what could simply be called applications of theory. They have also a knowledge of children that goes far beyond the lists of who is allergic to what foods, who is in what stage of potty training, and whose parent is out of town on a business trip and likely (the child, not the parent) to be grumpy and out of sorts. They are guided each day by an inseparable combination of theories and practices. Mark Mueller also holds this kind of teacher knowledge. He does not apply theory to practice in his classrooms as the news writer stated; those two entities, which are in truth impossible to separate, operate simultaneously throughout his days with "hormone-riddled 13 year olds," (C. L. Grossman, 2005). Life is a story we live (Connelly & Clandinin, 1994). Some stories are extraordinary; others less so, but we all live them and each one is truly unique to our material, historic, economic, political, spiritual, and social situations. Teaching stories all share, more or less explicitly, expressions of practical knowledge.

Carter (1992) defined teacher knowledge as "practical and contextualized in the sense that it is knowledge of common dilemmas teachers face" and as "personal in the sense that teachers formulate and draw upon their personal understandings of the practical circumstances in which they work." In the most uncommon of dilemmas and to the extremes of circumstance (Clandinin, 1985), teachers like Korczak and Dicker-Brandeis make educational decisions that make the difference, sometimes literally, between life and death.

In teaching, concerns for the intellectual and the moral are ultimately inseparable. Respecting both subject matter and students means valuing who they are and what they know; it means helping students develop understandings that have value in their worlds and to develop potentials for the worlds they might want to inhabit or create (Ball & Wilson, 1996). Though he may well have realized that he and his students would never again know a world outside the camp, Janusz Korczak could not physically separate himself from his children; as is always the case though personally, and therefore differently manifested, his ethical self did not live partitioned off from the rest of his person (Noddings, 1984). When we, as researchers and teachers, find ways to embrace, reflect, and honor the complexities (Ball & Wilson, 1996) of teaching and of practical knowledge, we advance our profession to its most ethical, an expression of integrity in practice.

Tracing the Genealogy of Practical Knowledge

Foundations

Aristotle and Plato

The study of medicine figures into the early careers of several important researchers of practical knowledge; the exercise of practical knowledge and the practice of medicine are, in many respects, analogous. Tracing the history of practical knowledge to its roots, I eventually found my way to Aristotle, who himself first studied medicine (University of California Berkeley Museum of Paleontology, 2005). Ultimately, though, Aristotle was sent to study philosophy at Plato's academy. He was a brilliant pupil but clashed with Plato with respect to the very foundations of Plato's teaching. Plato located reality in ideas; knowledge was only possible through reflection and reasoning. In stark contrast, Aristotle saw reality in terms of physical objects knowable through experience. Plato was not the only philosopher

with which Aristotle had disagreements; he alienated medieval and modern thinkers with his notion that the universe was cyclical, without beginning or end. He thought the universe eternal, matter continuous, found the universal in the particular, and over sufficiently long periods of time thought that no net change in system conditions could be observed (Van Melsen, 1952).

Practical knowledge is about both union and division. Theory can be applied to practice and the theoretical can be realized from the practical. Knowledge is constructed from both reflection and experience. Matter can be treated as both continuous and atomistic; electrons receive successful treatment as both particles and waves. Aristotle made statements confirmed only after centuries had passed; he held views that took millennia to deconstruct. In practical knowledge, his experiential knowledge unites with Plato's reflection and reason: taken together, a marriage of theory and practice, practical knowledge.

John Dewey

Dewey seems to side with Aristotle when he speaks of his confidence in the potential of education when it is treated as "intelligently directed development of the possibilities inherent in ordinary experience" (Dewey, 1938, p. 89). But he realizes unity, rather its lack, as a problem, desiring to "organize education, to bring all its various factors together, through putting it as a whole into organic union with everyday life" (Dewey, 1900, p. 92). Given that life is an assemblage of uniquely social, historical, geographical, scientific, artistic, economic, personal, intellectual, and spiritual concerns, Dewey's organic union is different for each and every uniquely situated student. The twentieth century's leading American philosopher and educational theorist built his career writing about the nature of education and collections of lively culturally situated young people. Dewey (probably unknowingly) shared

Janusz Korczak's radical views but only conceptualized ideas that have become the foundation of teachers' practical knowledge. Korczak was realizing his views in daily practice. In Korczak's words, "Thanks to theory I know, thanks to practice I feel. Theory enriches the intellect; practice colors feelings, trains the will" (Efron, 2005). Korczak's works are virtually unknown in the educational community; his writings are only now receiving wide-spread translation. Interestingly, we know that Dewey's statements were so eloquently and subtly offered that seventy years later Schwab described the field of curriculum as moribund and charged that the curriculum movement had been inveterately theoretic and its theoretic bent had let it down (Schwab, 1969b).

Joseph Schwab

Schwab (1969b, 1971, 1973, 1983) called for a shift in curriculum energies from the theoretic to the practical, to the quasi-practical, and to the eclectic; he differentiated between substantive disciplinary knowledge and knowledge of disciplinary syntax, a distinction carried forward and expanded on by contemporary practical knowledge researchers. With his use of the word practical, Schwab (1969b) was referring to a complex discipline unfamiliar to the academic and differing radically from the theoretic, a discipline concerned with "choice and action, in contrast to the theoretic, which is concerned with knowledge," (p. 3). By eclectic Schwab (1971) suggested a concern with the incompleteness of each subject as inseparable from the particulars of the practical omitted by theory. Schwab (1973) listed five bodies of experience which he saw as necessarily represented in the group which proposes to revise curricula: subject matter, learners, milieus, teachers, and curriculum making experts. His word choice with respect to teachers suggests that while he believes they are a factor in curriculum design, their presence is not necessarily required at the table.

In the final of his four foundational articles (Schwab, 1983) he insists that a teacher be first-named member of the curricular group and necessarily involved in the debate, deliberation, and decision making about what and how to teach.

Teachers practice an art. Moments of choice of what to do, how to do it, with whom and at what pace, arise hundreds of times a school day, and arise differently each day and with every group of students. No command or instruction can be so formulated as to control that kind of artistic judgment and behavior, with its demand for frequent, instant choices of ways to meet an ever varying situation (p. 245).

Herein, Schwab (1983) defines the concept central to this document, that of personal practical knowledge of teachers. His implications of the existence of such a knowledge base include its requirement in choosing what is essential for learning as well as its role as a determining factor in teacher willingness to subscribe to subsequent curricular reform. As with Dewey's earlier appeals, however, few sufficiently powerful receptive ears took heed. Thirty-five years ago we ignored Schwab's advice (Niaz, 2000) that science cannot be taught as an "unmitigated rhetoric of conclusions in which the current and temporary constructions of scientific knowledge are conveyed as empirical, literal, and irrevocable truths," (Schwab, 1962, p. 24). But to say that this trend continues today in America is an understatement. In a society that measures educational quality through state mandated achievement tests, the kind of deliberative style and dependence on the teacher as curricular agent advocated by Schwab is unlikely to find a receptive audience (Eisner, 1984). In addition, for members of the academy, to write in a language comprehensible to teachers and parents but which does not

result in scholarly publication in arcane journals is to risk to one's promotion and tenure opportunities (Eisner, 1984).

Freema Elbaz

Freema Elbaz's (1983) dissertation comprised the analysis of one Canadian high school teacher, Sarah, and explained a constituent body of knowledge regarding several aspects of every teacher's experience. Others have subsequently noted that the implications of Elbaz's 1983 case study were more revolutionary than she explicitly realized in her writing (M. Johnson, 1984).

As Schwab (1983) stated, the teacher should be the first to the table, the initiator of curriculum, neither the enactor nor the conveyor of curricula designed by an insufficiently invested outside party. Typical curriculum design intends presentation in a straightforward manner; that way, whatever difficulties impede the implementation process can be attributed to the teacher. It would appear that curriculum developers to date "refuse to perceive that which is not in their power to control, the work of teachers," (Elbaz, 1983, p. 8).

A basic assumption of Elbaz's (1983) work is simply that practical knowledge exists and that a direct examination of the thinking of teachers at work will make apparent the nature and defining characteristics of this knowledge. "Scientific inquiry is guided by theory and method. Together they provide the foreknowledge necessary to recognize that which is sought in scientific inquiry" (Garrison, 1988, p. 21). Garrison (1988) further explains in his treatise on the impossibility of an atheoretical science that concepts organize and structure otherwise disconnected features of perceptual experience into meaningful perception. Elbaz went looking for personal practical knowledge and found it. She was then able to address its

content and the manner in which it is held and used by teachers. This exercise in portraiture, thirty years later, represents a similar journey, albeit into a larger classroom.

Development and Growth/Elbaz Revisited

Elbaz (1983) describes the conception of practical knowledge with respect to its content, orientations, and structure, culminating in a cognitive style. Content includes the teacher's knowledge of self as individual, as resource, and in relation to others, followed closely by knowledge of the milieu or environments with and within which they operate. Subject matter knowledge includes that which is disciplinary in addition to learning and study skills, reading and writing as subject matter. Knowledge of curriculum and knowledge of instruction round out the categories identified as a result of Elbaz's interviews and observations. Elbaz's research participant Sarah exhibited keen insight with respect to curriculum and instruction in stating that whatever is deliberately taught in class is ultimately less likely to have lasting impact than the 'hidden curriculum'. Orientations of practical knowledge include the theoretical, the situational, the social, personal, and the experiential all of which are implicit in all of these different ways in which Sarah ordered experience as a classroom teacher and then as a resource teacher within her school.

Elbaz (1983) admits that practical knowledge is most easily defined negatively, in terms of what it seems to lack. Since it is idiosyncratic and unique to the individual teacher it would seem to lack generalization and since it is practical it has a relationship as close to its objects as the theoretical is distant. To be able to describe the positive generalities means not to apply it to the extension of knowledge but to enable it to generate consistent practice. Thus Elbaz (1983) named three basic terms: rule of practice, practical principle, and image which culminate in a "cognitive style" (p. 50).

A rule of practice is a brief statement of "what to do or how to do it in a particular and frequently encountered situation" (p. 132). *Practical principles* are more inclusive and less explicitly formulated, "make the teacher's purposes more clearly evident, and indicate an expression of the personal dimension of practical knowledge" (p. 133). The *image* is the least explicit and most inclusive of the three types of structure; it inspires rather than requires conformity (p. 134). The image takes on different senses in each situation; it is a briefly descriptive, frequently metaphoric statement which seems to capture some essential aspect of teacher practice and serves to organize teacher knowledge in practical situations (p. 134). Integration of the three levels of practical knowledge is an indication of the consistency of teacher practice (p. 138). In the childcare scenario described earlier in this document, a rule of practice might dictate mandatory potty time and hand-washing for each child before morning snack; the associated practical principle for that specific act might be a concern for the well-being of all diners at the snack table, or perhaps a desire for lack of interruptions during meal time. The image governing this practice is possibly a desire for and subsequent planning and preparation for a calm, family-style mealtime reminiscent of the teacher's happy home life, of one she remembers fondly from her own childhood, or of a situation for which she continues to yearn having only known its absence. The theme of family-friendliness as image would, in this case, likely include similar attention to toy placement, neatness of the cot area, and tone of voice when addressing others in the room. Such an image has the potential to mirror what the classroom members know from their own homes; it could just as easily, however, present quite the juxtaposition to same.

Elbaz (1983) uses the term cognitive style to express a sense of practical knowledge in use. She views style as a generalization from behavior to manner; imagery is a

generalization from practical rules and principles of practice to a metaphoric form of guidance for action. Writing of her observation of the Canadian high school teacher, Sarah, Elbaz assimilates the teacher's images of each of the content areas of practical knowledge into a depiction of her cognitive style; Sarah is frequently seen to work at the level of the image with subject matter seeming to overtake the other content areas. The resulting balance, though, is the accomplishment of a cognitive style (Elbaz, 1983). Given the uniform appearance of large lectures to the casual observer, of interest for this project is the degree to which cognitive style is evidenced in the portrait of Patricia's large lecture teaching.

Continuing Evolution

Practical knowledge has been studied in myriad circumstances. Marlatt (2001) developed a survey of practical knowledge and combined it with interviewing to study pre- and in-service teachers of deaf and hard of hearing students. He identified images of teachers, students, and classroom and links between image and uses of rules of practice and practical principle. Studying the practical knowledge of sailing coaches helped the French prepare for the 1996 Olympic Games in Atlanta (Saury & Durand, 1998). The power generation industry debates the methodology for capturing expert practical knowledge in an era of alarming turnover (Hylko, 2005). Hockey (2004) posits that there seems to be fertile ground for uncovering what he terms mundane knowledge in sport, especially for those where the playing terrain changes like golf, skiing, and cycling. He uses an auto-ethnographic methodology to better access the practical knowledge of the sporting mind, which is intimately linked to the body.

Chan (2001) has developed a quantitative measure of teacher education students' personal theories. He discovered that though literature and teacher education programs place

value on the constructivist approach to teaching and learning, teacher education students in Hong Kong are not inclined entirely towards constructivism. Tamir (1972) advocated the use of alternative forms of evaluation to the paper-and-pencil test to access the practical mode in biology. Three decades later he comments that,

" It is ironic that the countries that launched the whole curriculum reform movement, and spent enormous sums of money on curriculum development, have suffered most from deficiencies in implementation, mainly because of their reluctance to create the necessary frameworks for effective dissemination, diffusion, and utilization," (p. 176)

In other words, the reorganization of schools through national efforts is not closely paralleled to subsequent local classroom changes (Yerrick, Parke, & Nugent, 1997). As stated earlier in this document, for good or for ill, there exists no teacher-proof curriculum. Tabulawa (1998) offered an indictment of the technical rational model of change implementation in education in Botswana. Findings indicate that disregarding teachers' practical knowledge of their taken-for-granted classroom practices when attempting to effect change can lead to disappointing results.

Some researchers have spent years conducting research into the conceptualization and characterization of practical knowledge considering the influences of the personal, contextual, historical, political, societal, and experiential dimensions. Connelly and Clandinin and others (Clandinin, 1985, 1986; Clandinin & Connelly, 1986, 1996, 1998; Connelly & Clandinin, 1986, 1994; Connelly, Clandinin, & He, 1997; Whelan, Huber, Rose, Davies, & Clandinin, 2001) emphasize the link between the personal and the professional. Their storying of teacher knowledge emphasizes the individualistic nature of teaching; Shulman's views (Shulman, 1986, 1997, 2004) focus on the relationship between what

teachers know about content and how they communicate that content to their students. Carter (1992, 1995) takes the concept of teacher knowledge into the organization and management of classroom spaces. Many others (Bullough, Knowles, & Crow, 1991; Knowles & Muchmore, 1995; Meijer, Zanting, & Verloop, 2002; Muchmore, 2001, 2002; Mueller & Skamp, 2003; Robinson & DiNizo, 1996) place teacher knowledge into the broader context of personal and social history, maintaining Clandinin and Connelly's emphasis on the personal but contextualizing each story by including social, political, historical, and cultural dimensions (Cole & Knowles, 2000). Munby and Russell (1991) add to the picture Schön's concept of reframing with their inquiry into practical experience as an authoritative component of teacher knowledge, an analogy to the Gestalt shifts of Gestalt psychologists, Kuhn's paradigm shifts, an allusion to "seeing differently" (Toulmin, 1953) when learning science.

Research into image, metaphor, and story as representational forms for advancing alternative explanations and frameworks for characterizing modes of teaching knowledge honor and recognize the practice of teaching as minded (Cole & Knowles, 2000), mindful (Langer, 1989), and an expression of knowing in action (Schön, 1983). With the adoption of such literary technique (Egan, 1986), teaching and teachers are portrayed with the key qualities of a mindful state including creation of new categories, openness to new information, and awareness of more than one perspective (Langer, 1989). Indeed, the storying of teacher knowledge is the research direction taken by Freema Elbaz herself as her professional career continues to evolve (Elbaz, 1990; Elbaz & Elbaz, 1985; Elbaz-Luwisch, 2004). Researcher stories have determined that teachers' professional and moral character could not be separated from each other (Tirri, Husu, & Kansanen, 1999). Elbaz and Estola

(Estola, 2003; Estola & Elbaz-Luwisch, 2003) express narratively and metaphorically the practice of teaching as embodied physical labor.

Higher Education

Elbaz (1983) detected a propensity for Sarah's cognitive style to feature her subject matter orientation. Indeed, educational research undertaken in the name of higher education must not discount the importance of subject matter if disciplinary faculties are to be expected to join the conversation on curricula.

"While it is indefensible, and universally condemned in academic circles, to be preoccupied with method to the detriment of content, it is just as indefensible, although quite often viewed with self-righteous approbation, to be preoccupied with content to the exclusion of method," (Schueler, 1951, p. 91).

Higher education faculties think of themselves in terms of their discipline first and as teachers some distance after that; but "Ph.D. students must learn that narrowness in education or interest is not an asset," (Breslow, 2006, p. 174).

University of Chicago alumnus Lee Shulman considers himself a product of Robert Hutchins' orientation toward the traditional canon and Joseph Schwab's advocacy of John Dewey's philosophies (Shulman, 1997). One of Shulman's goals is the union of practical knowledge and higher education's emphasis on discipline specific or subject area knowledge.

In his early research career, Shulman found himself immersed in two worlds. As a member of the education faculty at Michigan State he was asked to help organize the initial assembly of Michigan State's medical school. At that point he was struck by an anomaly that while physicians were being studied as complex, autonomous, thoughtful, reflective, strategic problem-solvers, teaching was studied as if it were a series of mindless behaviors emitted by

teachers in response to students as stimuli (Shulman, 1997). The resulting conception of pedagogical content knowledge (PCK) resulted in disciplinary exams for National Board for Professional Teaching Standards qualification, the Praxis examination, and in an unexpected impact in higher education. PCK is a friendly notion to higher education faculties since it begins with respecting what they already know, which is content, and then asks about the pedagogical transformation required to move from learning to teaching. Within topical PCK, Shulman includes the most useful forms of representation of those ideas, the most powerful analogies, illustrations, examples, explanations, and demonstrations, the ways of representing and formulating the subject that makes it comprehensible to others (Shulman, 1986). Hence, included in practical knowledge is a "veritable armamentarium of alternative forms of representation" (Shulman, 1986) some of which derive from research and others of which originate in the wisdom of practice. Novice chemistry teachers, for example, learn to negotiate careful and consistent use of microscopic and corresponding macroscopic terminology to avoid student confusion (Van Driel & De Jong, 1999a).

Focus on Pedagogical Content Knowledge

Deborah Loewenberg Ball, Shulman's former student and a direct descendent in the practical knowledge family tree, has pursued practical knowledge as it impacts the mathematics classroom (Ball, 1990, 2000, 2001; Ball & McDiarmid, 1990). She posits, as a goal of teaching, the development of intellectual resources that enable legitimate peripheral participation (Wenger, 1998) in the major domains of human thought and inquiry (Ball & McDiarmid, 1990). The focus of her research is in mathematics teaching and mathematics teacher training. Ball maintains that if a constructivist perspective holds that children's learning of subject matter is the product of an interaction between what they are taught and

what they bring to the learning situation, then teacher education can be improved by taking this perspective on teacher learning (Ball, 1990). When seen through a child's eyes, adult assumptions about the reasonableness of subject matter often prove insufficient. Ball argues that a teacher's own mathematical domain must be "ample enough to match the full range of a child's wonder and curiosity, his unexpected ways of gaining insight to mathematically sacred ground," (Ball, 1990). Ball believes teachers should grasp subject matter content knowledge, pedagogical content knowledge, and curricular content knowledge, but figuring out what to teach and finding the resources necessary to support instruction can be overwhelming challenges for new teachers. Data suggest that disciplinary knowledge in mathematics was the greatest influence on how novice teachers evaluated and implemented their textbooks (Manouchehri & Goodman, 2000). Properly motivated, fully developed curricular frameworks can support the formation of pedagogical content knowledge; they can serve as scaffolds in an era of increased accountability when beginning teachers do not necessarily relish curricular freedom (P. Grossman & Thompson, 2004).

Ball (2000) agrees with Dewey (1910) that good teachers recognize and create genuine intellectual activity in students and that methods of such activity are intimately tied into disciplinary knowledge. But some teachers, and not just new ones, many college graduates, and even successful post-graduates, have exhibited solid understandings of content but they are often "unable to hear students flexibly, represent ideas in multiple ways, connect content to context effectively, and think about things in ways other than their own," (Ball, 2000). Korczak attributes to research, child observation, medical studies, and physician experience the notion that, "What a fever, a cough or nausea is for a physician, so a smile, a tear or a blush should be for an educator. Not a single symptom lacks significance," (Efron,

2005). Likewise, Ball writes that pedagogical content knowledge "strengthens the teacher's powers and in doing so, heightens the possibilities of his or her art," (Ball & McDiarmid, 1990).

Reflecting In and On Practical Knowledge

Donald Schön

Schön (1983) states that universities are institutions "committed, for the most part, to a particular epistemology, a view of knowledge that fosters selective inattention to practical competence and professional artistry" (p. vii) At the university level, this model of technical rationality, based on positivist philosophy, "is the view of professional knowledge which has most powerfully shaped our thinking about professions and the institutions in which the professions are cultivated. Within the model, professional activity consists of instrumental problem solving made rigorous by the application of scientific theory and technique," (Schön, 1983).

Instrumental problem solving implies arrival at a final answer. This definition makes sense particularly if one subscribes to the notion that the professions as specialized occupations arose around and in response to new scientific knowledge. This type of knowledge, though, is the mechanism by which clear-cut, well-defined problems are solved, not how one handles the complexity, uncertainty, instability, uniqueness, and value conflicts within a situated dilemma like the classroom. Practitioners are frequently faced with conflicts of goals, values, and interests. Teachers are faced with perhaps the most complicated of all scenarios as the minutes of their days tick by; scenarios in which the goals, values, and interests of individuals within entire classrooms and schools and the individuals charged with managing them conflict and are ever-changing. Teachers are expected to

perform in increasingly efficient budgetary manners, rigorously teach the basics, encourage creativity, build citizenship, and help students examine their personal values, all in forty-seven minute blocks of time, not to interfere with baseball practice or student lunchtime or, in the case of college students, desired nap time.

As Schön (1987) describes reflection-in-action, he implies focus on a tacit knowledge. Teachers' practical knowledge, the result of their reflection-in-action in combination with their immediate practical situation, can be thought of as tacit in the sense that professionals usually know more than they can say. It is very difficult for an actor, a discus thrower, for example, to describe exactly how she accomplishes her art; with practice she develops a remarkable virtuosity. But this is achieved only through action; there is no separation of knower and known (Fenstermacher, 1994). To achieve beyond the level of a skill to the level of artistry is to "learn to appreciate, directly and without intermediate reasoning, the qualities of the materials that we apprehend through the tacit sensations of the tool in our hand," (Schön, 1987, p. 7). Reflection-in-action is a way of demystifying the art of practice, but it can lead to the paralysis of the proverbial centipede. Sometimes very useful prescriptions for action interfere temporarily with performance. It is up to the actor to judge the degree of risk associated with reflection-in-action at any given moment. Humans learn to walk before they can verbally accept such direction even if it was possible to accurately verbalize the complexity of such activity. Teachers exhibit reflection-in-action continually in the course of their activity with students. For example, it has been my experience teaching large lectures that sometimes whispered comments among students lead me to believe the attention of the class is beginning to wander from the lecture and sometimes I sense that students are asking each other questions on the topic about which I am

speaking. Sometimes they are relating relevant stories to one another; sometimes they have found a topically relevant video on YouTube. With increasing frequency, they are facebooking; sometimes I sense that I may have chalk on the backside of my skirt.

My pursuit of a portrait to describe Patricia's practical knowledge in the teaching of her large chemistry classes requires investigating tacit events in her classroom. When questioned about classroom practice, Patricia's faculty colleagues have been known to begin with, "Well, I'm no Patricia, but..." (Hanson, 2005). Failure to examine that which can be described as tacit serves to mystify the art of practice. Even given that Patricia's intuitive knowing will remain richer than any description I could possibly write, it is possible that this research project will allow the articulation and subsequent demystification of parts of her already well-respected, much rewarded practice.

My position as participant observer for this study means that I will apply, so to speak, reflection-on-action to Patricia's reflection-in-action. While Schön's (1983) conception of reflection-in-action is largely out of the control of the actor, reflection-on-action is not; the concept implies careful consideration of familiar data (Russell & Munby, 1991). The large university lecture is an inimitable context within which to study reflection-in-action; there is a distance between lecturer and student unlike the public school classroom and unlike smaller campus classrooms, yet they share many of the same professed goals (Bligh, 2000). To the casual observer, nothing much is happening in the lecture; the professor speaks, the students write; but Young (1994) has collected evidence that a meaningful framework can operate at several levels in second language lectures. These dimensions of the cultural context of lecturing can be active for native language listeners especially when the subject matter is complex or new, as in Patricia's general chemistry class.

Expressing Practical Knowledge with Metaphor

In the Swamp

Donald Schön (1987) opens *Educating the Reflective Practitioner* with a metaphor for practice:

In the varied topography of professional practice, there is a high, hard ground overlooking a swamp. On the high ground, manageable problems lend themselves to solution through the application of research-based theory and technique. In the swampy lowland, messy, confusing problems defy technical solution. The irony of this situation is that the problems of high ground tend to be relatively unimportant to individuals or society at large, however great their technical interest may be, while in the swamp lie the problems of greatest human concern. The practitioner must choose. Shall he remain on the high ground where he can solve relatively unimportant problems according to prevailing standards or rigor, or shall he descend to the swamp of important problems and nonrigorous inquiry? (p. 3)

Education of the reflective practitioner is preparation for life in that swamp; college teaching is also a combination of that high ground and swamp, hence this qualitative research design. While positivistic research is intolerant of the ambiguities of non-laboratory settings, Eisner (1997) identifies ambiguity as a potential source of insight, a way of intentionally keeping the door open to fresh insights and multiple interpretations. In addition, Elbaz (1988) reiterates Freire's view of complex, swampy, education as a collective process in which participants reflect on their situations, coming to perceive them as objective-problematic situations thereby acquiring the ability to intervene in reality and gain agency as

they become more aware. This process is analogous to an enormous, unique, living code to be deciphered (Freire, 1999). The value in reflection for teachers is not to obtain reliable data or a correct answer but to access, to decipher, a valid description of professional events. Clandinin and Connelly (2000) too lean most heavily on narrative as a form of representation rather than a mode of analysis. Often, especially in the swampy business of classroom practice, a complex situation presents itself as a unique case for which there may be no one unique discernable solution. Improvisation, invention, and testing of strategies from the wealth of the teacher's practical knowledge base rise from reflection in and on teaching.

In Conclusion

Practical knowledge is undeniably contextual. The story to be written here may foreground additions to or expansions of current practical knowledge research. Narrative meaning is a cognitive process by which humans organize experience into meaningful episodes. But narrative meaning can not be investigated as an object; the validity of this study will be based on a more general understanding of validity as a well-grounded conclusion (Polkinghorne, 1988). While ambiguity is certainly not without peril, development of a foundation of teaching cases would provide the novice teacher with a representative array of prototypic cases "designed epidemiologically to correspond with the character of the broader field," (Shulman, 1984). The professions of medicine and law are well-developed examples. In the past decade numerous examples from the educational field have gone to press (Childress, 2000; Kompf & Denicolo, 2003; Lawrence-Lightfoot, 2000; Muchmore, 2001).

A case study is a story of a person, a classroom, a school, or something much larger; Elbaz (1983) named her initial study with Sarah a case study since it offered the opportunity

for educationally valuable vivid and full description. Within teacher education, the term narrative has come to refer to an emphasis on lived experience or personal life story (Carter, 1995). Several distinct and exciting approaches to personal narrative are being taken. Connelly (not coincidentally, Freema Elbaz's dissertation research advisor) and Clandinin (2000) have pioneered the field for three decades. The work in embodied knowledge (Estola & Elbaz-Luwisch, 2003; M. Johnson, 1989) and metaphor (Bullough et al., 1991; Chapman, 1997; Craig, 2001; Elbaz-Luwisch, 2004; Fox, 1983; Lakoff & Johnson, 1980; Volkmann & Anderson, 1998) in practical knowledge has blossomed as well. Elbaz (1983) herself champions story as that which most adequately constitutes and presents teacher knowledge.

The teaching stories created for this study will result in a portrait that describes the integration of theory and practice that is Patricia's practical knowledge in the teaching of her large chemistry classes. While all narrative research seeks to illuminate the complexity of a unique experience; portraiture is distinctive in its blending of aesthetics and empiricism in the effort. The more specific and subtle the prose, the more likely the reader is to identify with it. "The particulars of this case or any case study are only a flat surface until a reader provides the other half of the picture from the fleeting images of his or her lived experience," (Nespor, 1997, p. xx). Within portraiture, context is not a positivistic source of distortion but an intentional and "rich resource for examining and interpreting behavior, thought, and feeling," (Lawrence-Lightfoot & Davis, 1997, p. 41). My goals align with those of the critical ethnographer; I want the readers of these stories to be the instigators of positive and productive change, thereby addressing in their own professional spheres the further development of the conception of teacher practical knowledge. This is my effort to heed Shulman's (1997) call to develop the capacities of current and future faculty, myself

included, to become scholars of teaching and learning in their disciplines. I can contribute to the scholarship of teaching and learning in higher education and to the development of Elbaz's theory of practical knowledge by remaining in the classroom and acting as both education researcher and reflective practitioner and, at the same time, working to encourage others to do the same.

Chapter Three

Introduction to Methodology

Variations and combinations of qualitative methodologies have proven useful in the study of chemistry teachers and chemistry teaching (Duggan-Haas, 1998; Lyons, Freitag, & Hewson, 1997; Sweeney, Bula, & Cornett, 2001; Van Driel & De Jong, 1999b; Volkmann & Anderson, 1998; Yerrick et al., 1997); but very few involve chemistry instruction in higher education (Campbell, 1992; M. A. Johnson, 1996), and none located to date focus on the topic of practical knowledge in the large lecture. Portraiture methodology is not only uniquely suited to this particular project, it carries with it an appealing, if startling, divergence from disciplinary research in chemistry. Qualitative scholarship in teaching and learning is well-situated to engage faculty in general; but in departments of chemistry it arrives into a disciplinary culture with strongly entrenched educational traditions (Coppola & Jacobs, 2001). And, Weimer (2008) posits, "if standards of the discipline are used to assess practitioner scholarship, it will never measure up. Or, if it does, it will be because pedagogical scholarship has lost its unique identity and has become like accepted research in the field," (p. 3).

The swamp metaphor is one Schön (1995) continues to use with respect to reflective practice, my own swamp story lends methodological insight to this project.

Entry Point

On a family vacation in my youth, my sisters, parents, and I hiked through the Cranesville Pine Bog in the mountains of western Maryland. Hidden under tall stinking leaves of skunk cabbage were low-lying blueberry bushes heavily laden with the most perfectly tart tiny fruit. The berries were hidden from view when walking, but my father's

shoulders had grown tired with the weight of my then four-year-old youngest sister and he had lowered her to the ground. Being shorter than the skunk cabbage, she alerted us to the presence of the juicy berries. Encouraged by our guide to eat, we indulged in that messy sweetness scattered on the ground for the remainder of our trek. I vividly remember the combination on my teeth of slimy berry and gritty mud from my dirty fingers. Over three decades later that smell of skunk cabbage, mud and berry remains lodged in my psyche.

Complexity requires reflection and lives are infinitely complex. In 1976, I first wrote the swamp story for my elementary school newspaper; I have rewritten variations of it several times throughout my graduate career each time making connections with successively more thoroughly examined aspects of my education and life.

As I prepared to hike with Patricia through her lifetime, I remained mindful of the swamp blueberries. They were hidden from view save for the intersection in time and space (Eisenhart, 2001) that was season, tired shoulders, and the gaze of a little girl; but their storying now served as a point of entry (Nespor, 1997) for this project. Patricia's life story as well is a collection of spaces and times, "articulations of intersecting networks beginning and ending far beyond their immediate boundaries" (Nespor, 1997, p. 168), a "porous array of intersections" (Rosaldo, 1989, p. 20) of family history, schooling, subject matter, and students. I only reluctantly grew to treat this study as if it had a beginning and an end, since "it's really only our engagements with processes that begin and end" (Nespor, 1997, p. 196). Inclusion of autobiographical dimensions (like the blueberries) that bore relationship to the themes of this portrait rendered portraiture uniquely adept at expressing such intersections. Fogg (2003) labels such a methodology "side-by-side portraiture" (p. 21); Witz (2006) calls it participant as ally (p. 248). My role in this portrait as its author was implicit in that I selected

the stories that appear and constructed the prose through which they are told but my role as a college chemistry teacher added a dimension. I chose to include narrative fragments that are explicitly my own to the extent that doing so would added insight, lent support, or provided contrast to Patricia's stories. The following research questions guided the portrait construction.

- Are aspects of Elbaz's practical knowledge identifiable in the research conversations conducted with a large lecture college professor?
- Is practical knowledge identifiable during observations of Patricia's large lecture chemistry classroom practice?

Freema Elbaz conducted research conversations with Sarah, a high school classroom and writing resource teacher who conducted much of her teaching work one on one with students. Patricia's practice differs significantly from Sarah's with respect to subject matter and to scale.

Can I locate practical knowledge in the large college chemistry lecture? Conversely, what does this unique classroom setting have to offer theories of practical knowledge?

Researcher/Researched

Patricia earned her Ph.D. in chemistry from Virginia Tech in 1984. I completed my B.S. from the same department in 1986 and my M.S. in 1996. We met when I began my tenure as lecture demonstrator in 1986 and for well over twenty years now, we have worked for Virginia Tech's chemistry department, quartered side-by-side in Davidson Hall's basement. Patricia has been a part-time and full-time instructor for twenty-five years and has served as Director of General Chemistry for the last ten. I served as lecture demonstrator for a dozen years (interrupted briefly by several years as a high school chemistry teacher) and

have served as a classroom instructor for almost 15 years. This exercise in portraiture cannot but reflect such intimate familiarity with this place and with each other; it is a case of committed involvement, an example of Freirean "co-intentional education" (Freire, 1999, p. 51). I feel that my personal history qualifies me as a uniquely aware participant observer since participant observation requires that the researcher "engage in some relatively prolonged period of participation in a community or group and take some part in the daily activities of the people among whom he or she is studying," (Schwandt, 1997, p. 110). As a critical theorist I wish to effect change in the way my colleagues view teaching and learning; Ritchie (1998) contends that researchers "might make a more significant impact on teaching practice by working with teachers to help them individually and in teams to articulate their personal practice theories of teaching" (p. 3). Elbaz (1983) herself intentionally chose close friend Sarah as her research subject as she assumed they would establish researcher/researched rapport easily and early on in the research process. In this interview-based research project, the text will be constructed with our personal and professional relationship a unique and useful, rather than a contaminating, element of the work (Josselson, 2004).

Acting as my own key informant following a research project (Eddleton, 2005c) for an educational psychology class that involved interviewing seven faculty members in my department, I designed this project involving only one participant to facilitate a detailed investigation of one teaching practice and to minimize a propensity for data quantification and comparison. A narrower participant focus yields a wider "scope of discovery" (Smith & Strahan, 2004, p. 358) and richer information than I felt capable of expressing in the earlier project including many more interviewees. Patricia was not one of the participants in the

previous study, but her name was repeatedly mentioned as the best our department has to offer our undergraduates (Hanson, 2005; Taylor, 2005; Viers, 2005).

Patricia and I may be exclusively suited to undertake this study since we are simultaneously members of emic and etic cultural categories in our personal and professional lives. Also, a consistent point of view, a sense of moral and ethical responsibility that comes from personal identification and responsibility, and a set of craft-like norms are consistent with a case study constructed by a single pair of scholars (Van Maanen, 1999). Over many years Patricia and I have engaged in a daily interaction that supports, energizes, and entertains each of us; I have continually marveled at Patricia's devotion to her students, the consistently spectacular ratings she receives from those students, her poise and grace in her professional and personal lives. I must admit to more than a modicum of jealousy in terms of the respect afforded her teaching practice by her colleagues, a group that has proven itself superbly successful in the world of academic chemistry research and that has long addressed, though in their own opinions, less successfully, the same demographic in the large lecture halls at Virginia Tech. Though Patricia will receive the protection offered by Virginia Tech's Institutional Review Board; participant confidentiality will be impossible to maintain. My authorship makes Patricia's identification virtually a guarantee; she is already aware of this and remains a willing participant.

Mechanics

Narrative "functions to organize elements of awareness into meaningful episodes" (Polkinghorne, 1988, p. 1). Bruner (1990) describes it as one of the "most ubiquitous and powerful discourse forms in human communication" (p. 77). Within teacher education, the term narrative has come to refer primarily to an emphasis on lived experience or personal life

stories, with biography and autobiography as exhibitions of the "storied lives" (Carter, 1995, p. 326) we live. Life as we know it, in general and in the large chemistry lecture, is full of narrative fragments "enacted in storied moments of time and space" (Clandinin & Connelly, 2000, p. 17). Most importantly, portraiture will serve as the narrative technique uniquely able to bridge the realms of science and art I feel so desperately compelled to unite in this study of a professional who is both scientist and teacher. The portraiture research stance evolves from "listening and observing, being open and receptive to all stimuli, acclimating to the environment, documenting initial movements and first impressions" (Lawrence-Lightfoot & Davis, 1997, p. 187) to more purposeful activities.

Interview

Research conversations with Patricia are examples of Ellis' (2004) reflexive, dyadic interviews. Field notes taken during the interviews, journaling activity immediately following the interviews, transcription of audio interview recordings, and comments of my own recorded during interviewing and transcription served as the data by which I created the aesthetic whole of the portrait. Since the interviewer stands as a co-participant in the construction of the discourse (Briggs, 1986), contexts are continually renegotiated in the course of the interaction. As interviews proceed, questions were broad and open-ended, if I had to ask questions at all. I found that the most valuable of data simply tumbled out during our conversations, a mixture of the personal and the professional spheres of which we were both (and continue to be) simultaneously members. This study is directed at no well-defined problem; Becker (1998) warns that the well-defined problem is one for which we have already ruled out of consideration a lot of "potentially very interesting processes" (p. 23). I must listen *for* in addition *to* the stories Patricia shares (Lawrence-Lightfoot & Davis, 1997).

Observation

So that I could observe Patricia in action, doing what she is reported to do very well, I attended and audio and video recorded her general chemistry classes fourteen different times during the spring semester of 2011. My plan had included three classroom visits. During the lectures I recorded field notes; I took time for solo reflection and journaled on the experience thereafter. The video recordings invaluabley facilitated stimulated recall in subsequent interviews and during rumination and writing. Though I am acutely aware of all manner of things going on while I am lecturing to my own classes, I had observed enough large lecture classes to suspect that I might get distracted by the subject matter being presented and lose focus on the actual classroom experience. But I was reminded of another of Becker's "tricks of the trade" (1998, p. 1), "social scientists often make great progress by paying attention to what their predecessors thought was boring, trivial, or commonplace," (p. 96).

While I felt very comfortable with Patricia, the subject matter at hand, and with the large classroom in general, I was forced to admit a certain necessary level of objectivation (Schrödinger, 1944) since, even given this close relationship to the components of the study, I had no "direct subjective or objective access to the infinitely intricate problem of nature" (p. 118), including human nature. Schrödinger (1944) presents the antinomy that "a moderately satisfying picture of the world has only been reached at the high price of taking ourselves out of the picture, stepping back into the role of a non-concerned observer" (p. 119). I would amend that the portraitist is no unconcerned observer, but an observer nonetheless. Yet I was encouraged by Bruner's interpretation of antinomies (and obviously wildly excited to have been able to use such a chemistry sounding word in this document) as pairs of larger truths, which, though both may be true, nonetheless contradict each other. He posits that antinomies provide fruitful grounds not only for strife, but also for reflection. (Bruner, 1996)

Mechanism

The chemical term mechanism usually refers to reaction mechanism, the collection of elementary processes that explain how an overall reaction proceeds. "Almost any property of a reaction system that changes with time can be made the basis for an analytical method" (Glanville, 2004, p. 570); the property is then investigated, expressed graphically, and a mechanism determined to fit the data. Interestingly, that a mechanism successfully explains experimental results is taken as no guarantee of its accuracy; a mechanism proposal serves as a challenge to others studying the same or similar reactions. So too for this exercise in portraiture, but the challenge is more complicated, taking more the form of an invitation and thereby issued to other researchers but more importantly to our selves. Portraiture serves as both reaction mechanism itself and the exercise by which reaction mechanism is determined; it is both an end and the means to that end. A portrait is a credible story, logically coherent, but not overly consistent or so simplistic as to misrepresent the complexity of the reality represented. "Including the subjective and emotional reflections of the researcher adds context and layers to the story being told about participants," (p. 62). This work is much like Glaser and Straus' (1967) constant comparative method, writing as a way to focus the analysis of the data.

Conversing, re/reading, re/writing, and reflecting compose the activities by which I constructed this portrait to describe Patricia Amateis' practical knowledge in the teaching of her large lecture classes, though writing both stands alone and is the action by which other research activity is served. St. Pierre (Richardson & Pierre, 2005) describes of collecting "in the writing" (p. 970) all sorts of data she had never before encountered in interpretive qualitative textbooks. These data were neither in interview transcripts nor field notes, but "always already in my mind and body, and they cropped up unexpectedly and fittingly in my

writing" (p. 970). Portraiture's post-interview action is "ruminative" (p. 189), reflective, meditative; patterns were discovered from the data, recovered in a contemplative, if not totally conscious, way. Portraitists and others working in a hermeneutic tradition resist rigid or discrete coding and strive instead to maintain the integrity of human thought and depth of feeling.

Challenges

The goal of bringing the audience "into a direct emotional experience of the findings and support(ing) vicarious understanding of participants' experience contrasts with more traditional qualitative methods" (Piercy et al., 2005, p. 364) that attempt to duplicate the type of rigor reserved for quantitative research. Attempts were made over the past decade to locate and develop evaluative criteria for the processes and outcomes of naturalistic inquiries (Guba & Lincoln, 2005, p. 207). I am sufficiently motivated by past research experiences (in which I've served as subject) to write my own research project in a manner which allowed research participants to both participate fully and determine the authenticity of the resulting product. Producing a portrait from participant observation and in-depth interviews will allow me to reconcile "my practices to my beliefs," (Muchmore, 2002, p. 2).

Anfara, Brown, and Mangione (2002) posit that many qualitative studies "fail to provide enough description and details to allow validity judgments to be made by the reader," (p. 29). Portraiture's rigorous attention to detail reflects an unwavering adherence to the same standards of as other research methodologies: authenticity and truth. (Hackmann, 2002) "Indeed, a key part of qualitative research is how we account for ourselves, how we reveal that world of secrets," (Hackmann, p. 29) intuitively built into inquiry yet rarely revealed for public inspection. Elbaz (1983) considered the provision of all transcripts to the

reader to be an essential aspect of her study's report such that the reader could follow the interpretive process. All collected material is not necessarily presented in the case; it may not all be sufficiently significant. Inclusion of some of this evidence as appendices may convince readers that little other relevant data went untouched by the researcher; alternatively, that the researcher has thoughtfully examined possible ramifications of absent data.

In line with Lawrence-Lightfoot's (1983) belief that a work "loses its power and honesty if it becomes a consensus document" (p. 375), I requested that Patricia offer commentary on the document only upon its completion. Her comments are included in their entirety as an appendix.

Lather (1986) reconceptualizes validity by recognizing that, just as there is no neutral education, there is no neutral research. We no longer need to apologize for unabashedly ideological research and its open commitment to using research to criticize and change the status quo.

Richardson (2005) includes portraiture in her list of CAP (creative analytical processes) ethnography practices; practices which "adapt to the kind of political/social world we inhabit, a world of uncertainty" (p. 962). Though she admits (and celebrates) that there is "no getting it right, only getting it differently" (Richardson & Pierre, p. 962), she believes that readers and reviewers deserve to know how the researchers claim to know, how they position themselves as knowers and tellers. In her evaluation of CAP ethnography for publication, Richardson offers four criteria.

- *Substantive contribution.* Does the piece seem "true"? Is it a credible account of a cultural, social, individual, or communal sense of "real"?

- *Aesthetic merit.* Does the methodology and its representation invite interpretive responses?
- *Reflexivity.* Is there adequate self-exposure for the reader to make judgments about the point of view?
- *Impact.* Does the piece affect the reader emotionally or intellectually? Does it generate new questions or move the reader to action? (p. 964)

Portraitists must build relationships of trust and rapport; understandings arrived at then take validity from mutuality, the existence of the relationship itself (Jackson, 1989, p. 35). The product of social science portraiture is to be a gestalt, a whole so unified as such that its properties cannot be identified from examination of its parts. The document as portrayed and as held to Richardson's CAP criteria must resonate with three audiences: the actors reflected in the story, the readers, and the self-critical portraitist.

Conclusion

Portraiture and studies of chemical kinetics are both iterative processes. Planning research events, reading previous research, collecting data, expressing data, looking for patterns in the data, re-reading research, choosing data for dissemination, viewing data through the eyes of others, revisiting data, checking data, perhaps manipulating the data by altering an approach to its collection, nuancing the representations of desired data patterns, all are earmarks of intentional scientific investigation. Successive iterations, trials if you will, further data collection, or re-examination of existing data, allow successive approximation to a desired result, a truth of sorts, but one that is only ever as stable as the next, potentially outright contradictory, data set or re-searching of an existing data set. Post-structuralism understands that we are particular persons writing from particular spaces and

times and that we are free from writing a single text that means everything to everyone.

Elbaz (Elbaz, 1983), in her inaugural treatise on the subject, expressed her concern with this very issue by defining criteria of clarity: that which makes possible the communication on which extension of knowledge in the field is based (p. 132). In 1983 Elbaz did "not believe the search for a theory of teaching with explanatory or predictive power" (Elbaz, 1983) to be a defensible undertaking, nor, today, do I. My goal was to produce a document sufficiently readable that it gets read, is understood, and that further conversation on the topic ensues.

Chapter Four

Introduction

"I feel better today! Yeah, and I was excited to go in yesterday and start Chapter 17. Had to sit, just can't stand for that long but I did burn magnesium ribbon. Can't really do that sitting down but this guy in class, kind of excitable, Coogan, I said, "Coogan, do you want to burn some magnesium ribbon for me today?" and he said well heck yeah. So it was fun. I was excited to go in. Had to take a nap, got very tired, but I'll do the same Friday if I feel as good. Didn't throw up my orange juice this morning; that was a good start. Yeah, they (the doctors) can't see it right now but I'm (my kidney is) still swollen so it's still there. Will definitely need Shamy for Monday...procedure will be Monday...unless I pass it before then, wouldn't that be nice?"

So went the conversation I had just a short while ago with Patricia Amateis, the key figure in this research project. How interesting that this medical event, a kidney stone on the move, would reveal itself now, at a time when I was searching for an entry point into the next segment of this social science portrait. The story to be continued here illuminates the marriage of theory and practice that is Patricia's practical knowledge in her professional role as a professor of general chemistry at Virginia Tech. Our conversations and the portrait to be drawn from them is my purposeful attempt to link research and practice, an explicitly activist and interventionist process dedicated to further developing the body of research on teachers' practical knowledge with a focus on one teacher in her large lecture. This project represents an intersection of researcher and researched, the perfect combination of methodology and analysis for a project that is both product and praxis.

Entry Point

Patricia's kidney stone attack began after her classes ended during the early afternoon of Wednesday, February 8; I happened to call her cell phone on an office related matter late on that very afternoon. While she dutifully answered my questions, I noticed a thickness in her speech and as I was about to ask if she was ok she mentioned,

"Gosh, so sorry, Jeannine, my fingers seem to be fumbling a bit on the keyboard; Ralph and I just got home."

"Oh," I said, "from something fun I hope?"

"No, from the ER, I haven't had one since '85 but I've got another stone."

"WHHAAAAT??!!!" I yelled into the phone. "PLEASE just stop what we're doing here and go lie down!!!"

But no, she fixed the Scholar setting I was having an issue with and then said goodbye with a slurred promise to go collapse on the couch. Patricia and I have each successfully delivered three babies without anesthesia and we have each passed kidney stones and so when I write here that we KNOW that kidney stone pain, not labor pain, is the worst kind of excruciating, nausea-inducing anguish possible, we speak from an embodied base of knowledge, a personal and intimate knowledge of sheer agony.

Patricia could not teach her classes on Friday, February 10. Another General Chemistry instructor, Shamindri Arachchigi, covered those lectures for her. But since Monday, February 13, was the first scheduled test for her spring semester classes the show had to go on. Weak from nausea and a lack of calories and a weekend of torturous pain, unable to drive due to the pain meds, but determined to be in the classroom while her students took their first chemistry test of the semester, Patricia arrived at Hahn Hall North 140. Any number of her colleagues would gladly have administered the test and offered to

do so, but Patricia refused all offers of assistance save that from her husband, Ralph, who chauffeured her to the classroom and picked her up after. At work on Tuesday the 14th, I got an email from Patricia asking if I might bring her test papers to her at home so that she could alphabetize them, a request to which I responded,

"NO. How about I alphabetize for you?"

"Well, ok," Patricia responded, after I pressured her to entertain the offers of assistance she had received from many colleagues. "But I do need to see the Form Bs. Can you bring those?"

"Sure, but is there anything I can do with them? To help, I mean. How can I just take care of this for you?"

"I think there was a problem in printing. I really just need to go through them to see how many mistakes a typo has caused."

So, of course, I gathered the papers and headed to the Patricia's house after my classes were over for the day. The problem with the test papers was that, by the mysteries that are word processing and remote printing and photocopying, a question, recorded in Patricia's original as

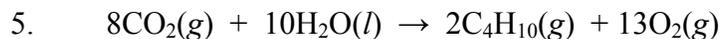
5. In which of the following reactions is work done by the surroundings?

1. $C(s) + O_2(g) \rightarrow CO_2(g)$
2. $4H_2(g) + CO_2(g) \rightarrow CH_4(g) + 2H_2O(g)$
3. $2NaHCO_3(s) \rightarrow Na_2CO_3(s) + CO_2(g) + H_2O(l)$
4. $8CO_2(g) + 10H_2O(l) \rightarrow 2C_4H_{10}(g) + 13O_2(g)$

printed as

5. In which of the following reactions is work done by the surroundings?

2. $C(s) + O_2(g) \rightarrow CO_2(g)$
3. $4H_2(g) + CO_2(g) \rightarrow CH_4(g) + 2H_2O(g)$
4. $2NaHCO_3(s) \rightarrow Na_2CO_3(s) + CO_2(g) + H_2O(l)$



It is the case that Patricia caught this numbering error when proofreading immediately before the test and corrected it verbally in class after the students had received their test papers. Nevertheless, evidence from the statistical analysis of the test results indicated some possible student confusion as they chose from the improperly numbered answer choices on the test and recorded their responses on their orange opscan sheets. The original test question sheets now on her lap, this ill, pale, drawn, and tired chemistry professor sat on a couch in her living room dressed in slippers, flannel pajamas, and a micro-fleece robe to check each test sheet individually for evidence that the correct answer might, indeed, have been chosen on the printed test paper and a mismatched response marked on the opscan sheet...or vice versa. If it was possible to award credit, well credit was going to be awarded, today, in the immediate emotional aftermath of that test. As asserted previously in this document practical knowledge is grounded in the practical but it is NOT common sense for common sense would dictate rest for the ill and a justifiable sense of fairness since the mistake had, after all, been pointed out to the students while they had the test papers in their hands. But, no. Pain from the kidney stone brushed aside, Patricia's focus was clearly to minimize painful, from her perspective perhaps unfair, test grade scenarios for as many students as possible.

This most recent event is an extraordinary indication of the "goodness" (Lawrence-Lightfoot & Davis, 1997) to be described in this portrait of Patricia's practical knowledge. It is but one story yet it showcases multiple orientations, ways in which Patricia holds and uses her knowledge.

Orientations to Practical Knowledge

Elbaz (Elbaz, 1983) identifies five such orientations of practical knowledge to practice: experiential, situational, theoretical, social, and personal. These orientations form the structure of practical knowledge, culminating in a cognitive style. It has long been obvious to me that Patricia's cognitive style, though I did not yet call it that, was well received by her students and colleagues. I remained unsure, however, even after collecting all of my data for this project, that I could find evidence of this complicated theory in what I viewed as a rather traditional, far less than exciting teaching practice.

What is special about Patricia's style? *Is there a style here that I can describe?* I commented on this notion several times during interviews with Patricia. Sure, she was research participant and I was researcher but we are still also friends and colleagues, working mothers with busy lives given, in the name of research, all too rare and uniquely lengthy opportunities to talk. As a result, personal chatter entered into our research conversations on many occasions. Over the course of the spring semester 2011, I interviewed Patricia fifteen times for an average of about an hour each time. I recorded fourteen lectures, seven sessions of office hours, some lasting over two hours, and two of her weekly evening help sessions. On at least three occasions I offered in a frustrated, but humorous tone, "You know, you are the most awarded, rewarded professor in the department, one of the top at this university... surely you know this. But I'm still not sure what I'm going to write about! What *is it* that you do?! Do *you* know? I'm not sure I know what's so special about it!" Patricia would respond with a good-humored nodding, an acknowledgement of agreement with my sentiment, usually also with laughter. "I *know*, I really don't know what it is! A lot of people here (at Virginia Tech) have done at least what I have, many (have done) *more*. I guess you do it long enough though, what is this, my 50th semester?!" I know now that, having spent

the time in the video footage and having transcribed hours upon hours of interview and class time, my frustration was an indication that I was about to embark on, in fact was already deeply immersed in, a truly authentic research experience. I expected to see uniqueness in Patricia's classroom, innovation, excitement, or at least I expected something to grab my attention! At least I'd *hoped* it would. Instead I sometimes found myself nodding off behind the video camera and thinking, "Why am I doing this?" Each time I set up the camera, however, I was sure it was *the* day, the one when I'd capture THE EVENT. I'd get hit with that moment of clarity...and I would know what I'd write about! Remembering back to that period of time, I am reminded of my spouse's frustration when, decades ago, he was employed at a service laboratory at a major research university. He'd prepare and run the samples, the data would come back, and oftentimes the graduate students were far less than satisfied. Some were downright angry! Surely there were problems with their samples or mistakes made by laboratory personnel for the data didn't fit their research project! In some instances the students had already written the results of the experiment; all they needed to do was fill in with supportive data! So they were understandably perturbed when all did not go as planned. In my final official interview with Patricia in January of 2012, I expressed, head in my hand, that, "This is *not* going the way I thought it would." "Oh, ok," replied Patricia, "I'm sorry 'bout that." She followed that with giggles over which I protested, "No, no you're *supposed* to report what the data *says*...correct? You're not supposed to invent something and then your data falls into place to support what you already knew? *That's* not how it's supposed to go. You're supposed to make sense of what *does* present itself, and..." I emphasize my point by hammering on the conference room table, "I think I've *finally* come up with something! Some things we talked about years ago that are sticking in my mind.

But instead of trying to remember everything, I thought I'd just ask you about them again. Please just talk to me." She had and she did, talk, that is.

What follows here, then, is my attempt to render readable some details of our research conversations, the particulars of Patricia's teaching practice and her thoughts about that practice, all of which reveal, as Elbaz discovered in 1983 and I know now, the five orientations of practical knowledge to classroom practice that culminate in Patricia's well-regarded cognitive style.

1. Experiential Orientation

The experiential world of the teacher includes time and space, in addition, a tension of consciousness with respect to the range and the number of considerations held in attention in the course of a given activity. My first interview with Patricia took place on January 10, 2011. It was a new year and that most peaceful of times during the college calendar when the 26,000 students who inhabit Virginia Tech's campus are largely gone. Parking spaces abound on campus when the students have gone home for a break; the sky is usually bleak and the drillfield grass brown, swept clean of autumn's brightly colored debris. It is that unique time on a college campus when things look calm but only because the most visible mission of campus, teaching, is on hold. Thus liberated, albeit temporarily, from their students, research faculty grind out research proposals, graduate students hit the lab bench hard, and teaching faculty mop up the mess left by the previous semester and focus on a myriad of other administrative responsibilities. That Patricia and I each had this time available to begin our research conversations, that we had purposefully scheduled time in early January, was both a result of the experiential structure of the teaching life and confirmation that it exists.

"Whew, the semester is OVER," was one of the first statements I uttered on camera during our first interview. Yes, she agreed, the semester was over and her office, as always, was in desperate need of a clean-up. Patricia's office is dreary. A remnant of old gray indoor-outdoor carpeting covers most of the asbestos tile flooring; old yellowing beige paint covers the walls and the dust-encrusted, insecticide-laden windowsills. Aging manila roll-up shades are drawn over the many filthy windows; a collection of desks, file cabinets, tables and chairs fill this rather large corner basement space. Wooden cabinets originally designed to hold chemicals, but now groaning under the weight of textbooks and paper, line most of one wall. Several framed certificates hang, rather haphazardly, from the walls and several more are propped up against the windows or lean against the walls from their perches on the floor. A flimsy buckled cardboard frame containing three portraits sits beside the computer monitor on Patricia's desk, this outdated record of Patricia's three children smiling for the school photographer is the only item in the room that might be called decorative. So on this day in January we sat in the chairs she years ago rescued from the trash heap and surveyed the piles of papers largely covering her office floor. The level of mess was of particular concern since the evacuation and impending demolition of Davidson Hall was upon us; the long-anticipated new chemistry building was indeed going to happen and it was time to move out. As to the level of dreariness in the room, that had been a constant for years.

That I initiated this project during the winter break at Virginia Tech was no accident. I know that's the calmest time on campus but it's also, from the perspective of the primary household caregiver, the time after the Christmas decorations have been banished to the attic and the kids have gone back to school. Comforted at having executed another holiday season there is the opportunity to draw a breath and to reflect, to have a few moments to look both

back and forward. What I did not fully and intellectually appreciate at that time however, was the degree to which the recurring notion of time, what Elbaz calls the experiential, governs thinking and decision-making in the life of the large lecture professor. With respect to her teaching practice, Patricia experiences distinct periods of time: There exists the time of preparation before classes begin for a new semester, the period between the first day of class and the final exam, and then the relief of having officially concluded the sixteen week foray into chemical principles with four hundred young adults, which served as our first topic of discussion.

When we began our first interview, the end was foremost on Patricia's mind. I noted that by January all the loose ends were usually sewn up, grade questions asked and answered...the avalanche of phone calls and emails had subsided...so how was it? Patricia responded with, "It went well. I think it went well. I had two classes with recitations; I thought on the whole it went well. Recitation instructors did well. Students seem to think it went well. I did my typical SPOT form (Appendix C), students seem to think it went well overall. Online homework went well. I think better than last spring; last spring I gave them too much homework so I backed off a bit between our written and our online homework. We still had one (of each) each week, but I think that went better." As I listened to and transcribed hours of interviews I was struck that my reply to her answers rarely varied, "So what do you *mean* by that? What do you *mean* it went well?" Patricia would laugh, and then words would tumble out in a seemingly disjointed rush that inevitably and more clearly illustrated her sentiment, "We made it to the end and there were no catastrophes! That's part, a big part, of my definition of things went well!" She went on to add that having successfully managed the work of six undergraduate recitation instructors, an online homework system,

and four hundred students over eight chapters of material, "I'm relieved that its over; it's nice to have an end, wrap it up, file it away. That's just nice. The recitation instructors did what they were supposed to do; the homework system didn't crash and those students are all now on break." Patricia was delighted, then, at having called the fall semester a wrap, but she was already excited at the prospects of the semester that lay ahead.

The sentiment, "Everything is brand new!" appears to conflict with her earlier statement that she'd taught the same class 50 times, but she seems to emerge from each and every teaching moment murmuring to herself, "Next time I do this..." And in January of 2011, Patricia expressed that, "I've done this, what, zillions, but I get to start over! A whole new class! It's full of promise right now, from my perspective and from theirs." Since many of the students would have just finished Patricia's section of first semester general chemistry, CHEM 1035, they would know the ropes, so to speak, and she spoke of their being full of energy and ready to roll, hoping to do better and grateful for the clean slate before them. For the students who would enter her spring semester class having had another instructor during the fall, the semester was just as full of potential though they might approach it with a bit more trepidation. "We're starting from scratch; we've got no grades," as she spreads her arms wide, "it's a new class. I feel like I could change a policy maybe, if I wanted to. You know, once you're in, you can't change."

Once you are in, indeed, the sixteen weeks during which the semester was in session are a much more complicated set of experiential considerations with respect to time and there was a big change planned for the 2011 spring semester. There were no general chemistry sections that would be taught with recitation.

During her first year of teaching, Patricia recalls feeling overwhelmed during the semester just trying to keep ahead of her students with respect to subject matter, and not confident that she could add much more than that to her practice. She felt herself on a steep learning curve and "I felt so rushed I hardly did any demos. And then I thought, ok, these are important, and I made the time for them." It was with some humor but more incredulity that she remembers securing her first teaching position at Radford University having had, in her mind, no relevant teaching experience. Sure, she'd just finished her Ph.D. at Virginia Tech, but she had no real credentials for college teaching. "They put me in charge of some classes; I really didn't know what I was doing!" but she succeeded in capably handling two semesters of Monday Wednesday Friday lectures by taking one day at a time and began teaching on that same time sequence at Virginia Tech the next academic year. Three 50-minute (or two 75-minute) lectures a week for 15 weeks comprise the typical college semester. For the general chemistry professor, the first half of the textbook gets covered during the fall and the second half (usually minus a few chapters) during the spring semester in three lectures per week with three to four lectures set aside at regular intervals for testing. (That chemistry professors get to flirt with cryogenic materials and rapid oxidation during the semester is a subject for an entirely different research project.) This is the traditional pacing into which Patricia entered in 1984 as a part-time instructor of general chemistry at Virginia Tech charged with one section of 560 students. She became proficient with demonstrations, indeed she now routinely includes at least one but up to three each and every lecture period. But for almost a decade, her three lectures per week, four tests per semester pace continued.

In the early 1990s, now-retired Virginia Tech professor Jimmy Viers, promoted the idea of a recitation program which would include only two lectures per week but would

include an additional problem-solving session, in a small group of about 40 students and led by an undergraduate chemistry, physics, or engineering major; choice of major was not so important as that the recitation leader had succeeded in general chemistry. The recitation sections began in 1993 and Patricia has been integral to their existence since, ultimately organizing and supervising the entire operation. Though she taught only twice per week when assigned to the recitation sections, her administrative duties regarding recitation far exceeded the amount of time she had been spending preparing for and delivering that third lecture. Funding and space issues were forcing a change as spring 2011 approached and for the first time in more than a decade, Patricia was looking at a three lecture per week semester.

"Now, here's the thing, when I didn't have recitation, before, when I had three lectures a week," chopping the table multiple times for effect, "three times a week," her arms are wide and palms spread open, hands facing each other, "I learned how to do that in *two*," and she almost closes her hands as if to squish those three lectures into two. "So now I feel like I *can* do that in two lectures a week so I have almost a whole third lecture of time to expand on those. I don't want what used to take me two lectures a week to just fill up three now. I want to be much as I can more active than what we typically do in our large lectures. Cause I can do what I need to do in two lectures, now I have that third to play around with, that's what I am hoping to do." Maybe she could invite students to the board to solve problems. Maybe she could give them a few minutes to work on a problem in groups before she actually worked it out for them. This recent rapid expansion in lecture time wasn't causing her concern so much as it was adding to the excitement of the upcoming semester. She was going to have to think seriously about the extra fourteen lectures worth of time now in front

of her and while she did think that the students would miss recitation, she adopted her usual positive stance and looked forward to the productive possibilities the change might bring.

2. Situational Orientation

Practical knowledge arises out of situation and responds to a new or changed situation by growing and changing. Situation locates at the intersection of objective conditions and internal factors; a teacher with a situational orientation integrates circumstance and expresses a valuation of the personal and the interpersonal. But if Patricia's traditional and straightforward teaching practice has evolved, it has done so as a result of change that she did not herself initiate. Changes to her practice have long been evolutionary and not revolutionary; they have been a response to situations that present themselves as obstacles to business as usual or more likely as opportunities necessarily taken advantage of. Homework serves as the perfect vehicle to describe such situational orientation.

"In the beginning," as Patricia refers to her early teaching years, there was no homework. The large lecture professor with multiple hundreds of students and no grading support simply could not grade written problems in a timely fashion though it was typical to list suggested end-of-chapter problems on the syllabus. During those early years, some of Patricia's colleagues began assigning homework, the answers to which were recorded on opscan sheets for efficient grading; though there were also professors who required their own grad students (albeit infrequently) to grade handwritten homework. Homework scenarios were, for years, a collection of these individual unique efforts from the general chemistry professors; there was no coordination within the general chemistry program. Indeed the resources available to different instructors of different sections of general chemistry varied widely; an instructor like Patricia had no corps of graders on which to call. On the whole,

homework had no official role in the general chemistry curriculum with respect to its integration into official grading schemes. Patricia saw the initiation of recitation in 1993 as an opportunity to address the issue of homework. She knew, of course, that doing problems was generally accepted as good practice. Chemistry is the study of matter and its changes; it uses a unique vocabulary and symbolism to describe what we know about our world. Chemical expressions are largely mathematical expressions using this unique symbolism and it is generally accepted that success in general chemistry requires strong problem solving ability *and* that problem solving ability can be improved with practice. But with no one to grade, no assignments are made for grade! So, acting on the situation as it was presented, Patricia hired undergraduate recitation instructors and decided that weekly homework would be assigned to the students in those recitation sections and that the recitation instructors would function as graders. The grades in general chemistry that semester proved that homework was a great idea...or was it recitation that was such a great idea? No official data was collected in an attempt to determine the reasons behind the rise in overall grade point averages for the recitation sections but the rise in the grades was reported to the provost's office and with subsequent continued funding this homework model continued for fifteen years.

Most recently, though, the written recitation homework was in addition to on-line homework assigned throughout the semester by the individual general chemistry profs. Textbook publishing has evolved to the point where all of the available texts include websites on which are contained the ancillaries that professors find useful (tables and images from the textbook pages, banks of test questions, homework systems.) Faced with the imminent cessation of recitation, Patricia was relieved that this would not also mean the end of

homework. Modern technology, in this case, now serves as the grader, the long missing link to being able to add this valuable component to the large chemistry classroom.

Interestingly, Patricia uses online homework as a way to reflect on the situational with respect to the propensity of students to procrastinate, "It's funny, an online homework assignment, they have plenty of time to do it, and I'm going to graph, I haven't taken time to do this yet but I'm going to graph how many people have done it in each twelve hours, because it's going to be like this, flat line, (she claps her hands together horizontally) and then its going to...last twelve hours, last three hours, *shoot up!* (then separates her hands, the top one as high as her arm can reach) but they do have a definite due date, it just cuts them off. And even though I say this, when it's the computer, there is much fewer...can I turn this in late?...I think they really think, well that's it, whereas the written homework they try harder to turn in late, so with the computer, they take that part much more seriously. But when they come to see me, when they come for help, or for help session, they ask questions about the written homework they ask hardly any questions about the online homework. The online homework, you eventually just put in an answer, the written homework, (she waves her hands, fingers spread wide, as if to express a mess on paper) So, I'm going to miss, I think *they're* going to miss, the written homework. They might not realize they're missing it but I think they are. So I'll see what I can make up with the online homework."

If problem solving makes for productive homework, this is reflected in the propensity of general chemistry professors to solve problems in class. Patricia commented at length regarding problem solving in the big lecture hall style classrooms. She expresses, again, situational decision-making when she expresses the need to "tailor what you are doing" to the situation that presents itself. Regarding the physical classroom space, she regrets that, "I

can't get to them in the middle; lots of aisles would be better. I could visit and see what they were doing. I can't walk behind them," so she views her decision to lecture to them as situational. Whereas lecturing was once driven by the lack of available printed materials, Patricia describes a desire for interaction with students, a desire to move away from the lecture style that is limited by the physical space of her classroom.

The general chemistry classroom we inhabit is quite new; we moved in only a few years ago. The teacher in this classroom faces two hundred seats, each with its own tiny fold-up desk. (Interestingly, zero left-handed desks were installed in this classroom.) The audience is divided into three sections by two aisles that step up to the back of the room. The seats are upholstered and the walls are covered with a lovely light-colored wood paneling; the lighting is bright and additional light streams in through two side-facing windows at the back. Two sections of black bench-top stand at the front of the room with an opening in the middle, providing a path for the instructor between the space behind the bench but in front of the chalkboard (oh the arguing that went into that chalkboard...current design sensibilities dictate whiteboard) and the space in front of the bench which is available for occasional overhead projector use and also for ease of access for students with mobility issues. Above the chalkboard on the front wall is space for the projection of two screens from the LCD projectors mounted in the ceiling. Connection to the projector is through outlets on the bench-top. Two huge and fairly colorful periodic tables flank the empty space on the front wall so when the students are viewing the projected images, they have easy visual access to that amazing work of (science and) art. The bench is already scarred with the residue of chemical demonstrations and coated with dried pools of candle wax, but unlike the bench in our previous lecture hall, Davidson 3, it remains intact. The old one had been heated, frozen,

and hammered until the structure remained functional only because chemists long ago invented adhesives. The ceiling above the bench is pockmarked from the rubber stoppers that fly from our methanol bomb and the floor tile is permanently discolored from nitrogen triiodide detonations. Patricia spends time behind the bench writing on the board and doing demonstrations; she frequently steps to the front when speaking during her lecture but especially between classes to facilitate conversation with students. Her tablet pc rests on a podium she positions in the pathway between the benches. She works lots of problems on the tablet, projecting her writing onto the front wall, but she laments that "we slowly move to where I just talk and they just write, even though I'd rather it not be that way." She describes attending workshops on campus and at other universities where teaching is done differently, in small groups, in flat classrooms filled with round tables where students work in groups and the instructor is free to move about the space and has sufficiently few students that they can, in fact, be interacted with in the time and in the space allotted for the lesson. She feels that with fewer students and more space she could circulate while they worked problems and that "more of them would come to their own conclusions." While such classrooms exist on Virginia Tech's campus, they are not the ones to which Patricia is assigned.

3. Theoretical Orientation

As I thought about the different orientations of practical knowledge in advance of beginning the intense re-reading, re-thinking, and re-organizing of the data, it was the theoretical that caused me the most concern for Patricia mentioned it specifically and early in our interaction. She expressed that she hoped she would make sense; she was intimidated by the notion that I knew "so much, from all those classes, all that study." Elbaz (Elbaz, 1983), defines the theoretical as that which is broad, general, comprehensive, and stands

above practice, serving as a guide to practice. We as students, and especially those in the sciences I think, carry the underlying conception of theory as an exhaustive study of facts that lead to an objective truth. Lavoisier, after all, formulated the law of conservation of mass after decomposing mercuric oxide, and doubtless many other simple compounds. But, as young science students we are told *about* Lavoisier and his law; we don't examine tables of his data and then re-conclude the conservation of mass on our own. We are told of the big theories in class and then we use those concepts to solve problems; science is taught as a re-examination of particulars that follow from theory. Teachers, however, spend their days surrounded by the particulars and don't usually have time to draw a deep breath, let alone conceptualize the bigger picture. Elbaz's high school teacher and research participant, Sarah, viewed theory as remote from her work in the classroom. Whereas Sarah ultimately began to accept a multiplicity and relativity of theory to her practice, I sensed that Patricia continues to work within educational theory though she professes to not know it in that she has a theoretical way of thinking about issues. She seems to acknowledge and to accept that there is a framework within which she works, and her professed sense of disconnection from theory is of particular interest since Patricia's undergraduate degree is in chemistry education. Her program at Concord College was geared toward teaching high school science and she found theories of child development fascinating and relevant to her own experience as a parent, but she does not recognize them as a body of knowledge from which she draws professionally. She is unable to articulate the theoretical though it permeates her teaching practice.

Late in the semester I asked Patricia if she thought that having raised her own children through the stage of development at which she met (most of) her students had

impacted her practice for, in an earlier research project (Eddleton, 2005c), many of my research participants had commented that they understood the perspectives of young people much better when their own children were in high school and college. Patricia's teaching career precedes the birth of her oldest child and, for her, the journeys through high school and college were recent history. Her oldest is a spring 2012 law school graduate, her middle child finished a graduate program in occupational therapy in that same semester, and her youngest is currently a senior in college. "Yes," Tricia agreed with her colleagues, the aforementioned research participants, "the way students can mis-think things, I can anticipate some of that."

But then our stream of conversation continued down a path that stirred some memories and she added, "You know, when my own kids bring me, when they would bring me a math book and a problem, I would always want the paper and the pencil, and say it wasn't something I remember right away off the top of my head, I flip the page," as she makes a turning motion with her arm, "and an example is right there. But they don't do that. Turn the page. Helping them, helping my own kids, I learned how students operate. I don't think my kids are unique; they don't *read*. They don't read the instructions."

"Oh my goodness," I said on camera, slapping my forehead, "had a moment just last night I had the same thing happen with Ellie on the front porch with puzzles." Ellie is four and she loves to do puzzles. She turned one over, dumping pieces on our front porch table, and then knelt back in her chair and said with a sigh, "I can't do it." "Oh Ellie," I said, "oh we just need to *turn the pieces over*." Patricia erupts with laughter.

Turn the page. Turn the pieces over. Hour after hour after hour, Patricia sits with students who seek her help in office hours. She does not read the textbook for them and she

will send them out into the hallway gently but firmly if they have done nothing in preparation for the visit. The line in the hallway is frequently long and she does not have time to re-explain everything. But each student enters, pulls their books out of their backpack, and takes out the sheets of paper containing their work. Patricia will ask for their textbook if they do not lay it on her office table with their worksheets and the first thing she does is reach for that book and open it, "Let me see here," turning to the appropriate chapter, "let's see where we are."

Scaffolding

When there is no textbook, she asks them to take out their notes. In class Patricia reminds students to bring with them what they have done if they plan to visit in office hours and I've seen her turn calmly through an unruly stack of pages to find in their handwriting the words she spoke on the topic during lecture. Though they have come with subject matter questions, Patricia's actions seem to convey a much broader goal for her students. Her message was clear to me as observer: Read the textbook; take good notes and read them. These items have value. She wants to teach them skills that are more broadly important than the subject matter she officially covers in class; her job, one on one with a student, is not to simply tell the information but to help the student fumble through it on their own. Not to show just the page in her notes where she wrote the desired information, which would be tremendously more efficient, but to turn enough pages to get to the place in the students' own notes that explain the confusing concept or outline the perplexing problem. Her articulation of this point, "The more they struggle with it the more they're gonna learn. The more they write down, the more pieces they'll have to put together," conveys an understanding of her

role as the teacher as provider of pieces that belong to a whole but are best learned when assembled by the student.

And if the student is not the assembler or if the student fails to assemble what looks like an end product, then maybe the student is not quite there, not yet capable. The hope would be, of course, that they are on their way.

"Hybrid orbitals, they all look at me like I'm speaking a foreign language and I lay awake at night wondering how do I explain this better?" We are speaking in Patricia's office after she has taught two classes through the lunch hour; she has already opened a can of Coke (that I brought with me to give her) and she proceeds to pick up and begin to peel and eat a clementine, "Like a tangelo, this isn't one but a tangelo is a hybrid, I think, kind of like a donkey, or is it a mule, from a donkey and a horse, whatever, it's a hybrid...kind of looks like both and has traits of both but is isn't either one. Orbitals are the same way."

On the subject of reaction mechanisms, Patricia comments, "First time through you just do not get it, not, oh well, they just aren't smart enough. You just don't, maybe you can't, get it. But maybe you've been the part where they hear it for the first time...in another class they might put it together. Maybe they get to organic and they do understand it." With this statement, Patricia conveys an understanding of scaffolding that belies her professed lack of knowledge of, in any case her lack of memory of, educational psychology.

Pacing

One memory from undergrad that Patricia is able to recall and does so with humor: modern technology, the laminator. "I know it's silly now but I did like the laminator;" her view on more updated classroom communication technologies isn't as light-hearted. "If you have a powerpoint, they will just not hear you 'cause they are too busy copying!"

General chemistry lab graduate teaching assistants and laboratory support staff had recently asked, "Why can't we just do a powerpoint?" They wanted each teaching assistant to have access to and to deliver the same complete outline to each of the multiple hundred sections of students via the overhead projectors mounted in the lab ceilings. But Patricia denied this request, expressing, "There's a *reason* why we do it this way." Via Scholar, Virginia Tech's online course management site, Patricia posts lecture outlines in the form of word documents and she provides the same to the general chemistry teaching assistants for their lab briefings. She is not opposed to providing students with some form of information prior to a classroom or laboratory event, but her outlines contain many blank spaces designed to be filled in by the students with pen or pencil as they listen to her progress through the outline as she too writes her own spoken words on her tablet pc for projection on the wall. "I write as they write; little things, it's the little things." I replied that, having observed many of her lectures I had gotten used to the rhythm of her lecture delivery style, adding, "Your pacing as you speak is never faster than *you* can write."

"Right," she adds, "that's *purposeful*." She then expresses two different ways in which she thinks about powerpoint presentations, a practice she sees as providing too much information but in usually counter-productive ways: "When students have all of the information, they write nothing and they go to sleep. Or they don't already have the notes and there is too much to write. "I could say, the first person to raise their hand gets an A in this class, and they wouldn't even hear it, they'd just keep writing."

In one of our research conversations, I recounted a time during lecture when she was using the chloride ion as an example of a spectator ion, and I had been continually changing camera orientation as she spoke at the podium, wrote her words on her tablet pc at the

podium (at which point they appeared on the wall), and manipulated the demonstration glassware on the bench. I subsequently realized, only in my re-viewing of this recording of this particular stretch of lecture, that the script representing the symbol Cl bore very little resemblance to the actual symbol, for she was writing in cursive, she'd been stepping quickly back and forth between her demonstration and her tablet pc, and writing just as quickly. With respect to penmanship issues on both her part and that of her students, she comments, "Oh I sometimes think I should work on that. I want it to be legible, but if you heard me say it then the chicken scratch would probably make more sense. They rarely write more neatly than that in their own notebooks."

Epiphany

And it hit me. It was at this moment, when watching the video and re-reading that part of my transcript, that I had one of those moments, in my mind not unlike the moment when Leo Szilard stepped off the curb in London and time cracked open before him. For each and every minute of video I had recorded, each thought spoken aloud in our interviews, each action taken by Patricia in the minute by minute execution of her teaching practice was, in fact, multiply-laden, multiply-layered *with* practical knowledge, was indeed a product of it while at the same time acting as a practical knowledge generating machine. I had long feared the notion of not knowing what to write about, of not being able to identify practical knowledge in this large lecture practice. I now feared the notion that I had collected an insurmountable quantity of data, more data than I could analyze in a lifetime let alone in the period of time available for writing this dissertation. The split second of time required of Patricia to write that symbol, Cl, the barely legible style in which she wrote it, the way she simultaneously spoke it, both in context and in tone, her thoughts on the product image and

how it might be interpreted by different students, the technology on which she wrote it and the manner in which she projected it to her students, let alone the complexity it represented on the periodic table and with respect to its actual existence in the world as we know it, represented both a culmination of the history of Patricia's practical knowledge, an exemplar of the totality of the same and was, in fact, a newly-birthing practical knowledge-generating segment of her future practice, a segment bounded by this very moment and her next evocation of the term, and others like it, in any or all of their forms.

Were recitation and homework experiential and situational or was the entire issue an example of Patricia's sense of working within the theoretical? She had continued to wonder whether it was recitation itself or homework itself or maybe the quality of the recitation instructors themselves...or maybe that the recitation instructors were undergraduates and not graduate students...that had resulted in markedly higher grades when recitation and homework became part of the general chemistry curriculum. Patricia was in the process of questioning the current disconnect between online homework scores and scores, which were markedly lower, on corresponding tests. She sensed that there was research to be done there, that there were reasons to be discovered though she did not have the time available to her to undertake such a project on her own. She is fully aware, though, that there are reasons for circumstances and describes her work as purposeful; the implicit, that is to say the theoretical, is operating if not explicitly named in her teaching activity.

I spent some time mired in this swamp of information, unable to move forward. But when I looked back at the sections of this document already written and saw that each could each have been differently interpreted yet still legitimately located with Elbaz's theory of practical knowledge, I decided that the swamp was simply a continuing conflict in my own

mind between scientism and what is, instead, scientific. The scientific method is one valuable way of investigating one's world; it carries not with it the guarantee of universal applicability as scientism implies. Steadfast belief in scientism has successfully lead humanity to explanations of phenomena not otherwise possible. But my scientific investigation of Patricia's teaching practice was leading me to a place not unlike that discovered by quantum physicists, the place where specification of one thing necessarily implied losing the ability to specify an other. Alternately, as I had discovered within Elbaz's theory of practical knowledge, there exist different, but equally legitimate categorizations of teaching practice. As Billie Jo Armstrong sings, "All her doubts were someone else's point of view." (Armstrong, 1994) So I kept writing, but now with confidence.

4. Social Orientation

I chose to view Elbaz's social orientation in the context of a reflection of social structure over which the individual has little or no control, in fact, a structure that can defy awareness. A sense of social orientation can both open possibilities for the teacher and simultaneously minimize them.

Consistency

As I reviewed transcripts, this issue of social orientation featured grades. Patricia relates that the issue of grades serves as a point of contention within the department, at least it had in the past. "A few years ago there was a period of finger-pointing, buck passing, folks in divisions that were disappointed in what they saw as our ability to *teach* general chemistry. They saw us (the corps of general chemistry professors and instructors) as causing problems that had to be fixed by somebody else."

"A grade means something, that you come out of class *knowing*." She relates that the department does look at grades, making sure no one sticks out "like a sore thumb," but the call for such consistency has really strengthened in the past ten years. There is a concerted effort in the chemistry department to evolve to common time (and content) tests but this is really, Patricia thinks, a differently named call for consistency.

In her opinion, twenty years ago there was just doing what you thought you had to do to get covered what you wanted to cover, using the textbook as a guide, of course, but there was variety even with textbook choice. "We're using Bodner and Pardue and Brian Hanson is ordering Brown and LeMay. Then Ketan wants to use the DVD (referring to a DVD of general chemistry principles he wrote, constructed, and marketed himself), Glanville wrote his own book for the engineers. It was crazy. And for classroom management, in Dorn's class you could retake tests, Brownlee gave quizzes in class every week, and Dillard had that wacky homework." Currently, the call for consistency has been met with one textbook being used in every section of general chemistry, no matter the instructor. Homework is assigned online and from the same system, but the actual problems assigned are a matter of instructor choice as are the due dates.

"We are watched far more closely, now, to make sure that what we're supposed to be doing is getting done...making sure we're not giving away too many A's. (As director of general chemistry) they expect me to watch out for this," a degree of this desired consistency; as a matter of fact, the classroom management practices of the new corps of general chemistry instructors is modeled closely on her own practice. But this is an area on which we have previously expressed mutual disagreement for, as I view it, Patricia is charged with certain responsibilities and subject to some expectations without having any real power to

enforce her aims and is regularly asked to accomplish tasks for which she receives little support, though that is fortunately and finally changing. We also disagree on the meaning of consistency; I equate the term with gate keeping. As frustrated as she can get with these issues, she very quickly returns to her usual manner of trying to see the best possible angle on the issue, the ways in which the situations can be handled to best address the best interests of the students.

A good number of years ago, one of Patricia's long-time colleagues asked her if he could have all of her notes for her general chemistry course, "I want to teach this without thinking." She recounts that she was horrified by this attitude, but provided a copy of her materials without further comment since, "Hey I knew what else (pressure to secure funding, research, and publish) he had going on." She didn't get mad so much as realized that the interests of the general chemistry students were best served if such an instructor was teaching with *her* notes.

Patricia said to me, on the subject of testing, "If half my class got A's on a test I wrote, I'd be fine with that. But it just doesn't happen." In my mind, Patricia writes tests on which her students earn almost identical averages compared to her colleagues, half of which do *not* earn A's because she is so very comfortable with the social expectations of her discipline. I pressed her hard on this issue as she had mentioned that she just *knows* when she's finished writing a test that includes every relevant topic for that segment of the semester. I plagued her for several interviews with, "What do you mean by you just *know*?" Chemistry is known as a "hard" science because it is based on the quantifiable, but also because most students of it find it difficult. How did she *know* that she hadn't forgotten even one small detail or one type of problem? I can only answer this question in the context of

what is socially acceptable in the chemistry classroom. Patricia has so long existed and succeeded in this society of chemists and chemistry and the large lecture classroom that she writes tests that address all of the relevant subjects in a manner consistent with that in which she succeeded. Such thinking breeds success among the population of students who are capable of achieving success in much the same way. It does not invite in those who see the discipline differently but it does maintain a status quo. And this has certainly resulted in no lack of students taking general chemistry. Patricia writes tests that match her definition of success on a chemistry test and her definitions match those of the discipline. Patricia's test averages and grade distributions are the epitome of social acceptability as are her responses to her colleagues' some times unreasonable requests.

Possibility

Another such topic came up during our Coke and clementine lunch interview (a particularly productive January session). As Patricia peeled the clementine and devoured two pieces of fruit piece by piece, leaning to spit seeds midsentence, she was also laughing about a recent brief conversation with a superior over 'teaching for instruments' as she called it or 'gen chem as cash cow'. "We're getting NMRs, what?! One per lab, oh or maybe LC/MS...one of those is better for general chemistry students than the other?!" (NMR stands for nuclear magnetic resonance, an analytical method by which instrumentation identifies based on nuclear spin, and LC/MS represents liquid chromatography/mass spectrometry, both also analytical methods used, in this case, in combination.) She was simultaneously incredulous and amused, if also a bit disgusted. "But, why are we really getting it? So that other (research) labs can use it! We're trying to get this to add up to \$100, per student, but we'd *have* to use it...so that *they* could use it!" On one level Patricia was irritated at having

to develop new lab exercises to accommodate the new instrumentation being purchased in order to justify the purchase of said equipment, but she very quickly assumed her positive outlook and was shortly talking herself into being on board with the project, "Ok, I can do this." We did agree that though the specifics and much of the theory of NMR and of LC/MS were beyond the scope of the existing general chemistry curriculum, that the notion of fingerprint had merit and value at even a basic level of understanding. Patricia has this way of only very briefly needing to vent, then she's back to looking at the situation and its possibilities for benefitting the students, for moving forward. As is *my* usual way of reacting to situations, if she was a bit disgusted, I was, at first, incensed. But then I realized another angle and surprisingly offered a supportive, "You know Neil deGrasse Tyson was on the Daily Show last night (O'Neil, 2011) and it's kind of the same thing where after he was finished making his point about going into the labs of people who are researching organ regeneration and it sounds crazy but we're not making this stuff up, Jon Stewart says to him (in his inimitable Jon Stewart way), "so you say to me that you don't make stuff up, but here's the thing, you *could* be, I would have *noooo* idea," accompanied, of course, by much laughter from both host, guest, and audience, but Tyson continued with, "Here's the thing, sometimes on the frontier of knowledge between what is known and unknown reaching into that abyss you have to make something up that *might* be true so that you can formulate a research plan to find out whether or not it is." And I add that this 'gen chem as cash cow' situation shares many traits with a truth about scientific research; I am excited to be able to offer support! So Patricia isn't really a Daily Show fan and she's never heard of Neil deGrasse Tyson and she isn't nearly as enthusiastic about Tyson's point as I am; my comment falls flat.

She responds with, "Hmm, I could make this work, but then I doubt, I *did* analytical research remember, reliability? How reliable are these instruments?" She's already moved on into planning for the incorporation of these new instruments into the general chemistry curriculum, into the labs and onto the benches. How big are they and where will we put them? So she's moving forward; but, despite my Daily Show story of support, I'm still angry. Did she miss my point? I don't know. But she's already moving on! *And* she's the director of general chemistry; she gets *told* what's happening, what is being planned for. And she is nothing if not *eminently* adept at molding her daily work such that it only supports existing social custom.

5. Personal Orientation

Patricia and I met for five different conversations during the second week in January 2011 and it was during this time that her youngest daughter, Lindsey, began spring semester classes at college. Lindsey and Patricia had chatted at length about one incident in particular, a first class meeting for math, a class Lindsey dreaded having to take. The first day had been less than fulfilling for this junior occupational therapy major; Patricia reacted to Lindsey's comments, "He was just so negative! I mean your body language, the way you say things, *says* things. He says, you can do this (homework) or not, I don't care." Patricia insists that she says these same things, but in a different way, "I say hey this is the homework and you won't do as well if you don't do it." She approaches her practice with a distinctly personal orientation in that every aspect of it reflects her values, her beliefs, ideals she holds dear. So too, but differently manifested, for Lindsey's calculus professor. The personal orientation, because it so frequently defies self-awareness, defines a teacher's hidden curriculum. Acknowledged or not, the hidden curriculum is always at work in a classroom. Schwab

described this (Schwab, 1962), Elbaz (Elbaz, 1983) located it in her examination of Sarah's practice, and I can see it here.

Of course, Lindsey is now panicked but will not be contacting her professor due to fear, "If you don't earn an A, then you shouldn't even be here (at JMU). Email? Don't email me, I won't reply to email; it's a poor form of communication." While Patricia's email load is significant and is sometimes an avalanche of pleas for attention to which she'd prefer not to be subject, she presents her perspective differently, "Well, I agree somewhat, I won't try to explain a problem via email, but I'll say please come in and we'll talk about this. I mean, it's (math is) not her thing, but I'd rather be positive. Not misleading though. I tell them this is a difficult class and, if you don't do your part, you won't do well. I want to push them to be successful, whatever that definition is for them."

Patricia wants her students to learn chemistry and to learn to appreciate chemistry; she expresses that she is there to help them but that the bulk of it lies on them. "I want them to think that it's doable; I think everybody *could* pass chemistry. But I want them to learn in my class what they need to move on to *their* futures. *Their* future goals. Maybe chemistry's not their thing; math's not Lindsey's thing. But she's got a lot to offer. I don't want them to feel dumb even if they don't do well."

Interestingly, homework and problem solving are components of Patricia's practice already much discussed in this document but on this day she beautifully describes them in a personal context: "My homework assignments are a path; I tell them I am going to provide a path on which you can succeed." She describes that when planning lecture, she needs to speak simply but then address topics to the depth that she will expect on a test. "I ease them in and do more in depth stuff to prepare them a bit more. I warn them that I spend a long

time making up problems; I want to make sure I have the best possible means to challenge them on different levels. My goal is, 'What is going to help them succeed?'"

My typical question follows, "What do you *mean* by help them succeed? What does that mean for you?"

She relates that first, the university's definition of success is a C or above, but that for some, "they are happy to just pass...and I am happy for them to just pass!" followed by a cascade of giggles. "Really it's whatever it means for them." Patricia wants to provide whatever it is that makes them feel like they had the tools they needed to do as well as they could do. Student comments on her evaluations and in direct conversation indicate that if you didn't do well in her class that you *really* weren't trying because there are so many opportunities between office hours and help sessions and recitation; the opportunities to get help are there. It doesn't make Patricia sad so much when a student fails her class, and this happens on a regular basis, but "What is really sad is when you realize there's this student you've never seen before in office hours, or a help session, and it's late, very late in the semester, and they, they just didn't take advantage of *anything*."

Patricia feels that an intimidation factor begins sometimes in high school where students are told repeatedly how "things are going to be different in college; college profs are too busy to bother with *you*." So she tries to make sure (and she leans forward toward me as if to imply invitation or pleading) that she invites as many students as possible and reminds her class as often as possible to *please* come to office hours. She feels that if there is a connection, "to the fullest extent possible, you know I'm not their best friend, but if I can build some connection, they'll be more invested, but that's just harder to do in a large class."

Patricia learns as many names as she possibly can and relates, "One kid in McBryde (a classroom in which Patricia taught for many years and that contains 560 seats) he came up to me and said, 'You know people's names! I want you to know *my* name!'" She truly believes that *one* thing, maybe learning a name, some indication of connection with students, makes them feel sufficiently accountable that it makes "*the* difference."

Patricia states that she gives each semester her best shot, with "office hours *all* the time, a help session *every* week." She finds it especially rewarding when a student who is not really doing well in class takes the time, either in writing or in person, nevertheless, to mention that it was actually very interesting or when she hears from a student that her class was "a *lot* better than they thought it would be" or, even better, more interesting than they thought chemistry *could* be. She received a visit from a student during the spring of 2010 who had earned a 64 on his first test, and then had failed the second test with a 56. He asked what he could do to improve; he asked what she might do to help him. She gave him the tutor list and then they talked for quite some time about specific general chemistry topics and about the act of taking this general chemistry class. He reported to Patricia, shortly thereafter, that he did hire a tutor; she noted that he earned a 76 on his third test. He followed that with an 87 on the fourth test and polished off his semester in general chemistry with a 92 on the final exam! She knows he worked hard; but Patricia reports, "He said *I* gave him the confidence to do it. Everything you say, do, is potentially this golden moment."

Storying a Lecture

Introduction

Having analyzed and reflected on data for the past year and a half, I am fully confident that each and every piece of Patricia Amateis' teaching practice can be categorized

within one or more of the orientations of practical knowledge and that these orientations comprise the entirety of a teacher's work; Elbaz's theory subsumes the history, evolution, and future of Patricia's large lecture teaching practice as it did Sarah's high school practice. But, after using the theory of practical knowledge as the lens through which to view the aforementioned particulars of Patricia's teaching practice, I feel compelled to use one piece, the fundamental piece of a college course, one lecture, of Patricia's teaching practice as a lens through which to view the particulars of practical knowledge.

During the examination of a video-recorded lecture after I had largely planned (unfortunately only in my mind) the orientation pieces of this document, I recalled a comment made by the only Nobel laureate I shall likely ever met, Leon Lederman, who visited Virginia Tech in 2000. The date was March 2 and I greeted him with, "Nice tie!"

"Oh yes, thank you," he replied, "I always honor the great Dr. Seuss on his birthday." (So he really *is* a genius, I thought to myself.) The *relevant* statement he made, though, went something like, "The subatomic universe is at least as complicated as anything above it," and his statement was accompanied by his holding up his pinkie finger and squinting at it as if to examine a miniscule something perched on the edge of his fingernail. Lederman's work in physics can be summed up as one of the most ambitious of efforts to understand the smallest of things, subatomic particles, so that we might understand the largest of things, the universe. And if the theory of practical knowledge is an atom and the particulars of Patricia's practice its subatomic parts, can her teaching practice or even just a piece of her teaching practice, then, not be viewed as the whole, the atom, and practical knowledge then serve a subatomic role? This theory encompasses her practice, but can one lecture subsume the entirety of this theory of practical knowledge? Is it possible that the theory and the practice might collapse

on each other as in quantum mechanical theory's ability to only approximate, to define one aspect of an atom only to lose its grasp on another, equally important but also less than completely quantifiable aspect? Yes, it can. And it does.

Practical Knowledge in the First Minutes

Patricia stands at her podium in front of a chalkboard covered with the eraser dust from the 9:05 class dressed in what I would describe as Sunday school teacher best, she is impeccably groomed but nothing draws or commands attention; she has a definite propensity for black and on this day has on black pants, black flat shoes, and a dark patterned jersey underneath a dark jacket. She does wear a sparkly black necklace around her pale neck, but in general, her dress throughout the semester reminds me of the very nondescript uniform of sorts that I remember from my undergraduate days watching my, mostly male, professors teach and from years of prepping demonstrations for the same corps: darkish, usually gray, flat-front pants with a belt, a light colored dress shirt, leather shoes, nothing fashion forward, nothing repulsive, just a whole lot of really dreary clothing. Patricia's appearance is more pleasant; she's pretty, trim, and always wears at least earrings in addition to her wedding ring. But, in keeping with tradition and consistent with practical knowledge's social orientation, it seems, her make-up is minimal and her outfits plain.

The first page of the class notes that Patricia has prepared for the students and made available online via Scholar shines in duplicate on the front wall but she begins the period with a laundry list of reminders not listed on the projected image. She urges students to pick up a syllabus if they didn't get one during the first day. She makes comments about Connect, the online homework system, reminding them to register and cautioning them not to wait until the night that the first assignment is due to go about registering...just in case...not that

she's had reports of problems, but you never know. She alerts them to a change in a previously announced time for the first help session, asks for questions from the class, "before we get started," and after answering a few about a necessary plug-in for the online homework, she checks again for questions. When the response is silence she then launches into her subject matter by announcing, "Okay, well then we're getting started with Chapter 6, an early chapter in the book but one we delayed until this semester. It goes with another chapter that we'll cover this semester, right after this one, matter of fact, Chapter 20, that's like part two of this one," laying out a plan for subject matter and sequencing that makes sense. I am reminded of her comments that she intends to provide a path on which her students can succeed, and she clearly provides multiple paths, this one into the specific topic for this early semester lecture, evidence of a personal orientation.

Within the first minutes following the brief introductory remarks, she asks a question regarding the topic of both of the first two chapters for this semester, thermodynamics.

"Thermodynamics, what word do you know that uses 'thermo', where 'thermo' comes from?"

Encouraging a connection between new material and something, anything, that a student might already know or be familiar with or have heard before illustrates Patricia's orientation to theory, though she had difficulty articulating this very point. After asking the question, she has stepped away from the podium and is motioning palms up as if to stress that this is a real question, and she looks as if she might approach the class, leaning forward if only slightly but as if to invite response. Both the question and the distance she moves, toward the class and away from the podium, invoke a situational orientation. She orients subject matter to student situation by asking if they have heard a relevant term or at least part of the term, thermo, as if to forge a connection between subject matter and student experience. (And a

class member responds with the word thermometer.) Her question also clearly invites a real response; she wants to hear from them.

Situational orientation of a different sort is evidenced by the fact that she is only able to move toward the class and away from the podium to the extent that her stylus cord will let her. She is quite literally tethered to the podium. In order to write her notes into the skeleton outline projected on the wall, she needs her tablet pc and to write on the tablet pc, she needs the stylus and an un-tethered stylus is ridiculously easy to misplace, even mid-lecture. LCD projectors have liberated professors from the overhead projector and Vis-a-vis pens; Patricia's tablet pc and the stylus have similarly liberated her from the chalkboard, but she remains chained to the technology through that nylon thread connecting stylus and tablet (Appendix D).

Word Choice

Experiential orientation has been revealed as well in these few minutes with her use of the word, "Okay." Patricia's speech is bright; her inflection is uniquely articulate, and cheerful. She enunciates brilliantly and with an almost imperceptible, but distinctly West Virginian, accent. I became fully aware of her accent and intonation not by listening to it for hours (though that didn't hurt!) but by both rewinding and re-listening to her words and by attempting to slow down video recordings of our interviews and of her lectures in order to catch every word.

It was frequently the case that I would type only, "You didn't do so well on the second test," before I lost track of my fingers and the recording speed such that I would stop typing, stop the recording, rewind and listen again only to have gone back too far in the video such that I re-listened to what I had, or thought I had, already written to find that her exact

wording was quite infrequently what I first wrote. I had *not*, in fact, typed the actual words Patricia had spoken, rather the words I *heard* her speak. "You didn't do so well on the second test," became, after a repeat listen "...you see, we, we didn't do so well when we had to reproduce that on the test."

Correction of the statement, "You got 94% on Connect but a 64% on the test," became "We're getting a 94% on Connect homework, but we're getting 64% on the test...." I backspaced over the word 'you' and typed the word 'we' enough times to know for sure that Patricia considers this endeavor to teach and learn general chemistry a joint effort.

Intonation

Her inflection on the word 'okay' on this particular day implied that they should, that she should, get going! "*Okay!*" brightly, as in, "Times-a-wastin', let's do this!" revealing the experiential orientation to time, and, though they likely would have no way of knowing this, practical knowledge's personal orientation with respect to Patricia's love of music. She took piano lessons as a child, continues to play, and has sung in many a church choir.

In an attempt to minimize stopping and starting when transcribing, I decided to listen to a slowed down version of my recordings; I was *shocked* at the resulting product. With speed slowed and inflection and tone lost, *everything* was lost. The word okay reverts from an indication of an orientation of practical knowledge to a part of speech. The transcription of all of those hours worth of data was going to take longer than I had anyway; listening to it on a slower speed was going to take *forever*. But that was not why I abandoned the notion of transcribing at slow speed. Too much valuable information would be lost to me if I had only Patricia's actual words.

'Okay' in this particular context differed from her use later in the semester, following both spring break and the second test, which she had administered on the Friday before the students left for their break. She opened that lecture with, "Okay, welcome back, hope you had a relaxing break, wasn't. quite. long. enough. but it will have to do." The lilt in her voice was absent; she sighed through 'O', and her utterance of 'kay' was curt. At this point in the semester, she was disappointed in the test grades and saddened by all that represented. The slightest inflection, change in tone, or variation in word choice, sets the stage for life in the classroom, possibly even more so in the large lecture hall than in a smaller space.

Sledding

Patricia followed her initial 'thermo' question on this early semester day by defining several terms, audibly and in writing on her tablet: thermodynamics, work, energy, system, surroundings, with the terminology often found in textbooks. But she moved quickly and seamlessly into a non-chemistry example demonstrating further evidence of a theoretical orientation with her consistent use of microscopic (or chemical) and corresponding macroscopic (or real-life, familiar) terminology. This was the beginning of a story, though, and it is through her storytelling in class that her personal orientation shines.

"If you go back to that back window and look out you see the Inn, anybody been to the Inn for dinner or something, maybe? That used to be an 18 hole golf course, the Inn's only been there, oh I don't know, 4 years or so, now it's a 9 hole golf course with the Inn on it. On that 9 hole golf course and I believe it's still there is a pretty good sledding hill, and the reason I don't know if it's still there is I don't have anybody anymore to take sledding. I haven't been there for some time. But we used to go there, sledding, because it was fairly close to where I live, so here is, uh (returning to tablet); I have three kids and there is one of

them, on her sled. (She draws a little stick figure, Appendix D) She was probably about 7 at this point and her viewpoint on sledding was that it was not her responsibility to avoid other people, it was their responsibility to get out of her way. Luckily when she was old enough to drive she had changed that attitude. (class chuckles) But here is her sister, who at the time was about 4, who was stuffed into one of those one-piece show suits, (makes big puffy clothing action with her arms in front of her body) you know the ones where you're not so agile in it? The kind where you're kind of lumbering around (makes lumbering motions which do *not* fit with her natural stance and a few students giggle) so Samantha comes down the hill on her sled, plows into her sister, who went horizontal and landed flat on her nose which *luckily* wasn't broken but it was blue for quite some time. So as she's up there at the top of the hill there is the *potential* to make something *happen*...which she...did. Now, in a chemical system what do we have a beaker at the top of a hill? and we're going to throw it down to somebody? well, of course not, *where's* the potential energy, where is the energy that could potentially you know, blow up a building, or, like the hydrogen balloon, where is that?

A student responds, "in the bonds." And Patricia continues, so, in a chemical system, there is energy, potential energy, but it's in the bonds. And so now she's writing on the projector. And so last semester we talked about bond energy, single bonds have less bond energy than triple bonds, for example, and that energy has the potential to make things happen. We'll come back to this notion of the bond energy later, but the energy that is in the chemicals that power this battery in my microphone, for example, the energy in the hydrogen and oxygen bonds meant that there was a fireball when we blew it up, the energy in any reaction that we're doing to make energy or to absorb energy, that energy is in the chemical

bonds. Now, potential energy can be converted to kinetic energy, now *that* is the energy of motion, now she's coming down the hill, now she's moving. At the top of the hill there's just the potential that something can be made to happen, it's not going to happen until its converted to kinetic energy that's the energy of motion...

Evident again, at the end of this segment is the consistent use of microscopic/macroscopic terminology, invoking the theoretical. This story is obviously of a personal nature, as well, but how intensely personal? If that gets lost reading it here to myself from this page, then surely the reader has missed it. I remembered Patricia having told the story in class but I fully realized its power, which I believe she unknowingly articulated, only when I listened again, multiple times, from the video. I believed it to be a spectacular example of her orientation to the theoretical but found its true power to rest instead in the personal. I have tried to insert personality into the written prose with italics but I find it impossible to manipulate the words on this page such that the reader of the transcript would come anywhere close to understanding the heartbreak implicit in her tone, during her very nearly imperceptibly sorrowful utterance of the expression, "don't have anybody anymore to take (sledding)."

Checkbooks

Just a minute or two following the sledding story Patricia describes using sign, positive and negative, to signal energy gain or loss by a system, when seemingly in mid-sentence, her speech slows just a bit and she haltingly says, "negative means subtract, so you take money out of your checking account, you subtract," and murmurs, sooo...

"I'm probably the only person in here who maintains a check book, I don't think people your age, (she leans and steps forward) even *own* checkbooks, my kids don't, they do

it all on line, ok, but when I subtract with a pen on a piece of paper, in my account, if I take money out that's a subtraction, if energy is removed from the system, we give that a negative sign. And of course the opposite possibility is you start with your system, your reaction or something you're going to change the phase, but when you're done your system has *more* energy that it did, Where did it get that energy from? If energy can't be created, where would it get that energy from? A student murmurs, 'from the surroundings,' ok, and in that case the change in energy is positive. Just like if I *put* money in my checking account, I *add*, making hand motions to emphasize. Ok, it's a plus sign. If the system has managed to gain energy, we will give that a positive sign.

Patricia's use of the word, ok, in these instances is a simple check for student understanding. But with this short story she references both her age and the fact that she has kids that must be close to college age, maybe a bit older or younger, but in any case, old enough to have checking accounts and maybe close to the ages of her students. This might forge a fruitful connection with someone in the class; as well it further expresses her love of sitting down and doing problems with pencil and paper. The story adds humor to this lecture in that she speaks of the checkbook as an antiquated technology, but, like the lecture, a technology loaded with purpose. Yes, Patricia's practice is, on one level, 'old-school', but delightfully so.

Calories

The lecture continues and the topic of units emerges as relevant, "we'll use the term joules but I want to use this other term because it's one we use...calorie...when you use the word calorie, what are you talking about?" A momentary silence ensues, but followed by the slightest murmur; she's just finished a segment of lecture that is decidedly un-storylike in the

sense that she is simply telling symbolic chemical representation, really she has been telling, using chemical symbols, a thermodynamic relationship, and I think the members of this class have, if only temporarily, fallen into a stupor. Or, as she mentioned earlier with respect to powerpoint slides, the students are writing so determinedly that they don't really notice that she's posed the question.

"Food! Right, so it's the same, how many calories is that and class murmurs 1000, right, when we talk about a food calorie and I'm going to use a big C for it, when we talk about one food calorie we're actually talking about a kilocalorie. Why do we use that term calorie, well because when you eat food you are eating potential energy and your body uses that food to provide energy for your body so you can walk over here to go to class, take notes, and go play racquetball later or whatever or even just the metabolism your body's doing for energy so that's why we attach the word calorie to that. Now, let me show you, uh, let's convert the potential energy to the uh calorie energy."

And at this moment Patricia has disappeared from my camera's view, having let loose of her stylus to stride to the opposite bench and heave the lead-weighted plexiglass blast shield into place on top of the bench. It lands with a tremendous clunk. "So your body burns calories," as she strides to the other side of the bench such that the shield stands between her and her equipment, and the students,

"We're gonna do it a lot faster than your body would so we're gonna use Ritz crackers because they work real well (she picks up the red Ritz box and says) so the side panel says that the serving size is 5 crackers and that is 80 Calories so you'd multiply by 1000 to figure, 80 kilocalories or 80,000 our calories. 1, 2, 3, 4, 5, 6, 7, 8, put in 8, finish the package.

While crumbling the eight crackers into a cast iron frying pan sitting directly on the bench top, Patricia looks up at the class. She is leaning forward with the crackers so the position of her head as she surveys her students reminds me of looking with purpose over the top of bifocal glasses. She raises her eyebrows as if to emphasize that she is questioning, not telling,

"Crunching them up, isn't that what you do? Chew the crackers, make a little bit more surface area, if you're eating those crackers that would go down in your stomach (flicking cracker dust off her hand, placing empty packaging to the side, then dusting off both hands vigorously) your body USES this for energy and what happens if you consume more calories than you then burn for energy?!"

The class mumbles a multitude of inaudible replies, and Patricia adds,

"Yesss, you then begin to wear them on your hips, well, you guys don't, when you're *my* age you begin to wear them on your hips, or somewhere else."

She says this mid-stride as she moves to the colored net dewar on the bench at some distance from the frying pan. Being miked, everything Patricia utters is audible to her students even when she is in motion or when her back is turned to her audience. Still clapping cracker dust off hands, she queries the class, "So what do we need to *burn* calories? Whadaya need to burn *anything*? A student says "Fire!" loudly. But with no reaction from their teacher, students continue to offer suggestions. I hear the word energy mentioned several times, but, finally, Patricia hears the word she wants and it is *oxygen*. And she continues,

"Oh yeah, oxygen, without oxygen it won't matter how hot I get those crackers, I need oxygen, that's in the air, *you* breathe in oxygen, your body has a source of oxygen, to burn

the calories in the crackers you'll eat. Air is about 25% oxygen so throwing a match in there right now doesn't really get me the rate of combustion I want so what I'm going to do is make myself an environment of about a 100% oxygen over my crackers,"

as she slides on safety glasses,

"So what I've done is taken some gaseous oxygen and gotten it really, really, really cold so it's liquid and you might be able to see this as I pour it out but liquid oxygen is a really lovely shade of blue (as she peeks ever so slightly into the dewar, which is a mirrored wrapped type, not the transparent one we also have in lecture prep) actually and I'm going to pour it over the crackers and let it evaporate cause we're *way* above its boiling point and when it evaporates I'll have a *lot* of oxygen over the crackers and then we'll combust them."

As she pours the contents of the dewar into the cracker-containing pan, I can hear the sizzle of the boiling oxygen and see the cloud that forms over the dish. The lecture continues, "So and liquid oxygen really doesn't do much, we've gotta let it evaporate and now we can burn some calories," as she strikes to light and then tosses a burning match into the cast iron pan with the crackers and their blanket of fog, "maybe." The flame glows in dish but nothing like I know it should be, Patricia continues, "A little bit of a slow start," as she steps toward the bench to peer in, "Let's try another one, maybe I have too much oxygen." At this moment she is mumbling to herself but her words are still audible; it strikes me that her tone is kind of conversational at times, she's in a room with 200 students but it is, still, a conversation. She moves from authoritative deliverer of information, in a tone designed be widely heard but still distinctly conversational, to a far less audible and enunciated manner yet still designed to be heard and taken down into class notes. The flame from those Ritz crackers now roars to life, grows, and continues to roar as the fireball grows. Patricia steps

back during the crescendo of this hiss of flame, "*Briiighht* light, *there*, now *that's* burning calories, now if we all burned calories like that," the class is laughing and chattering appreciatively, "we could have cheesecake *all the time!*" The class continues its amusement, as Patricia crushes out the remaining smoldering ashes with the packaging from another demonstration and returns the blast shield to the floor in the floor space between the bench and the first row of students, all the while speaking,

"So now we have some charred crackers, but I wanted you to see when we talk about the calories, that very word refers to the energy unit but in chemistry we are pretty much going to stick to the joule unit."

Returning to the podium she picks up the stylus.

Doing chemical demonstrations is hard work; there exist pauses in Patricia's speech when she has to exert significant physical effort. For the most part though, she is talking in a smooth stream as she moves about the room and executes the illustration of a chemical principle. Demonstrations require multi-tasking on a very high level. The teacher doing the demonstration is simultaneously talking about the process being demonstrated and about the chemical principles behind the phenomenon while physically manipulating equipment, tending to safety issues and classroom housekeeping. The demonstration has to have been thought about and planned in advance and cleaned up afterwards. Our department has a long tradition of lecture demonstration support for large lecture professors so while this aids in their execution, there is still a time factor in subject matter coverage during the lecture in question. In Virginia Tech's department of chemistry and at all of our benchmark institutions, demonstrations are how a semester in general chemistry gets done. Demonstrations are expected and the students love them. They serve to more clearly

illustrate chemical principles than does lecture alone, wake dozing students, and energize the lecturer. They serve particularly well to entertain. If they also serve as learning aids, that would be the topic of an entirely different dissertation, but even if they do not, they are expected, by students and by the administration supervising such teaching, and act as a most significant manifestation of a systemic social orientation for general chemistry profs.

Patricia is masterful at incorporating demonstrations into her lectures. At one point during this particular lecture I had my camera trained on the projected image of the lecture outline and was listening intently as Patricia went on about the equation $E = q + w$. She described as she wrote out a cryptic version of her words; the total energy of a system is the sum of q , thermal or heat energy and w , work. She moved from this equation to an explanation of pressure volume work at which point I could feel myself just staring at her writing appearing on the wall, zooming in and out with my camera as she spoke, "this is one way a system can do work on surroundings, a net increase in moles of gas is one way to do work (and I realize that by saying it this way she is implying that there are other ways, that they might learn about more ways, or just that she knows there are more ways) but right back to the tablet, work is negative $p \Delta v$, a lengthy stretch during which the issue of sign is discussed and then a few minutes later while my eyes and the video camera are still trained on the projected image description of the equation to be done as an example of increase in net moles of gas, I hear a big bang. Patricia has lifted the shield again to the benchtop, landing it with a thud, though she has given no indication, through her speech pattern, that she is doing this work, I am listening to her speak and watching what she, seconds ago, wrote and not even realizing (since I can't see her, but only the projected class notes through my camera lens) that she has again proceeded to do the physical work of demonstrating, this time

with an Erlenmeyer flask containing hydrochloric acid and an attached balloon containing powdered zinc the result of which is production of hydrogen gas which visibly enlarges the balloon. To accompany the rapidly expanding balloon located behind the shield, Patricia states,

" We just did useless work, we pushed on the room air with a balloon, big deal but when gas expands and pushes on piston, off you go down the road, when steam expands on a turbine, you make electricity for a whole city."

She then lowers the shield, glances at the clock, since she's facing it at this moment, back to the class, utters, "Let's see," as she strides back over to tablet, "whew," and wrinkles her nose, strides back over to the balloon that she's taken off the flask, and lays it on top of bench hood, continues with "but whew! I really don't want to lose my first row," goes back for keys to open the prep room, takes the balloon in (to place it under the hood), comes back out, squints at clock on back wall of lecture hall, and continues speaking with, "The other possibility is that the system contracts, uh but I think rather than try to cram in, we'll start there, we'll talk about work a little bit more, then we're gonna go to heat." Students are packing up, it's really noisy, but "Work on your review assignment in Connect. Have a great weekend and I'll see you on Monday." There follows an eruption of packing up noise, binders snap shut, backpack zippers and the slamming of foldaway desks signal the imminent departure of two hundred young people. The smell from Patricia's final demonstration has caused a delay in covering the topics scheduled for this day, but instead of talking up to the official end of class time, she ends about two minutes early.

Cutting Herself Short

Ending this lecture by cutting herself short, this single teaching act in itself illustrates each of the five orientations to practical knowledge. Patricia understands that the students have places to go, a situational circumstance. Several years ago, Virginia Tech altered its class schedule to accommodate the distance between buildings on campus; students now have fifteen minutes between sequentially scheduled classes instead of ten but there are destinations on campus that require every minute allowed. Patricia respects their need to manage their time and does not allow her subject matter to intrude, evidence of her attention to a personal orientation. Her abrupt ending also signals the experiential, "This lecture is *over*." Much like her comments regarding the end of a semester, she has exerted her body and her mind for the past fifty minutes and it is time to call this a wrap. Back to the situational orientation, there is very little else that is productively accomplished once the students have decided that it is time to leave. Hurriedly talking through an additional topic during the final moments of this lecture, even if the students could hear her over the noise created with their preparations to depart, would encourage behavior Patricia professes to discourage, that of memorizing or cramming information instead of understanding it. Educational theory knows that cramming isn't productive learning; the theoretical infuses this classroom practice though its leader denies calling on this larger body of knowledge in the daily execution of her practice. Though she chooses not to, Patricia's orientation to the social allows her to speak up to and past the official ending time of the lecture; a practice routinely exercised in the lecture halls of any college.

But Patricia's teaching practice is about her students, not about their instructor. Each and every teaching practice, be it a single act, a finely crafted sequence of events, a hastily assembled chemical demonstration, or a disastrously executed lecture, indeed even a

cancelled lecture, is guided by the theory of practical knowledge, acknowledged or not. Classroom and teaching decisions made by different instructors yield a variety of practice styles, differently manifested yet guided nonetheless by the multiple aspects of practical knowledge, creating in their wake further such theoretical iterations.

Chapter Five

Cognitive Style

Patricia wore a frown, as close to a frown as she gets, to begin the lecture that immediately followed spring break 2011. While Monday morning following spring break is no one's favorite lecture, it was a rare period on my recordings when she was, in class and not in the privacy of an interview, visibly irritated, frustrated at her students' overall test performance and she spent quite a bit of time at the beginning of her lecture expressing this disappointment by comparing homework score statistics and test score statistics. I revisited this recording several times and late one night as I viewed the video with the transcript open in front of me I was shocked to discover that I was seeing the scene in a very different way than when I had, several months previously, written the transcript. I added the following paragraph to my transcription of that class.

"Watching the video again from this lecture I am aware that a *lot* has transpired even before my initial first sentence describing the scene. It's even a part of the video that I had filmed and then stopped filming since "nothing yet was going on". But looking at it again, I am struck by how much good stuff happens in Patricia's classroom just "in passing" or "as a matter of course". Again dressed in what I would call Sunday school teacher best (but displaying again a propensity for black) Patricia carefully divides her stack of tests into small stacks and lays them neatly across the front bench, but as she turns the corner of the bench makes friendly eye contact with a female student who, with just a few words, conveys some information that leads Patricia to stride behind the bench amid the swarm of students and retrieve a notebook from one of the many drawers into which fall a myriad of lost and found

items. Oh so brief an exchange, but warm and friendly (Patricia's hand glancingly but firmly placed on the student's hoodie-clad elbow as she scoots around her in this very crowded space to get to the drawer) and efficient, they have obviously already had some exchange about the missing item, likely via email. And Patricia is smiling and noting how frequently items are left unclaimed and how pleased she is to be able to return such an important item to its owner. The student tucks the notebook under her arm and rejoins her classmates in their test paper retrieval...even over the din of student chatter and paper shuffling I can hear Patricia's giggle as she delights in the reunion of student and lost notebook, an 18 second exchange of warmth and success.

It was a mundane moment, as many classroom moments are, not a particularly memorable exchange, perhaps, for the actors. But, armed with a newly acquired understanding of practical knowledge (and aided no doubt by an excess of caffeine and adrenaline in my bloodstream), I saw it as a moment overflowing with meaning. A golden moment that, two semesters removed, neither Patricia nor her student likely remember. Such moments, though, remarkable but unremarked, are the stuff on which practice rests, of which practice is made, with which future practice is created.

If Elbaz posits that the entirety of a teaching practice culminates in the recognition of a cognitive style, what style belongs to Patricia's practice, this collection of golden moments? And what image or images best represent this style, this balance of cognitive and affective? Images inspire but do not require conformity; they take on different senses in different circumstances. In this case, the images originate in Patricia's childhood but are reflected in every aspect of her professional life, in her interactions (however brief or informal) with students, with colleagues, during her lectures, during her office hours and help sessions.

Safety Patrol

The journey to and from elementary school in Bluefield, West Virginia was accomplished on foot. One of Patricia's earliest memories from her school years is the extreme level of tired she felt when it was finally time for her to depart the patrol line for her front door. Though she does not recall the trip to school in the morning, she distinctly remembers lining up behind the 6th grade safety patrol leader at the end of the day and trudging for what seemed like forever on the seemingly endless and endlessly circuitous route through hilly Bluefield neighborhoods before her own home came into view. When she was still in the earliest grades, her family moved into a rented duplex just six houses away and downhill from the school. Patricia could see the school as she and her sister trekked uphill in the mornings and the journey home again in the patrol line was brief. My own journey to and from elementary school was an entirely different, far less orderly affair; swept along in the current of kids overflowing the sidewalks of Baltimore, I was quickly abandoned by the 5th graders my mother had asked to watch out for me.

Patricia donned the safety patrol strap and badge proudly as a 6th grader. Her safety patrol story was one I heard years ago when our own children were in various stages of modern safety patrol participation and we were lamenting the resulting necessary morning drive to school. I had to ask Patricia late in our research conversations to recount her story as one aspect of it leaped out of my subconscious triggered, I am sure, but something she said during an interview, though I cannot now recall what she said that made me remember.

Safety patrol now and safety patrol in Bluefield, WV in 1961: very different enterprises. Patricia's and my own children have struggled with the notion that safety patrol now, in the hallways of elementary schools as the kids make their way along an indoor route to their buses, just isn't that tough a job, or even necessary. Elementary schools located in

sufficiently low-traffic neighborhoods do, in fact, have token safety patrol members staffing the crosswalks, but only with an adult crossing guard actually in the street and officially on duty. In fact, as my children see it, the job is largely an exercise in deciding what to address as a safety issue and what is simply not worth mentioning to the noisy homeward-bound kids in the hallways. You want to do as good a job as the teachers expect, but you don't want to be *that kid*, the one regarded as a jerk for writing someone up who was simply laughing too loudly as they wandered down the hall with classmates in a less than military fashion.

Some safety patrol members turn on the computers and empty the library book return in the morning; some raise the flag. The real purpose of safety patrol these days is as recognition of a job, to date, well done in elementary school. The biggest safety patrol event, then and now, of course is the end of year trip. Patricia visited Washington, D.C.; our kids usually visit an amusement park.

Of course, even when the safety patrol is on duty, accidents can happen. Patricia recalls an incident on her elementary school playground involving the sliding board and a broken arm. Though there was no mention of fault regarding the safety patrol member on duty, the sliding board was subsequently dismantled.

Surely, there was order in Patricia's safety patrol experience, but more importantly, there was purpose to the order. Charged with safely delivering each child, the leader turned for home only after their line was no more. The parallels for Patricia's teaching practice are staggering. Patricia's roll serves for her patrol list, and she is charged by the syllabus she designs with guiding a rather long line of college students from the first day of class to semester's end. She leads them step-by-step through each lecture, through each problem. She takes seriously, their personal, albeit ostensibly intellectual, safety. While each word,

each act, can possibly be a golden moment, so too for acts and words that defeat, discourage, injure. But college students, and even young kids on playgrounds, are independent agents responsible to differing extents for their own success or failure. While most students finish the journey in reasonable shape, sometimes bones get broken, courses of study dismantled and reconfigured, sometimes ended. A myriad of ways exist to learn general chemistry; Patricia's practice shares much with the orderly, step-wise, purposeful exercise of old-school safety patrol and with the balanced required to successfully manage participation in its more modern iteration.

Patricia's practice is so enormously well received by students and colleagues alike (and I have admitted jealousy of same) because she so excellently executes a merger of the personal and social orientations of practical knowledge. Patricia has been for years spectacularly successful in working within and perpetuating this merger of practical knowledge terminology, the culture of the general chemistry professor. Her practice holds aspects as personal as any practice can be yet she can spend time telling chemical and mathematical equations with the best what might be called the droners. I recorded stretches of lecture time up to ten minutes long that involved only the telling of math; to be fair, the telling was accompanied by writing so it probably doesn't qualify as droning. But it isn't so much Patricia's lecture behavior I think, rather her culturally acceptable test averages and accommodating professional manner that have earned her such a highly-regarded reputation as a colleague.

Sugar

"Yeah, for most of elementary I think, I went home for lunch 'cause it was just there at the top of the hill, so most days I went home to lunch, my mom didn't go back to work

until I went to high school, so she always there, had a lunch there, ready, a hot lunch, not just a sandwich. I remember having baked potatoes, or soup, hot soup, hot lunch, not just a sandwich."

"Oh," I replied, "why not just a sandwich?"

"Well," Patricia replies, laughing to indicate, it seemed, the ridiculousness of my suggestion, "If you were going all the way home, you might as well have a real lunch."

"Leftovers?"

"Oh no, she dropped whatever she was doing and made lunch."

"And did you have Coke for lunch?"

"Oh yes, definitely Coke. I had Coke for every meal."

"Even breakfast?" I ask, incredulously, but laughing too since I knew the answer to my question. There was no meal served at the Gordon household that did not include Coca-cola.

Patricia nods, grinning, "Yeah, even breakfast."

I offer that in most households where Coke is drunk for breakfast, and she joins me such that we finish the sentence almost in unison, "Nobody's paying attention!"

"I know!" she gasps, "but no, my mother was *definitely* paying attention but my mother loved sugar, I mean she put sugar on rice; I was much older when I realized most people don't put sugar on rice. Breakfast, before school, well, like frosted flakes, it would have been a sugary cereal. It was sugary cereal and you put sugar on the cereal and for years I thought that you could only eat cereal with sugar. In fact if you had eaten the top layer of sugar, you might have to put more sugar on. Oh, I can *not* believe we did that!" Patricia laughs, gasps in disbelief, "Now I do *not* put sugar on my cereal."

But at a certain point I stopped drinking coke for breakfast because I discovered orange juice but I drank it lunch and dinner and between meals regularly until I had a kidney stone. And it (the cause of the kidney stone) might not have been *just* the coke, but I really drank an excess of coke. I *really* cut back. I've had attacks in the years since but just a few times.

Oh and *bottles*, not cans, yeah, you popped the top and then we had the thing you put on the top to put it back in the refrigerator when you didn't finish it all."

"I mean my mother was a wonderful mother, but as far as food goes, she liked cake, she liked dessert. She'd say to me, you know *some* sugar is good for energy. She was afraid my kids weren't getting enough sugar. (interruption for laughter) I'd say milk has sugar in it mom, sugar you can make energy out of. She was just *really into sugar*."

Patricia follows this statement with an extended session of full belly laughs, the notion requiring more than her usual cascade of giggling, leaning forward in her chair and sighing as she recovers enough to speak. I ask if she thinks her mother was particularly permissive, after all, frosted flakes and Coke for breakfast?

"Oh no, and she was certainly paying attention. She, she was into making us happy. Ralph makes fun, you know so I drove some to high school but then in college of course I commuted to Concord. She'd go start the car in the winter, go out front to clean it off and it'd be warm by the time I got out there. We'd (Carol and I would) drive away, Ralph thinks that's hilarious.

We were pretty self-motivated not like she had to make us do homework, but she was always willing to help, I could certainly hand my mom a list of words and say here mom, ask me these. And she was the type of mother, if you had a piano recital, if you had a science

fair or a gym exhibition, anything; she was there. They were supportive. My dad wasn't paying as much attention. Part of it was that he was gone (spending the workweek on the road in his job as a salesman of mining equipment) and part of it was because he was a man, not quite attuned to everything that was going on."

She loses herself in another brief fit of laughter.

"Oh and we had a candy drawer with candy bars in it. Oh sure, after school, first thing, a candy bar, Hershey's or Almond Joy, the full size ones...and a coke. But we had all that other stuff too, I've always loved broccoli, cauliflower, spinach...Late in my mother's life, we had to feed her, what do you want for lunch mom? I'll have cake; okay, we'll have cake. For lunch, not for dessert after lunch, but for lunch. *Ookay*, we'll have cake for lunch."

This time, Patricia's intonation on the word okay implies a loving but humorous resignation. Her mother's health was failing and it was time to just keep her happy.

"She wasn't real big on us doing chores. We (Patricia, her husband, Ralph, and their three kids) talked about this over break. One of the kids says, 'Well it didn't seem to hurt, you don't sit around now and wait for people to do things for you.' That was nice to hear."

I add, "As I think about it now, it's really sweet; she didn't do these things for you because she didn't think you were capable; why do you think she did these things?"

"I think, starting the car, I think she did it 'cause she wanted to. It was nice and it was helpful, we were getting ready and it was nice! She did things that she thought would make people happy."

"And is making people happy a worthy goal?"

"I think I do that some with my kids, like I don't start their cars, but there are things I do, and Ralph says I'm like my mother. What can you do to make other people's lives easier,

happy, up to a point. It'd make all our kids happy if we gave 'em a new car for Christmas but that's not gonna happen. You don't want to go overboard but if you can make somebody's life easier...my kids didn't do any laundry between Thanksgiving break and New Years. I don't mind doing that, go ahead and bring that home and we'll wash it."

"Is there any relationship between you as a child and you with your children and you as a teacher?"

"Yes, I want to make my students happy up to a point, some things that would make them happy you obviously don't want to do, like give everybody an A, something like that, but I'd like to make it as pleasant a situation as possible within the boundaries of, 'I'm still going to give you a test, and I'm still gonna make it as hard as I think it needs to be.' But I don't know why we can't make it as pleasant as we can otherwise."

Summary

It is with consternation that I added significantly to the length of this document with direct quotes, and it is with a perverse sense of poetic justice that I happened on another kidney stone reference; but as I transcribed the sixteen-minute stretch of sugar related speech during our last interview together, I fully realized that each and every word belonged in this document. Patricia mentioned during our time together that one of her students had long ago written a memorable comment on a blue SPOT form (and she mentioned that in fact she did not know the sex of the writer but had assigned that person as 'she', "funny how you do that, don't you think?" she had remarked at the time) recalled as, "She treats us like her kids." And she was very deliberate in saying that her interpretation was not, "She treats us like kids," rather, "She treats us like we were one of her own kids."

Indeed, and as well she treats them in much the same way that she was treated as a child: lunches at home with Coke and her daughters serving as a series of daily golden moments in Mrs. Gordon's parenting practice. Charged with providing her children the tools they needed to succeed through their days, she took the time she had available to provide freshly prepared food, some vegetables but *lots* of energy. Cleaning off the car and warming it up on winter mornings represents an act laden with love and each and every orientation of practical knowledge as it applied to Mrs. Gordon as she enacted her role as Patricia's mother. Guided unknowingly (on an academic level) by the tenets of practical knowledge and generous, indulgent even, with that which she valued and could provide, she exercised a practical knowledge that then created Patricia's teaching practice as she exercises it each day of her professional life in her classroom.

In the experiential realm, Patricia offers her professional and her personal self to her students at all times: in frequent office hours, during evening help sessions, via email when she is not on campus, and in the classroom thrice weekly. (Her additional professional activities notwithstanding, though those feature her personal self to a greater extent; that would be another dissertation's worth of material.) She's 'home' all the time, just like her mother was. She orients to all situations so as to make them as pleasant as she can otherwise; however, that practical knowledge is at work carries no implication or promise of success. Conditions in Patricia's body are ripe for the formation of kidney stones, despite the fact that she no longer swills Coke. As awarded and rewarded her practice, some students still fail. The theoretical is evidenced in 'up to a point' and in not going overboard'; Coca-cola remains in the bottle to be stoppered and refrigerated. Patricia's personal orientation to teaching style is parental; and she reconciles her desire for professionalism with her colleagues' missteps by

categorizing their behaviors in the realm of what is male; like her father, they mean well but just aren't that attuned to everything that is going on.

Elbaz's research participant, Sarah, professed a belief (Elbaz, 1983, p. 90) that whatever is deliberately taught in class is ultimately less likely to have a lasting impact than is the hidden curriculum. It is Elbaz's subsequently derived theory of practical knowledge that subsumes the hidden curriculum. Patricia's students are not aware, her colleagues will likely never be aware, of the conditions under which she sought to correct their errant test question. And that is as it should be perhaps. Her effort was mundane only in the sense that it was largely hidden and therefore remains un-interpreted, and in no way because it was ordinary or typical; the parents of driver's-license toting teenagers suffer their worry unseen in the wee hours of the weekend. Inherent in the hidden curriculum is the cognitive style of the teacher; Patricia's cognitive style is that of parenting par excellence.

Cosmos

This project was to be both product and praxis. And both goals have been realized, but not in the way I had originally intended. I wrote, at one point in time and then removed from this document, the following:

Portraiture methodology allows subjects of research portraits to report transformations in their self-understandings (Lawrence-Lightfoot & Davis, 1997) and researchers to listen for such transformations. This research project will be both an investigation of Patricia's existing practical knowledge and an inspection of the changes it undergoes, if any, throughout the portrait construction. Reform or no, most teachers' current

perceptions of their professional identities as professionals differs significantly from their perceptions of identity during their period as beginning teachers (Beijaard, Verloop, & Vermunt, 2000). The notion of deliberated teacher reflection as a means of improving professional teaching practice has, in fact, become one of the most pervasive concepts to influence science teacher education during the past decade. Formal articulations of individual personal practice theories have been shown to lend themselves to development as a teacher/researcher. This development is seen as a useful model of science teacher practitioner professionalism (Sweeney et al., 2001).

I began this project with a *huge* chip on my shoulder and I set out to describe the practice of a renowned professor in order to point out its flaws. I wanted to reveal to Patricia, to make her see the large lecture as, a fraudulent activity. I have long adored Patricia and still do; my aims weren't rooted in the personal, rather at the system in which she, and I, work. A bachelors degree and a masters degree in chemistry followed by a Ph.D. in education had led me to a place where I found liberal arts topics and small classes and discussion to be good and productive, in fact, transformational, and science (for as fascinating as I find the subject matter) and large classes (for as much as I LOVE my job teaching them!), the way science is taught, to be bad. My assumption, that a description of Patricia's practice would be a typical case and that the typical case would be found lacking, is undeniably flawed. Interestingly I also now know that my research questions could not address this very issue with which I have long struggled: that being in lectures is boring and not a good way to teach chemistry, or anything else for that matter. I failed to adopt a research strategy that would have proven

this point. That I adopted a methodology, portraiture, that aims to describe and that holds, as its express purpose, a focus on goodness is the reason I have *fully* realized the weaknesses in my original, hidden, hypothesis. And therein lies the praxis. It wasn't until I had done it, this research project, that is, that I realized what I'd actually done, the full extent of what I'd actually learned. That this intensely scientific investigation of Patricia's teaching practice yielded a completely different result than intended by this investigator is evidence that this product represents a truly authentic piece of research. The joke's on me.

As to what to do with this piece of research, at this moment I am overwhelmed and paralyzed like the proverbial centipede (though surely there is a body of work lying in wait, other practices to portray). To the extent that this exercise in portraiture is also sentimental display, I am unsure even whether I aspire to transform consciousness or to raise awareness, those being, I believe, worthy goals of sentimental display that is also intentional academic work.

As a college chemistry teacher I want most of all for each and every one of my own students to appreciate the majesty, the beauty, complication, elegance, order, and ambiguity that simultaneously comprise chemistry; I want them to see this discipline like I do! But to succeed for each student, I need to create the perfect classroom for each and every one of them, which is, of course, impossible. There are simply too many differently-abled students in one room for this approach to succeed. And while there exists no perfect classroom, no perfect practice, there do exist many classrooms, many teaching practices, which foster success for many different students.

And so, to approach research in teaching and learning as operations research is "wrongheaded." (Greene, 2012) I had ulterior motives, yes; but went about addressing them

in a "righthanded" way. So much time has passed since the inception of this research idea (Eddleton, 2005b) that I very nearly can't believe that I asked, in fact, legitimately answerable research questions about a tremendously complicated theory, practical knowledge, and succeeded in answering them with an appropriately complicated methodology, portraiture. Complicated situations deserve intense scrutiny and frequently merit complicated solutions. Bohr succeeded most spectacularly in proving the abject failure of Newtonian physics to offer solutions to any atom save hydrogen. Solutions to every other atom on the periodic table hinged on the development of quantum mechanical theory, which prides (and protects) itself by offering explanation couched in terms of probability, uncertainty, and seems destined for failure itself when applied to the Big Bang. Continued progress in explaining the world, as we know it, awaits further development of string theory, which might unite the macroscopic world as described by Einstein's theory of relativity with the quantum mechanical descriptions of our subatomic world; but string theory thus far has succeeded only in indicating an enormous diversity of possible universes. I find it fascinating that the theory regarded as possibly unifying everything we know about the entirety of the conditions in which we live has thus far only given us the answer that, well, *it's complicated*. In searching for the uni-versal we've succeeded only in revealing the quite possibly multi-versal.

I have concluded that there is only immersing oneself in what is there to describe and doing so in detail; the truly productive endeavor is the storying of the situation or situations that appear in some context laudable. There is no best of all possible worlds (or classrooms) but there are many possible worlds to describe and many possible ways to describe them. Portraiture could easily result in a product of a different sort than the one I have written here;

I could easily have written a different product by incorporating different examples from the research conversations, telling different stories than the ones I have chosen to include. There are a myriad of other stories in my data that would support the conclusion at which I have arrived. There are also, possibly, other conclusions to be made that largely support the cognitive style argument I present. Put simply, there exists only the describing of the conditions that successfully created their observer.

I would, to be sure, have written a different story if, as the office banter goes, instead of having babies I had gone ahead and finished up this graduate school journey. In the years before I was a parent myself, however, I would have been incapable of producing *this* story. And, frankly, I *love* this story.

Epilogue

Dear Reader,

You made it! Hopefully you were able to read this entire document and emerge from that activity unscathed. I had an ulterior motive (one I failed to realize) when I undertook this project but I also had an ulterior motive in its writing: the creation of academic work that is an enjoyable read. I can say with certainty that I have enjoyed writing it.

Schrödinger's desire with respect to quantum mechanics was to produce no blurry photograph, rather a crystal clear picture of a fog bank or cloud, the physical manifestation of the confluence of pressure, temperature, water, and gaseous impurities that hover over the surface of humanity. What I hope to have captured here is a similarly specific image of an infinitely complex situation. There can be no controlling of variables in a classroom populated by a teacher and students, there can be only the attempt to describe it and to represent that description in such a way as to affect and thereby effect classroom practice.

I will have considered this endeavor to be time well-spent if I have caused you to reflect on your own professional, perhaps teaching, practice, your own life experiences, the intersections of circumstance that enter your practice with you, bidden or not. I truly believe that such reflection is merited and of primary importance in the well-being of our students.

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APPENDICES

Appendix A: Interview Protocol

Elbaz treated her initial interview as a pilot and explained her research intentions to Sarah only after several months had passed and she had formulated her research plan of study. I plan to open the project by asking Patricia what she thinks my research intentions are and what she expects to happen as a result of the research project.

Elbaz began her interviews with two very broad questions of Sarah. I have personalized those very questions to Patricia's professional situation:

What purposes and needs motivate your involvement in General Chemistry and how are these purposes met by your ongoing work?

What knowledge are you drawing on in this work?

And added:

What would you like to tell me about your teaching practice?

I will attempt to direct our conversations to schooling stories. Though no script will be used in particular interviews, I will share this protocol with Patricia prior to our first scheduled interview.

- Describe your early schooling. Are there particular memories you have of your K-12 education? Are there favorite or least favorite teachers? Favorite or least favorite classes or activities? Do you remember particular successes...or failures? Are there particulars that you feel impact your teaching practice now?
- Describe your home life prior to high school graduation. What type of relationship existed between your home life and school?
- Describe your schooling path after high school. Can you recall any set-backs or successes? Are there particular memories that stand out?
- What type of relationship existed between your home life and school after you left high school?
- Do you like your job? What are some of your favorite and least favorite aspects of your job?
- How would you describe yourself as a teacher?
- When and how did you decide to become a teacher? What training prepared you for your role in your general chemistry classrooms?
- Describe your path through the past thirty years in the Virginia Tech Chemistry Department. How did it begin? Can you recall set-backs or successes? Are things around here better or worse than they used to be?

- What is your function in the department of chemistry?
- How do you organize your class?
- How does your class fit into the department of chemistry?
- What do your students need from you?
- Do you think you are (were, are going to be) a good teacher?
- Describe your classroom and describe a typical class meeting.
- Describe a typical workday that includes teaching. Describe a typical workday in which you do not teach.
- Describe your interactions with your colleagues in your role as director of general chemistry.
- Are there memories that stand out as particularly good or bad over the course of your years teaching chemistry at Virginia Tech? Do you recall favorite students?
- What strengths and weaknesses do you think you bring to the classroom? How do you feel about the large lecture classroom? Have you taught in smaller classrooms? If so, how do you think this changed the way you taught?
- What are some goals you have for the students in your classes?
- Have you changed as a teacher over the past thirty years? How?
- What are your professional goals?
- How do you feel about, "Well, I'm no Patricia, but..."

Mostly, we just talked.

Appendix B: SPOT

DO NOT WRITE ON BACK OF SHEET

VIRGINIA TECH
Student Perceptions
of Instruction

USE NO. 2 PENCIL ONLY

dept. _____ course no. _____ index no. _____ date _____

name of instructor _____

WRONG ① ② ③ ④ ⑤

WRONG ① ② ③ ④ ⑤

WRONG ① ② ③ ④ ⑤

WRONG (too light) ① ② ③ ④ ⑤

RIGHT ① ② ③ ④ ⑤

Mark the column labeled NA when a question is not applicable or inappropriate.
P = POOR, F = FAIR, G = GOOD, E = EXCELLENT

HOW I RATE THE INSTRUCTOR COMPARED WITH OTHERS I HAVE HAD AT VIRGINIA TECH:

1. Apparent knowledge of subject matter. P F G E NA

2. Success in communicating or explaining subject matter. P F G E NA

3. Degree to which subject matter was made stimulating or relevant. P F G E NA

4. Concern and respect for students as individuals. P F G E NA

5. Fairness in assigning grades. P F G E NA

6. Administration of the class and organization of materials. P F G E NA

7. Overall rating of this instructor. P F G E NA

HOW I RATE OR DESCRIBE THIS COURSE COMPARED WITH OTHERS I HAVE TAKEN AT VIRGINIA TECH:

8. Adequacy of textbook and other study materials. P F G E NA

9. Educational value of out-of-class assignments. P F G E NA

10. Time and effort required. LESS THAN AVERAGE AVERAGE MORE THAN AVERAGE

HOW I RATE OR DESCRIBE MY OWN SITUATION AND OUTCOME FOR THIS COURSE:

11. For me this course was:

a. A required course in my major field.

b. A required course outside my major field.

c. An elective to fulfill a requirement. NA

d. A free elective in my major field.

e. A free elective outside my major field.

12. My academic level is:

a. Freshman d. Senior

b. Sophomore e. Masters NA

c. Junior f. Doctoral

13. The grade I expect in this course is: F D C B A P NA

14. I would rate my gains in this course compared with similar courses as follows:

a. Knowledge of principles, theories, techniques, etc. LESS THAN AVERAGE AVERAGE MORE THAN AVERAGE

b. Logical thinking and problem solving ability. LESS THAN AVERAGE AVERAGE MORE THAN AVERAGE

c. Appreciation of the subject matter and discipline field. LESS THAN AVERAGE AVERAGE MORE THAN AVERAGE

15. I am: FEMALE MALE

SUPPLEMENTARY QUESTIONS

LIST 1

1 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩

2 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩

3 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩

4 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩

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LIST 2

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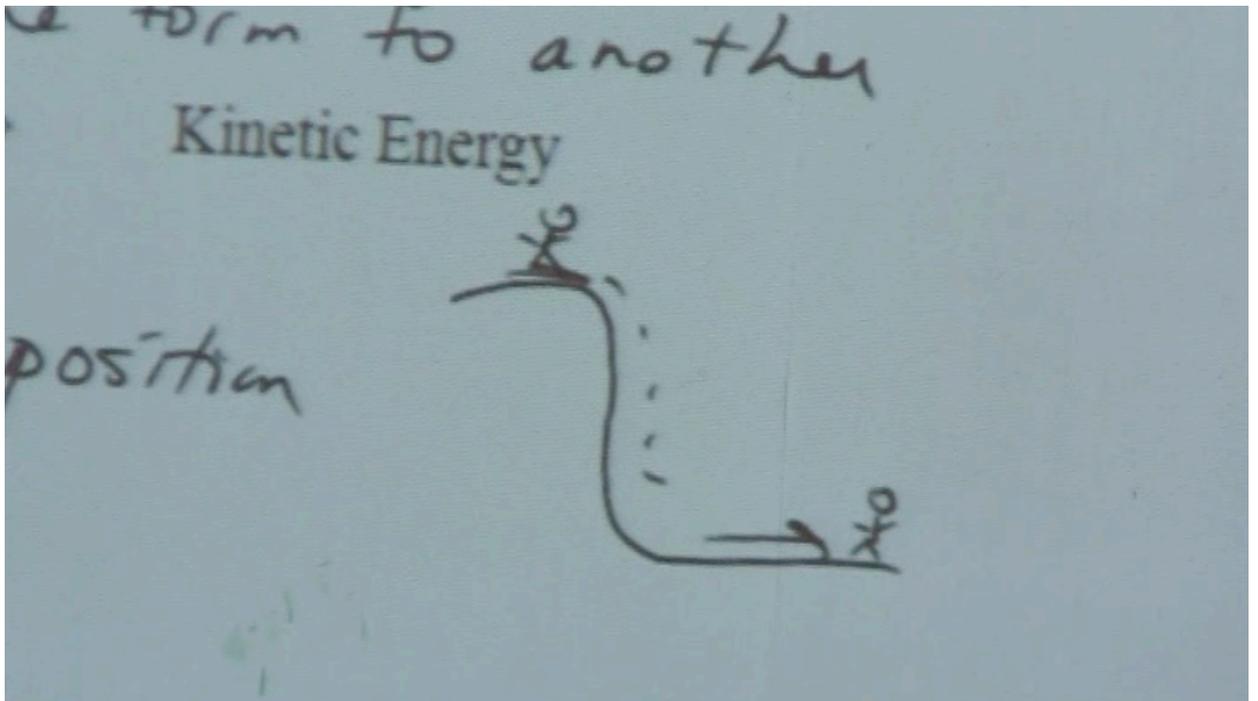
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MAKE WRITTEN COMMENTS HERE.

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Appendix C: Photos



A Sledding Story
January 21, 2011
Copyright: Jeannine E. Eddleton



Tethered to the Tablet!
January 21, 2011
Copyright: Jeannine E. Eddleton



Burning crackers: Calories!
January 21, 2011
Copyright: Jeannine E. Eddleton

Appendix D: Transcript

Interview 1

January 10, 2011

Tricia's office

white tank/brown cardigan

WOW, so this is going to be a unique semester. Should we shut the door, I say oh sure it's up to you and she says, well I was thinking about interruptions...ALREADY she's thinking about me (my first thought oh maybe she doesn't want to be heard...but no, she doesn't want me to be interrupted)

...and I'm going on about how I am the research instrument and not a survey and I know her and she knows me and we both do the same type of work, teaching in the large lecture, and...her eyes dart to my computer screen because it has just gone dark and she wants to make sure this is working well for us, that we are still recording...

I hate listening to myself talk.

awards/rewards - rolls eyes, grins, giggles, YOU are the many times awarded, rewarded, rolls eyes, but nods, shifts in chair, wouldn't you be a good person to talk to and wouldn't I be a really good person to ask the questions since I also have some insight, isn't this a really uique opportunity to try to, I don't know, NAIL down some things that you might do?...things that haven't been investigated and maybe, maybe they can teach us something about how to teach a large lecture well?...nods, well, I add, and it's generally recognized on campus that you're among, you're the very best, still nodding but shifts draws in deep breath nearly imperceptible kind of grin

and this is to be open-ended, I don't have a preset list of questions, since this is the week before classes begin, maybe it's a good time to ask, how did last semester go? where do you find yourself, how do you prepare? nodding I have a hard time thinking of this having a real end, that we've learned everything there is to learn or that we're out of questions, we'll just at a certain point stop taking data and write it up
you will learn...oh undoubtedly! giggles

you're the best...well, I try.

You are about to begin another semester. As you look ahead, can you tell me how did last fall go?

It went well. I think it went well. I had two classes with recitations, I thought on the whole it went well. Recitation instructors did well. Students seem to think it went well. I did my typical SPOT form, students seem to think things went well overall. Aris online homework went well. I think better than last spring a bit better than last spring I think last spring I gave them too much homework. Students seemed to think I gave too much homework so I backed

off a bit between our written homework and our online homework. Although we still had one written and one online homework assignment as week. But I think that went better. I say IT WENT WELL and how did you know you went overboard last spring how do you mean that

Well, part of my definition is

...****We made it to the end and there were no catastrophes.**** That's part of my definition of it went well. Laughs, gestures with hands. Especially when you have 6 different undergraduate recitation instructors, they did what they were supposed to , didn't have any big complaints from students about anything they did, my definition of what went well for online homework was the system didn't crash and we were able to do all our online assignments. Uh, grades were about the same as usual. Uh how I knew I went overboard last semester was, uh, comments on evaluations, really a lot of comments about homework, too much homework, too little time between talking about a topic and homework due...I did night tests last spring and some people really like that and some do not just reading comments mostly is how I felt like maybe I had given too much homework. Oh and students, I mean students complain about homework all the time, I mean I'm not going to say, "poor thing" I'm not going to give you homework anymore, just seemed like from comments like I'd gone a bit too far. And while some people complain all the time, I just didn't get comments like that this fall.

How do you feel at the end of a semester?

Big laugh

relieved that it's over

nice to have an end, wrap up, file it away.

It's nice to have an end to something. That's just nice, Relieved. But also, what went well, what didn't go well. What can I try for next time?

So you're already looking forward. Yeah, I mean You're almost always looking to do something different.

do I feel like it went well

Do I feel like students were with me when we're engaged? Or do I feel like they weren't.

You can kind of sense some of that.

How do you sense that?

For example, end of a lecture, did I feel like it was high energy, did I feel like it flowed? I definitely have a sense of that. There are SOME DAYS when I just feel like we're just plodding along, shakes head.

if it's high energy, flowed, don't know if students feel it like that. Sometimes things just fit well together (laces fingers for effect) and sometimes I feel like I'm just talking AT them as opposed to their really being engaged...*how I feel* is not necessarily the way they feel, what they say, when it's not, they usually don't say THAT, but some days I can tell

So now you're about to start all over again. How do you feel like, when it's almost time to get going again

clean slate, I'll have some of the same students, of course, starting from scratch... what do you mean "starting from scratch?" well... we have no grades, spreads arms wide, we, it's a new class, at least some new students, like "I could change (a policy maybe) if I wanted to!" "Once you are in, you can't change."

Do you change a lot?

Well, for the past , this will be the first time in what 15 years maybe that I'll have to sit down, I won't have recitations. I'll have no recitation, three classes a week instead of 2. So the possibility for changing things is greater than, because I've always felt, like I don't want to just lecture for that third time each week. I've always felt (chops hand with other hand) like I had to get in there, cover stuff, move on, now we could take almost a whole lecture and I really could have students come to the board. I really could say, now we're going to work on this problem for five minutes. and then somebody will tell me what to do... I want to do much more of that, this really could be different

, had not thought of that. You taught for a long time without recitation, now you've taught for a really long time with recitation... now you find yourself having to revert back

Now, here's thing thing, when I didn't have recitation, before, when I had three lectures a week, chops table multiple times, three times a week... I learned how to do that in TWO (wide hands palms facing as if to segment or squish) lectures per week so now I feel like because I CAN do that in two lectures a week to what I want to cover so I almost a whole third lecture have time to expand on those, I don't want what used to take me two lectures a week to just fill up three now. I want to be much as I can more active than what we typically do in our large lectures. Cause I can do what I need to do in two lectures, now I have that third to play around with, that's what I hoping to do. I used to feel pushed for time when I had three lectures...

Sounds to me like your excited, YES, at the prospect that your class time might change... at the same time: The students are not going to have recitation! YES, emphatic YES.

Yeah, it's kind of mixed.

In some ways I'm bummed because they won't have recitations and I think that was helpful. But while I'm regretting that, at the same time, what can I do to make up for that? And it was interesting at the end of the semester I can see... at the end of the semester I did an informal poll, told my class, the chemistry department is thinking about now having reciations, I gave them an opportunity an opscan, a quick and dirty circle number one if you would be disappointed that there were no recitation because I liked that and circle number 2 if you didn't like it or if you really don't care. Well, overwhelming, like three, four, three to one wanted to keep recitation So it would be interesting at the end to ask some of those same students because I'll have a lot of those same, ok now that we've done it this way, do they really miss recitation as much as they thought they would? Would they have rather had

recitation? That'll be interesting because what I'm hoping is to make the best of the situation...so we'll see, but then there's things like, I won't have written homework. I'll just have my online homework and they take their written homework much more seriously...so we'll see what the online homework will do for them.

So they submitted their written homework in recitation but other than that what structure was recitation?

Well I had a lecture on Monday and Wednesday and we would go over some topic and they had homework on that topic due on Thursday at recitation. When was that assigned??

When was that assigned?

That week, that's quick, I know, it was, but the whole semester, they know, the whole semester is laid out (makes hands like sheet of paper, like a Christmas list) for them, they know. Actually this fall, I tried a Wednesday/Monday and then homework was due on Thursday but I couldn't make that flow as well. So I went back...and that was a complaint, a legitimate one, that they had a topic Wednesday and then homework due by late Thursday afternoon, BUT I've had a help session, when? Wednesday night...and I would have had office hours and recitation instructor had office hours before recitation, then they could hold onto it for this time but the idea is that they would go in (to recitation) with it done but they could ask questions about it, they could hold onto it during that time, you could say, hey I just don't understand how to do this, and ask questions and I was told that you should walk out of recitation thinking ok I have a pretty good handle on what we did this week. Soooo, sometimes, I would always do an example problem in class but I knew I was sending them to recitation where they could really flesh that out...now I'll have to do all that fleshing out in lecture. AND, it was a small group about 32 students and I told them they should feel free (wide arms) to say, "WHAT was she talking about!!?" throws up hands, when she did this in class...and I told recitation instructors not to just solve the problem but talk through it, take the time to break the stuff down. NOW, some students went in with a blank sheet of paper, you know, wanted to just write everything down, nodding, and nods, and well, that was just well kind of one of the consequences of that

I say, you wanted to be fairly flexible, yeah, nods, BUT they did seem to like the small group atmosphere, they would form study groups, within the recitation, they got to know each other, they really liked, have got lots of comments, they REALLY liked having the undergraduate instructors, somebody they could say, hey, who'd you take for organic? My recitation instructors have been the wide majority have been quite more than adequate, good jobs, so now they won't have the written homework. SO what I had with recitation is, this is my thought process anyway, don't know if students always appreciate this part, but ok, you've been to recitation, and you've turned that in, so that night an online assignment came live and it was due Monday night at 11 and it was based on the recitation, the idea being, ok so you've had your questions answered, now go do this online assignment which, of course, wasn't proctored, but still they weren't in a recitation where they could ask questions, so that's the way I ran the written homework and the online, so now it'll just be the online homework. which, I'm gonna have two a week, or at least two a week, several smaller ones, and I say, so these pop up, they aren't just open, no I'm working on them, oh I say so you don't structure

them until your'e closer to, well the written ones, I made ahead of time and I was able to give them a printed and they had a whole semester's worth...the online I haven't tried to do that, now I have from last spring a whole bunch of online assignments that I'll modify for content and also because our timeline'll be different but I don't try to I'll give them maybe two or three days to do it...whether I decide to do several short ones or 10 questions for an assignment.

I interject that my biggest complaint was the lack of due dates for my online homework. Didn't do us any favors at all. They hated it.

Interesting comment. It's funny, an onlone homework assignment, they have plenty of time to do it, and I'm going to graph, I haven't taken time to do this yet but I'm going to graph how many people have done it in each 12 hours, because it's going to be like this, flat line, and then its going to last 12 hours, last THREE hours, shoot up. But they do have a definite due date, it just cuts them off. And even though I say this, when it's the computer, there is much fewer...can I turn this in late?...I think they really think, well that's it, whereas the written homework they try harder to turn in late, so with the computer, they take that part much more seriously. But when they come to see me, when they come for help, or for help session, they ask questions about the written homework they ask hardly any questions about the online homework. The online homework, you eventually just put in an answer, the written homework, waves hands as if to express a mess on paper. So, I'm going to miss, I think THEY're going to miss, the written homework. They might not realize they're missing it but I think they are. So I'll see what I can make up with the online homework.

So this will be a very interesting semester to look at.

I was kinda disappointed but then I thought although...well lets see what I can do without it.

How many years did you do three lectures a week before recitations even existed.

Let's see

MWF, sequencing of lectures
lack of written homework

began in 85, recitation began in 93.

Almost a decade, and then 15 with recitation. That's a rich body of experience.

When I first started teaching I felt so rushed, I hardly did any demos. And then I thought, ok these are important, I made the time but then people started doing iclickers, and I thought well I don't have TIME>

I don't have time for that (iclickers, demos) now I feel like I have time because I'm used to getting all this done in a shorter amount of lecture time. I mean, 14 weeks? I'll have 14 more lectures...that's really a lot. And I want to make good use of that time, I don't want to just students like, they like to work more problems in class. But I also want them to try to work

them more. even if it's just you know how maybe I'll do iclickers if we continue to not have recitation, but you know how you have them working a problem and then they're clicking in their answer, I want to do that but they just won't click in their answer. I can always get somebody to come to the board.

What did you do to "fit it into two lectures". How did you do that.

Well when I went to the lecture outline notes that I have, I don't have to write as much. They are mine, no one else wrote them. I used to write everything on the board or overhead (wide sweep with arm) and so my problem is there, written down, I don't have to write that down. A table we're going to fill out is there. The figures are embedded. In a ppt? No, yeah, but I'm doing mine on my tablet pc so it's not in ppt but it's actually just a word document but it's like a ppt. So you've got things prepared that you used to sketch out while you were in class. Yeah, now it's not a ppt where everything's there, I don't like that. But it's, here's a problem and I've left a space for that. Did you used to have that in your notes and you'd have to take time to write it on the board for display?

Right, Or draw a graph or use an overhead, I think you can still ask for a set of overheads but now you get a cd of all the figures. I probably DO work fewer problems than I used to but knowing that I was sending them onto recitation...rolls arm...to do more. AND I felt more rushed (with two lectures a week) because I knew they had homework, had to get to a certain place because they had homework.

Would you take the time to sketch it all out on the board? yes

Work fewer problems but I was sending them on to recitation.
Pressure to fit it all in, yes, well that probably still won't go away but I want them to do more problems...

Do you have notes that are exactly where you want to start and end, do you still prepare that way? Yes, or at least where I'm supposed to end.

And how do you think about that? How do you decide how to pace. Do you have documentation of this. I have lectures, for example, where I know where I want to begin and I know where I want to end but I don't have a couple of pieces of paper (eyes averted from me, mouth set in if not a frown then certainly a grim line) that document this, but nodding and I say I guess you get to a point where you can fly by the seat of your pants, certainly more so than for a new teacher, nods and says yeah, but still grim and eyes averted. Do you have notes and you know exactly where you're starting and exactly where you're ending, YES. For each lecture, YES.

How do you decide how to pace?

In the beginning, 4 tests. Chapters you were supposed to cover.
Recitation gave me less latitude to not get there...

I guess, when I first started teaching, there was no homework. It didn't really matter, the only stopping point was we were having a test. there was only the test. So up to that point, you stop. The only stopping point was the test. But in the beginning, laughs, IN THE BEGINNING, with large classes, you don't assign homework when you don't have anyone to grade them so we had four tests. There was just however many chapters you were supposed to cover. AND that you're your stopping point. THEN, I started recitation, then I wrote down how far I got each time and so based on that I plotted out the semester for the problems we'd do Thursday and everyyyonce in a while I'd have to move a problem to the next week. I would miss getting there. But then you can pretty much get to where you need to be, even if you have to leave something out. Pretty much you just get to wherever you got but recitation gave me less latitude there, if I was going to assign these problems, then I was going to have to get there, that does not set well with them, and I can understand why, if we haven't done that material and we're going to have to do homework on it.
Notes that are written exactly where I want them to begin and end.

It seems to me that recitation enforced structure on your pacing...how did it change the way you taught when you began to have recitation?

final endpoint = end of the semester.

4 tests - scheduled them, gave me four different stopping points...wow, it's been so many years don't know how I did it the first time, probably looked at someone else's notes/syllabus. But the once you do it, you know. And I do make notes, this took me too long, and I write this down and I keep it on a calendar. And I look back at that to see if I should move things around. Can't remember when I started doing that, or I come back looking at my lecture notes thinking ok this was an awkward way of doing that, this to WAY Too long, sometimes not too long, just really awkward. Sometimes, just got to be a better way to do this and still accomplish what I want to accomplish.

I don't KNOW.

I make notes on my notes.

Students like it when you are organized. And they know what the assignments are and they know what to do. They really do value that and I like organization, it makes me feel better to think I know where I'm going and I know where I need to get. That's different I think from some other classes maybe like English or like psych, like maybe go in with a loose plan I'm imagining, kind of

wherever the discussion takes them...I think it's very different from the way some people teach and I think some of that is discipline. we have topics to COVER. For English, throws arms wide, you can just discuss THE BOOK...guided, the discussion and wherever student take it is where it goes...

I then describe practical knowledge, expertise, that even for simple tasks, there is a level of expertise that may not even be visible to folks outside the discipline. Did you know that there are teacher specific things in this theory?

No, I don't think so.

Well, when people retire, for example, they take with them an untold wealth of knowledge, Jim Hall, for example...oh nods, yes, yes, an almost unquantifiable...so Tricia then says, so you can't possibly tell someone all the things they need to do the job.

Teachers KNOW, there is a tape playing in their head, doing this and planning this and dealing with ramifications of what gets done in the class room, office hour traffic for example is a result...

kind of annoys me really, they (GTAs) don't want to have to write this down they just want it done for them.

*Sense of practical knowledge: "Hello, I really do have reasons for all this." There are reasons why I am doing certain things with GTAs and the Gen Chem labs.

They think about the job a whole lot differently than you are, she says YES, YES they are! Your goal, YOU have the students at it's forefront, their (GTA's goal) is minimal investment (She says, yes, that's what I'm thinking!!) Maybe we can try some of these things (powerpoints for lab briefings) in 1046 and then ask students who had 1045 and then a different 1046 experience what they thought. And then we could see...but...I really did have a reason here...

you know when the whole powerpoint show's up there...People don't hear what you say when they are furiously writing or when everything is there without writing anything. I have something there, there is a structure. Just not everything.

In addition to teaching, you have ushered your own kids through high school and college.

Even just having them go through high school helped you know where they are coming from. I was supposed to write out my philosophy of advising, I didn't really have one. but I wrote I want to

Having kids go through HS - I want to advise my students the way I want my own kids advised. If my kids are trying to schedule a meeting with their advisor, I want them to HAVE ONE. I want the advisor to explain CORRECTLY what they need to do. I want to approach advising the way I want someone advising my kids.

A few years ago when I did a small research project with different people in the department, you were NOT one of the people I talked to but you were the person everybody SAID I SHOULD talk to.

In our department? Yes, Larry Taylor, Brian Hanson, Gary Long, Paul Deck, JP Wightman, etc.

Gary, Larry, and Brian all commented that as their kids went through high school, their whole attitude, everything they were doing in the classroom changed.

Tricia says, yeah, you know now I know that high school doesn't prepare you. Had a guy, financial aid wanted me to tell them when he stopped coming to class. He didn't pass

anything. Been doing a bunch of emailing over this break for several of our chem majors who made Ds in everything. And these are kids coming in with GREAT SAT scores. Are they young, first year students, several, we have half a dozen who are all changing their major, laughs, on academic probation, I mean Ds in EVERYTHING, or Fs, I mean BIG TIME bombing, I mean some of it maybe they didn't go to class. Some of it, I mean they are not necessarily prepared from high school, I mean what you can get by with in high school and get an A.

And I add, you know it was cool I was encouraged over the break to talk to the kids, you Andy (having just finished his first semester at VMI) has this enforced structure, and he does not understand how you can fail a class. She says, so he did well? Oh yeah, says the only excuse he can think of is, you didn't DO anything, Tricia nods, you didn't go, you know Lindsey has this roommate, transferred in from a small school, probably, I don't know Lindsey doesn't know either, on academic probation, but she doesn't do anything and she comes in and says, oh she had a paper due and she I didn't do it, I went to the professor, I cried, he gave me an extension, Let's watch a MOVIE! Lindsey's like, you don't have a paper to write? She never passed a chemistry test, Lindsey's in there studying and studying, the girls' not doing anything, Lindsey is flabbergasted, just watching tv? yeah, she's in the band and that's a good thing it's a big part of her life, but just NOT doing what you're supposed to be doing...so NO WONDER. Some kids, I'm convinced though, don't know how to study. I'm convinced now, I used to get really upset, this didn't happen so much in high school but my goodness in middle school, the "moon project" is due today, be sure to bring your moon project and then there'd be an email, well, so many kids didn't bring in the moon project, the deadline's been extended tomorrow, and I'm thinking, NOOO, slashes hands horizontally across space, NOOO, you just atught them that your deadline meant nothing. And they can get it in whenever they wanted to. Shakes head, laughs in frustration, used to drive me CRAZY.

I say, you know that is why I'm a fan of online homework.

Yeah, Tricia says, sometimes I'll get an email but usually it's just, how can you argue with a computer, it just shut you off. It was due. I don't think most of them realize I have any control over that. That I set the deadline but once I do there's nothing I can do...

ANdy said his exam week was the most pleasureable week of his entire semester because they let them just study.

If you go through each day doing something...Tricia says, it's not that bad.

All my kids have said, Samantha and Eric have both said, college really wasn't that hard. I mean, they weren't in engineering, they are biology and health sciences, but you just do your work, it's not that hard. Now, you do do your work, but to get a D in every class. I mean you go to three labs, you get an F. You went to three labs and you didn't take my last two tests...but some people you know they take every test and they can't get above a 40...you know, what's going on there? Sometimes they just don't know how to study.

Oh to be a fly on the wall.