

Learning from Text:
Examining Teacher Thinking and Practice in AP Environmental Science

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Abstract

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The ability to read and make sense of sophisticated subject-matter texts is an essential educational standard for navigating the twenty-first century. Although new standards emphasize critical reading and interpretation skills (CCSS, 2010; NGSS, 2013), students are rarely supported to learn from text in secondary classrooms (Greenleaf & Valencia, in press; Moje, Stockdill, Kim, & Kim, 2011). In science education, an emphasis on inquiry- and project-based learning tends to focus on building content knowledge with little attention to texts (Osborne, 2002). Research suggests teachers have little experience supporting text-based learning

(Greenleaf et al., 2011).

The purpose of this qualitative, comparative case study was to understand how teachers worked with texts in an AP Environmental Science course that had been redesigned to support text-based learning. This study was situated in a project-based learning approach developed to support students in under-resourced urban schools (Parker et al., 2011); previous findings indicated teachers in the course had previously worked around text with lectures and labs. In response, the course was redesigned with educative curriculum and aligned professional development.

Guided by a conceptual framework based on the Interconnected Model of Professional Growth (Clarke & Hollingsworth, 2002), this study focused on four AP Environmental Science teachers during the first half of the 2014-2015 school year. Two teachers had previous experience with the project-based curriculum; two did not. Data sources included three interviews per teacher, classroom observations, and formal and informal professional development.

Findings from this study show that when teachers were grounded in the interactive nature of support for text-based learning *and* in the curricular approach of the APES course, they not only encouraged content learning from text in their classrooms, but also provided adaptive and responsive support for students. As teachers changed their practice to incorporate learning from text, subsequent shifts in their beliefs and goals were evident. Teachers drew on professional development and the educative curriculum for support; however, more support was needed to encourage professional reflection on practice, including how teachers facilitate student thinking in discussions about content and texts.

TABLE OF CONTENTS

List of Figures	ix
List of Tables	x
Chapter 1. Introduction & Framing Literature.....	1
1.1 Purpose of the Study	2
1.2 Learning from Text.....	7
1.3 Teacher Learning	12
Chapter 2. Conceptual Framework	17
2.1 The Interconnected Model of Professional Growth.....	21
2.2 A Teacher’s World: Four Change Domains	21
2.3 Enaction	26
2.4 Reflection.....	28
2.5 Identifying Teacher Learning with the Interconnected Model	30
Chapter 3. Methods & Analysis.....	33
3.1 Research Methods.....	33
3.2 Participants.....	35
3.3 Participant Profiles.....	38
3.4 Data Sources and Coding.....	44
3.4.1 Professional Development Opportunities	45
3.4.2 Class Observations.....	49
3.4.3 Selection of focal lessons.....	52

3.4.4	Teacher Interviews.....	54
3.4.5	The PBL-APES Curriculum	56
3.1	Analytic Methods.....	64
3.2	Situating this Study in the KIA Research	68
Chapter 4. Findings: Durable Teacher Beliefs & Practices		71
4.1	Orienting Students to Learning from Text.....	73
4.1.1	Making sense of “go slow to go fast”	74
4.1.2	Absence of an Orientation to Text-based Learning	86
4.2	Reading Purposes Mattered: Differences Between Experienced and New Teachers.....	99
4.2.1	Beliefs and curricular knowledge support purposes	100
4.2.2	Unclear Purposes Lead to Confusion.....	103
Chapter 5. Findings: Shifting Beliefs & Practices		110
5.1	The Variability of Adaptations for Accountability.....	110
5.1.1	More in-class learning- from-text opportunities	112
5.1.2	Application opportunities held students more accountable for learning.....	115
5.1.3	Recall tasks limit mediated learning from text	117
5.2	Metacognitive Annotation Strategies: Fading, Fading, Gone?	120
5.2.1	Where did the annotation strategies go?	123
5.2.2	Did anything take the place of annotation strategies?.....	127
5.2.3	What, if anything, did teachers learn about strategic reading?	130
Chapter 6. Findings: Influences from The External Domain.....		133
6.1	Curricular influences on teacher learning.....	133

6.1.1	Experienced teachers view supports as educative.....	134
6.1.2	New teachers focus on procedural supports.....	139
6.1.3	Insufficient curricular support for facilitating discussion.....	143
6.1.4	Preparing to teach with texts: Teachers get ready.....	158
6.2	The role of professional learning opportunities.....	163
6.2.1	Professional Development: The Summer Institute.....	164
6.2.2	Collaborative team meetings.....	168
6.2.3	Support for text-based learning.....	171
6.2.4	Sharing resources.....	173
Chapter 7	Discussion.....	176
7.1	What Can We Learn From Teachers' Experiences with Learning from Text?.....	176
7.2	An Analytical Focus on Enaction & Reflection.....	178
7.3	Key Influencing Factors.....	185
7.4	Two Problems of Enactment.....	190
7.5	Rethinking the Interconnected Model of Professional Growth.....	194
7.6	Limitations & Considerations.....	195
7.7	Suggestions for Future Research.....	198
	Bibliography.....	201
	Appendix A: Beginning of year teacher interview protocol for returning teachers.....	209
	Appendix B: Beginning of year teacher interview protocol for new teachers.....	211
	Appendix C: Post-EcoFootprint teacher interview protocol.....	213

Appendix D: Post-My Community Ecology teacher interview protocol.....	215
Appendix E: Data Analysis Codes.....	218
Appendix F: Teacher Pseudonyms	220

LIST OF FIGURES

Figure 2.1. The Interconnected Model of Professional Growth	25
Figure 3.1. Knowledge in Action Study Timeline	37
Figure 3.2. PBL-APES Course Poster	57
Figure 3.3. The Interconnected Model aligned with Primary Data Sources.....	68
Figure 6.1. Learning from Text Homework Assignment & Application	145

LIST OF TABLES

Table 3.1. Participant Data: 2014-2015	36
Table 3.2. District Demographics by School: 2014-2015.....	38
Table 3.3. Data Collection Matrix	45
Table 3.4. Summer Institute Codes.....	48
Table 3.5. Collaborative Team Meeting Codes	49
Table 3.6. Classroom Observation Codes.....	51
Table 3.7. Data Matrix of Focal Lessons.....	53
Table 3.8. Teacher Interview Codes	56
Table 4.9. Teaching with Texts: Enactment data for Ms. Carson & Ms. Murie.....	82
Table 4.10. Teaching with Texts: Enactment data for Ms. Hunter & Ms. Earle	92
Table 5.11. Variations in Teacher Adaptions for Accountability.....	112

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DEDICATION

For Joe

Chapter 1. INTRODUCTION & FRAMING LITERATURE

When Ms. Carson and four Environmental Science colleagues in her district began teaching a project-based AP Environmental Science (APES) course in 2012, they found it challenging to support student learning from text. Teachers tended to work around text by providing content through lectures, films, and labs. If reading was assigned, students were rarely held accountable through assignments, discussions, or application tasks; in fact, teachers were likely to lecture the same information. These kinds of practices led students to report it was possible to pass class without reading, even when it was assigned. When students did venture into the textbook, both academically strong and underprepared students found the AP Environmental Science textbook to be discouragingly impenetrable: they struggled to identify meaningful information from the dense text, to interpret textbook diagrams and charts, and to support their project-based claims and positions with text-based evidence (Nachtigal, 2013; Valencia & Nachtigal, 2012). These kinds of teacher and student experiences underscored the “grammar of schooling” (Tyack & Tobin, 1994) that has firmly shaped subject-matter expectations for teaching and pedagogical practices in American high schools (Apple, 2008).

New standards that emphasize interpretation and analysis of disciplinary content assume texts are used in high school classrooms. Yet for teachers like Ms. Carson, reading has not been a reality. During an interview, Ms. Carson described the conflicted role of reading in her general Environmental Science classes:

Yeah. There's not a whole lot of reading that goes on. In my general [Environmental Science] classes? It's a *challenge*... a challenge.

[Speaking as a student] Can you put this on YouTube? I mean can you not watch it? Why would you read it?

Reading a *science* textbook? Reading... I mean it's not that I don't do any. You have to, right? There's a little bit of reading that comes in. We don't typically use the textbook. Hardly at all. (TI_A_APES_T552_14_11_04)

Even in her Advanced Placement (AP) Environmental Science class, Ms. Carson reported teaching primarily through lectures and labs. Although teachers and science standards share the goal of developing students who are proficient, critical readers of science texts, Ms. Carson and her colleagues across the district concurred that texts were rarely used as sources of learning.

The insights gained from the first implementation of project-based APES in 2012 led to an iterative redesign of the course in 2014 that was intended to better support teachers' and students' use of texts for learning (Valencia, Adams, & Nachtigal, 2016). Working with resources available at the urban schools, teachers were provided with professional learning opportunities and a curriculum embedded with supports for text-based learning. This comparative case study asks how teachers enacted text-based learning when provided with more professional support, and what supported their professional learning about working with texts.

1.1 PURPOSE OF THE STUDY

This qualitative, comparative case study takes place in the context of a curricular approach that was designed by the Knowledge in Action (KIA) research team to develop and measure a greater depth of student learning in project-based AP classes offered to students with a wide range of academic abilities attending urban schools (Parker et al., 2011, p. 539).

Supporting the acquisition of advanced literacy skills, particularly with secondary students in under-resourced schools, has been the focus of decades of literacy research (O'Brien, Stewart, & Moje, 1995), especially as literacy is increasingly recognized as an essential educational standard for navigating constantly streaming information in the twenty-first century

(CCSS, 2010; NGSS, 2013). The field of science education, driven to address disturbingly large achievement gaps for non-mainstream students and low-performing schools (Lee & Buxton, 2010), has seen largely positive results with project-based approaches, primarily in small-scale studies conducted in highly-resourced settings (Duschl, Schweingruber, & Shouse, 2006; Geier et al., 2008). However, an emphasis on inquiry- and project-based learning in science tends to focus on building content knowledge with little attention to texts (Osborne, 2002). Research suggests science teachers have little experience supporting text-based learning (Greenleaf et al., 2011). Two studies suggest students and teachers may need more support to interact with text productively (Alozie, Moje, & Krajcik, 2010; Moje, Collazo, Carrillo, & Marx, 2001). No study that I am aware of has focused specifically on how teachers support text-based learning in a project-based curricular approach. This study provides a rich opportunity to examine the thinking and practices of AP Environmental Science teachers for evidence of how they supported student learning from text in a project-based class; findings from this study will contribute needed research about how texts could be used in science classes (Moje et al., 2011).

One study is closely aligned with the work proposed here and a review is warranted because it speaks to the complexity of learning from text in inquiry-based science. The Reading Apprenticeship research, led by Greenleaf and colleagues (Greenleaf et al., 2011; Greenleaf, Schoenbach, Cziko, & Mueller, 2001) is notable as the only research study to focus on developing teachers' instructional capacity—and, ultimately, teachers' adaptive expertise—for integrating a Reading Apprenticeship approach with teachers' existing science texts and curricula. Designed as a two-year professional development intervention, the Reading Apprenticeship framework is based on “metacognitive conversations” that support teachers with various discourse routines and an “inquiry model of science and literacy integration” (Greenleaf

et al., 2011, p. 656). Across multiple measures, the Reading Apprenticeship teachers (n=56) demonstrated significant increased use of metacognitive inquiry routines, comprehension instruction, and collaborative learning structures, suggesting that “intervention teachers were more knowledgeable about and more able to integrate the teaching of science reading with science content” in their classroom contexts (p. 698).

Although my dissertation does not address student data collected in the larger KIA study, the student achievement data collected by Reading Apprenticeship is of interest in that it provides evidence of a relationship between increased teacher knowledge and practices for integrating literacy and content with increased student achievement; this assumption propels the KIA approach to learning from text. In brief, students in the Reading Apprenticeship intervention classrooms showed variable improvement on California standardized assessments of English Language Arts reading comprehension and biology: White students and English Learners demonstrated significant increased achievement, Latino students (the largest demographic at 40%) demonstrated positive (non-significant) increases; test scores did not change for African American students. On student survey measures, intervention students reported greater integration of reading with biology content and increased confidence toward reading science.

Greenleaf et al.’s research demonstrates that it is possible to develop teachers’ instructional capacity for integrating literacy with science content. This dissertation study extends that premise, but explores it in a significantly different context. Since the Greenleaf et al. study provides the only empirical contrast in the literature to date, I briefly compare the two studies in order to highlight points of divergence. Key differences are the amount and timing of teacher learning opportunities, the nature of teacher support and involvement, and the instructional context. To the first point, the Reading Apprenticeship study examined a two-year

intervention grounded in ten total days of formal professional development: a five-day summer institute prior to Year 1; ongoing collaborative planning sessions; two days of mid-year follow-up support; and a three-day summer follow-up session before the start of Year 2 (p. 675). In contrast, this study will focus on a much smaller time frame: the first three projects (units) within a single academic year. Teachers were provided with a four-day summer institute and monthly follow-up meetings (two hours each).

Second, the nature of teacher involvement and support in the studies also differed. Whereas the Reading Apprenticeship summer institute was designed for teachers to experience inquiry-based literacy practices, KIA teachers collaborated in a summer institute designed for iterative development of the project-based curriculum that they would be enacting. As a result, the studies positioned teachers differently (immersive inquiry learning of Reading Apprenticeship; collaborative KIA curriculum design) and provided different types of implementation support. Reading Apprenticeship sought to prepare teachers to integrate strategies and literacy routines into their existing curriculum. The KIA study, on the other hand, prepared teachers to enact a curriculum in which an emphasis on learning from text was woven into its very fabric. Thus, teacher implementation was supported through attention to the pedagogic practices integral to project-based learning (like Readers Apprenticeship, we also focused on discussion, structuring text-based tasks, etc.) – but teachers spent the majority of the summer institute engaged in collaborative curriculum refinement with the research team.

A third important difference was the instructional context of the studies. For Reading Apprenticeship, students were enrolled in general 9th grade biology and teachers had more flexibility in terms of content objectives. The KIA study, however, was conducted within the AP context; this meant AP objectives dictated the content and pacing of the course. In addition, the

AP test was high stakes for teachers and students.

Both studies argue text-based learning is an essential component of deep disciplinary learning for students, and a critical element to support for teachers who are frequently unfamiliar with how to integrate texts and subject matter. Where the Readers Apprenticeship study focused on the impact of a particular kind of professional development, this study examines teacher practices and thinking in the context of a trio of resources: curriculum that prioritizes learning from text, initial professional development that focused on collaborative curriculum refinement, and an ongoing district-supported team of teachers and researchers. Hereafter, I refer to the KIA project-based learning (PBL) approach to AP Environmental Sciences (APES) as *PBL-APES*.

With this context in mind, the following research questions guide this study:

1. How do teachers enact and think about learning from text while implementing a PBL-APES curriculum embedded with support for learning from text?
 - To what extent, and in what ways, is teacher thinking and practice influenced by the PBL-APES curriculum materials and/or their educative features?
 - To what extent, and in what ways, is teacher thinking and practice influenced by professional learning opportunities?
2. What contributes to variations in teachers' practices and thinking for student learning from text in a PBL-APES class?
 - How do these practices and thinking develop or shift over time?
 - What differences, if any, distinguish first-year and third-year PBL-APES teachers' practices and thinking?

- To what extent, and in what ways, do personal and contextual aspects of instructional settings influence variations between teachers' practice and thinking?

I now delve deeper into the nature of the fields that frame this study.

1.2 LEARNING FROM TEXT

Discussion of adolescent literacy is frequently connected to the historically dismal performance of middle and high school students on reading assessments. When only 34% of 8th graders and 37% of 12th graders reach proficient levels of reading¹ (National Assessment of Educational Progress, 2015a, 2015b), the capacity of adolescents to contend with the challenges of academic text becomes a critical factor for their educational progress (Lee & Spratley, 2010; Moje & Speyer, 2008). Evidence that adolescents are capable of reading at higher levels when they are personally moved to tackle challenging text they find relevant to their interests and goals (Alvermann, 2009) supports the assumption that engaging students in project-based learning (PBL) may also fuel student motivation and capacity for learning from demanding texts.

A shift from focusing on literacy in the service of content toward teaching content in the service of literacy is reflected in the recent rise of research and interest in *disciplinary literacy*. After decades of research focused on developing content area literacy, the premise of disciplinary literacy rests on the idea that literacy undergirds all disciplinary learning, a perspective raised initially in the field of social semiotics (Lemke, 1988) and – of particular interest to this study – taken up by researchers focused on scientific literacy (e.g., Norris &

¹ The National Assessment of Educational Progress (NAEP) is a congressionally mandated project of the National Center for Education Statistics. Administered every four years, NAEP has measured academic achievement in 4th, 8th, and 12th grades for over 40 years. By using the same testing material across all states, NAEP describes their results as “nationally representative.” The NAEP assessment scale measures three performance levels: basic (partial mastery of knowledge and skills); proficient (solid mastery of knowledge and skills); advanced (superior knowledge and skills).

Phillips, 2003; Osborne, 2002) as well as the larger literacy field. The debates around disciplinary literacy in the literacy field have been both vigorous and divisive (Brozo, Moorman, Meyer, & Steward, 2013; Faggella-Luby, Graner, Deshler, & Drew, 2012; Heller, 2010; Moje, 2008). As a result, it is important to clarify what I mean when I refer to disciplinary literacy broadly, and its constituent act of *learning from text* specifically².

Disciplinary literacy distinguishes itself as being inextricable from subject matter content. From a disciplinary literacy perspective, students must be engaged in doing the work of people who engage in a specific discipline: participation in disciplinary tasks then yields kinds of reading, writing, thinking, speaking, and doing that is viewed as synonymous with learning particular content (McConachie & Petrosky, 2010; Moje, 2007; Shanahan & Shanahan, 2012). In contrast, content area literacy and cognitive strategy approaches are often portrayed as reliant on general reading and writing strategies believed to be applicable to all disciplines (Brozo et al., 2013; Conley, 2008). Disciplinary literacy thus involves students in making sense of texts by using the very skills required of a discipline (Pearson, Moje, & Greenleaf, 2010). Project-based learning has the potential to foster a motivating, authentic context for this type of learning (Moje, Young, Readence, & Moore, 2000), particularly as it supports learning from multiple sources that may include, but certainly go beyond, the traditional classroom textbook (Goldman, 1997). This resonates with the KIA project's conception of project-based learning: students take on roles (for example, as an environmental scientist or commercial farmer) in order to generate a motivating "need to know." Subsequent learning would then be structured in ways that help

² The phrase "learning from text" has been used to indicate the cognitive processes by which learning from text occurs (e.g., Kintsch, 1986) but was taken up in a more disciplinary literacy perspective by Hynd (1998) and Goldman (1997), both of whom examined learning from text in project-based environments designed to promote critical thinking and collaborative problem-solving. Goldman and her colleagues noticed that the "coordination of information present in multiple texts is a significant challenge for many 11 and 12 year olds. Constructing reasoned, evidence-based explanations for their selections is equally challenging" (p. 359). Notably, both authors focus attention on student learning from text rather than teacher learning.

students interpret content through their perspectives as different stakeholders in a simulated environmental science setting. Conceiving of literacy as an integral part of disciplinary work supports the KIA design principles of “engagement first” and the centering of instruction around rigorous, authentic projects.

Although the KIA approach aligns with disciplinary literacy in the ways described above, other disciplinary literacy perspectives diverge from our intentional integration of text into instruction. For example, approaches that are deeply grounded in teacher facilitation of disciplinary inquiry based on discipline-specific epistemologies, structures, and processes (e.g., McConachie & Petrosky, 2010) and those that emphasize linguistic analysis of disciplinary texts (e.g., Fang & Schleppegrell, 2010) do not characterize our focus on learning from text within the context of project-based learning in the inherently multi-disciplinary realm of environmental science. Thus, while we certainly draw on some elements of disciplinary literacy in our work, in this proposal I will use the phrase *learning from text* to distinguish our particular approach to integrating content and literacy from the more theoretically ambiguous term of *disciplinary literacy*.

Learning from text is a stance that views reading and writing as fundamental elements of learning content (Norris & Phillips, 2003). Sometimes the texts and tasks reflect a strong disciplinary nature (e.g., students synthesize readings and data in order to write an environmental impact report), and sometimes texts and tasks serve more general purposes (e.g., students read a textbook section about state and federal land protection that does not directly impact their local study site). In other words, texts are not seen as conduits for content that students are supposed to “get” when the chapter is assigned for homework, but rather as texts worth examining in varying ways for specific project tasks. To that end, the textbook plays a limited but important role in

PBL-APES student learning about the environmental, economic, and social pressures that propel environmental science.

Despite the continued presence of textbooks as a “dominant curricular device” (Apple, 2008, p. 25), we do not view them as disciplinary texts. In fact, textbooks often obscure many of the disciplinary sources and differing perspectives behind the information they compile into a single, flattened account. Although research indicates textbooks continue to significantly influence instruction and assignments (Apple, 2008), we know little about how teachers actually use texts in general for teaching content (Alvermann, O'Brien, & Dillon, 1990; Moje et al., 2011). We do know, however, that textbooks are frequently disparaged and avoided by teachers and students alike (Ball & Cohen, 1996; Wigfield, Cambria, & Ho, 2012). We also know that research focused on science instruction suggests the assignment of reading in science classrooms “generally fails to engage students intellectually or provide opportunities for sense-making” (Dillon, O'Brien, & Volkmann, 2001; Greenleaf et al., 2011, p. 650).³ One possible explanation is that many teachers are deeply ingrained in a secondary school culture that has largely moved *away* from text use through pedagogies of “telling” (Sizer, 1984). Whether teachers “tell” students the content through formal lectures or informal explanations of the textbook, teacher talk can efficiently cover content in ways that “control the content, the pace of delivery, and the content and pace of classroom interaction” (O'Brien et al., 1995). To disrupt this trend, which was clearly visible in early KIA data (Nachtigal, 2013; Valencia & Nachtigal, 2012), our aim was to support teachers in the facilitation of student learning *from* text.

³ Greenleaf et al. base their assertion on the conclusions of the report, *Taking Science to School* (Duschl et al., 2006) and the findings of a national study (Weiss, Pasley, Smith, Banilower, & Heck, 2003) in which only 15% of K-12 science and math lessons were rated as high quality. Dillon and colleagues (2001) reported similar findings of insufficient teacher support for science engagement and learning from text in their single case study.

Over thirty years of literacy work has focused on infusing general cognitive reading strategies into content classes. Consequently, this approach has shaped what many teachers currently know about literacy through teacher preparation programs and professional development (Conley, 2008; O'Brien et al., 1995). There is little evidence, however, that cognitive strategy approaches have significantly impacted student achievement (NCES, 2008) or integrated literacy instruction into content classes (O'Brien et al., 1995). To this point, Heller and Greenleaf (2007) conclude, "Evidence suggests that relatively little literacy instruction goes on in most content area courses" (p. 15-16). Whether "literacy instruction" is conceived of as comprehension strategies or disciplinary engagement with text, recent research indicates most students rarely have opportunities to read and discuss text in ways that support meaningful content learning (Adams & Valencia, 2013). This in turn suggests teachers may need support for providing such opportunities.

Current reforms, however, are largely framed around what teachers *should* know how to do in regards to disciplinary literacy. Both the Common Core Standards and the Next Generation Science Standards assume teachers are able to draw on their content expertise to design inquiry-based instruction, support sense-making from texts, orchestrate discussions, highlight the discourse norms in specific disciplines, and also make visible and mediate the discourse demands that make disciplinary texts challenging to students (CCSS, 2010; Fang & Schleppegrell, 2010; McConachie & Petrosky, 2010; Moje, 2008; Shanahan & Shanahan, 2012). Teachers are expected to mediate this learning with students who typically have a wide range of reading abilities and varying amounts of background knowledge. Research indicates these practices are complex, unfamiliar, and challenging for secondary teachers to take up and enact (Alozie et al., 2010; Cavagnetto, 2010; Moje et al., 2001; Whitcomb, 2004).

PBL-APES offers an opportunity to examine the thinking and practices of teachers in the midst of teaching rigorous content with an emphasis on learning from text in urban schools. This requires viewing each teacher's classroom, school context, and the KIA curriculum as constituting a complex learning environment that is interpreted, enacted, and experienced (Billet, 2006) by teachers who bring their own perspectives, goals, and interests to their work. I turn next to how what we know about teacher learning applies to this context.

1.3 TEACHER LEARNING

Teacher learning is widely seen as the key to improving student learning (Darling-Hammond, Wei, Andree, Richardson, & Orphanos, 2009a; Desimone, 2009; Lieberman & Pointer Mace, 2008; Putnam & Borko, 2000). There is less agreement, however, on how teachers' thinking and practices change in ways that are aligned with the reforms at hand (Kazemi & Hubbard, 2008). Theories of teacher learning parallel the development of learning theories over the last twenty years, beginning with behaviorist notions, moving to cognitive theories, and then progressing on to sociocultural theories of situated learning (Hammerness et al., 2005; Lave, 1996; Lave & Wenger, 1991; Putnam & Borko, 2000). Evidence suggests asking teachers to implement complex practices requires ongoing and responsive professional learning opportunities (Little, 1993; Shulman & Shulman, 2004). Yet theories of teacher learning have only recently begun to guide approaches to professional development (Borko, 2004; Desimone, 2009; Penuel, Fishman, Yamaguchi, & Gallagher, 2007; Penuel & Gallagher, 2009) and other avenues toward teacher learning, such as educative curriculum and teacher communities, to name just two of the many other opportunities available beyond formal professional development (Davis & Krajcik, 2005; Vescio, Ross, & Adams, 2008).

Perhaps for this reason, theories about teacher learning are frequently implicit in the design of professional development, where qualities deemed effective for professional learning (e.g., having a content-focus or incorporating collaborative work) are often emphasized without clear connections between those qualities and the intended outcomes of teacher learning (e.g., Desimone, 2009; Garet, Porter, Desimone, Birman, & Yoon, 2001; Richardson & Placier, 2001). As Clarke and Hollingsworth (2002) have noted, “The application of contemporary learning theory to the development of programs to support teacher professional growth has been ironically infrequent” (p. 947). This may reflect a complicated reality: within varied school settings, there are myriad opportunities for teacher learning, both formal and informal. Districts and schools can support teacher learning through conferences, in-service workshops, coaching, professional learning communities, etc. Likewise, teachers may seek various formal or informal learning opportunities through courses or seminars, leadership teams, self-study, action research, or by simply conferring with fellow teachers (Desimone, 2009; Little, 1993).

In addition to these kinds of learning opportunities, teachers may also learn from instructional materials, curricula, and other resources. As Cobb, Zhao, and Dean (2009) put it: “teachers’ instructional practices are not merely influenced by but are *partially constituted* by the materials and resources that the teachers use in their classroom, the institutional constraints that they attempt to satisfy, and the formal and informal sources of assistance on which they draw” (Cobb, Zhao, & Dean, 2009, p 166; italics in original). One possible driver of such learning may be educative curriculum. Ball and Cohen also reasoned that curriculum materials, which are already installed as a stable and widely accepted feature of secondary schooling, are in a particularly powerful place to leverage teacher learning. After all, curriculum is “the stuff of lessons and projects, of what teachers and students do” (p. 6). Since Ball and Cohen argued this

almost twenty years ago, research has since shown that curriculum designed for teacher learning can “develop their knowledge of content and learners and expand their repertoire of instructional practices” (Beyer, Delgado, Davis, & Krajcik, 2009). Curriculum that aims to increase teacher knowledge and ultimately foster adaptive expertise for new teaching situations has been described as *educative* curriculum (Ball & Cohen, 1996; Davis & Krajcik, 2005). It is distinct from typical teacher materials that may provide suggestions for teaching strategies, but focuses primarily on student learning (Davis & Krajcik, 2005). Some features of the revised PBL-APES curriculum are educative in the sense that they are intended to support teacher implementation and understanding of the instructional design, including learning from text.

Another element of teacher learning that has implications for this proposed study is the issue of time. Desimone’s (2009) review of teacher learning research indicated that “intellectual and pedagogical change requires professional development activities to be of sufficient duration, including both span of time over which the activity is spread (e.g., one day or one semester) and the number of hours spent in the activity” (p. 184). Preliminary KIA data from teachers in their first year of teaching PBL-APES indicated that teacher acclimation to project-based learning and the new curriculum took significant time and effort. In fact, teachers in their first year of teaching PBL-APES consistently took longer to implement the first cycle than expected; teachers attributed the slower pace in their first year to learning the new curriculum.

While the quality and focus of teacher learning trumps contact hours when it comes to teacher learning and student achievement (Kennedy, 1999a), approaches that are “intensive and sustained over time” have been found to significantly increase teacher learning (Darling-Hammond & Richardson, 2009). Researchers synthesizing multiple studies have reported that, at minimum, positive benefits were seen with 30-100 contact hours (Guskey & Yoon, 2009) while

others suggest “close to 50 hours” (Darling-Hammond, Wei, Andree, Richardson, & Orphanos, 2009b, p. 46). However, two separate studies examining formal professional development focused on supporting inquiry-based science instruction found that 80 or more hours were required before teachers were significantly more likely to use inquiry-based instruction than teachers who received fewer hours of professional development (Corcoran, McVay, & Riordan, 2003; Supovitz & Turner, 2000).

Corcoran and colleagues (2003) also noted the clear effect of cumulative professional development on teacher practices and thinking over two to three years of sustained opportunities for professional development on inquiry-based instruction, a finding supported by other studies (Butler, Lauscher, Jarvis-Selinger, & Beckingham, 2004; Desimone, Porter, Garet, Yoon, & Birman, 2002; Schneider, 2013). The importance of significant, structured follow up to support initial professional development is similarly highlighted in Guskey and Yoon’s (2009) review of professional development research; they note: “Educators at all levels need just-in-time, job-embedded assistance as they struggle to adapt new curricula and new instructional practices to their unique classroom contexts” (p. 497).

These research findings are particularly relevant to this study, where I examine the thinking and practices of teachers who are teaching PBL-APES for the first time alongside experienced teachers embarking on their third year with the curriculum. This context presents a rich opportunity to examine how integrated curricular and professional learning supports may (or may not) constitute “just-in-time, job-embedded assistance” for teachers working to enact a complex project-based curriculum with an unfamiliar emphasis on learning from text.

As the literature reviewed on disciplinary literacy and teacher learning suggests, current research does not present a clear image of what supports learning from text in high school

classrooms, particularly in project-based learning environments that incorporate multiple textual sources and expect students to synthesize across sources and apply new knowledge to authentic situations. Nor does current research provide much guidance on what supports teachers in taking up the pedagogical practices and conceptual understandings that might support such learning from text, or what that might look like in environmental science.

Chapter 2. CONCEPTUAL FRAMEWORK

Teaching involves the simultaneous coordination of many instructional strategies in a complex social setting (Kennedy, 1987; Lampert, 2010; Shulman, 1987). Identifying those strategies and how teachers could or should learn them, however, has been an American education debate since Dewey (1904) and has played out in policy, districts, and schools in ways that have often provided little coherence or consistency for teachers (Randi & Zeichner, 2004; Richardson & Placier, 2001). As a primary goal of education, literacy in its basic sense of learning how to read and write has always been a target of new research and reform. Previous reforms for elementary literacy are viewed as largely successful, yet by 10th grade, “U.S. students score among the lowest in the world” (Time to Act, 2010, p. 1). Research agendas for adolescent literacy, however, are rarely accompanied by a research agenda for teacher learning about incorporating literacy into secondary instruction (a notable exception is the Reading Apprenticeship study: Greenleaf et al., 2011).

When considering a framework for teacher learning that would allow me to examine teacher thinking and practices around learning from text, I reviewed literature on professional development, teacher learning, and teacher change – as well as literature that reviewed those intersecting fields over time (Desimone, 2009; Garet, Porter, Desimone, Birman, & Yoon, 2001; Kennedy, 1987, 1999a; Little, 1993; Munby, Russell, & Martin, 2001; Randi & Zeichner, 2004; Richardson & Placier, 2001). I also considered empirical studies and empirically grounded reviews and position papers that focused on teacher learning through the lens of situative learning theory (Ball & Cohen, 1999; Borko, 2004; Ellis, 2007; Putnam & Borko, 2000; Vescio et al., 2008) as well as learning theories developed in the learning sciences (Goldring & Vye, 2004; Hammerness et al., 2005), workplace learning (Billet, 2006), and complexity theory

(Cochran-Smith, Ell, Ludlow, Grudnoff, & Aitken, 2014; Opfer & Pedder, 2011). Much recent work sat clearly astride theoretical differences between cognitive learning theories and socially situated and collaborative learning theories, arguing it was neither productive nor possible to use either perspective in isolation (Clarke & Hollingsworth, 2002; Davis & Krajcik, 2005; Hoekstra & Korthagen, 2011; Lieberman & Pointer Mace, 2008; Meirink, Meijer, Verloop, & Bergen, 2009; Shulman & Shulman, 2004). I also sought out empirical work that addressed teacher learning when implementing inquiry-based curricular approaches similar to what was developed in the current KIA study of project-based learning⁴ in AP Environmental Science (Cobb et al., 2009; Penuel & Gallagher, 2009; Rico & Shulman, 2004; Rosebery & Puttick, 1998; Whitcomb, 2004).

An important backdrop to this varied literature is the growing consensus around the hallmarks of effective learning opportunities for teachers. Our DBIR approach to project-based learning (PBL) in AP Environmental Science (APES) is reliant on work with teachers that incorporates elements of professional development, in addition to collaborative and research-based curricular revision. Within this context, I felt it was important to understand how our conception of collaborating with teachers resonated with research on effective formal and informal professional development.

I pause here to clarify what I mean by *professional development* because it is a nebulous, ill-defined phrase. An example of how broadly professional development can be defined is clear in Little's (1987) definition: "any activity that is intended partly or primarily to prepare paid staff members for improved performance in present or future roles in the school districts" (p. 491). A

⁴ What KIA calls "project-based learning" (PBL) goes by other names as well, such as *inquiry-based*, *problem-based*, and *investigation-based*. There are distinctions among these varieties of PBL that this dissertation does not explore; however, it is important to note that even within the singularly-named PBL category, core principles and implementation vary widely between projects and curricula.

more current approach to bounding the definition of professional development is put forward by Desimone (2009), who argues that, “One way of translating the complex, interactive, formal, and informal nature of teacher learning opportunities into manageable, measurable phenomena is to focus measurement on the critical features of the activity” (p. 183). Drawing on decades of empirical research, Desimone (2009) identifies five critical features of professional development: 1) content focus, 2) active learning, 3) coherence, 4) duration, and 5) collective participation.

While Desimone’s (2009) five features are reflected throughout the KIA project, a focus on the features alone foregrounds the impact of formal professional development; as a result, the context in which professional learning takes place and the mechanisms of learning are relegated to the background. A perspective so focused on formal professional development leaves less room to examine informal learning opportunities, such as communities of teachers (Horn & Little, 2010), coaching (Hoekstra & Korthagen, 2011), collaborative curriculum design (Penuel & Gallagher, 2009; Voogt et al., 2011), or educative curriculum (Alozie et al., 2010; Schneider, 2013). Because the KIA project incorporates various types of professional learning – from formal, structured sessions (the 4-day summer institute) to regularly scheduled collaboration time with teachers (informal monthly meetings) who maintain a professional relationship outside of researcher contact (teacher community), and with the intent to incorporate some educative features regarding disciplinary literacy into the curriculum (embedded curricular supports), I selected a framework that reflects the underlying KIA assumption that learning and enactment are connected by multiple, interactive pathways. Therefore, my use of the term *professional development*, whether formal or informal, does not presume that teacher learning aligns with the goals of the professional development, only that it is a potential learning opportunity.

This perspective is grounded in the foundational KIA principle of supporting teachers to

be adaptive decision-makers (Hammerness et al., 2005). In keeping with the larger project's design-based implementation research approach, the KIA approach drew on Brown's (1992) conclusion that if classrooms are to be transformed from "academic work factories to learning environments that encourage reflective practice among students, teachers, and researchers" (p. 174), then teachers and researchers would need to work together in a highly collaborative way, prioritizing teachers' integration of AP content with the project-based approach in the complex world of their classrooms. Thus, a primary role of KIA professional development and the curriculum was to support teachers' adaptive expertise (Hammerness et al., 2005)⁵ in their practice and implementation. Accordingly, there was no expectation of fidelity to the KIA curriculum, which was viewed as one supportive element working in tandem with formal and informal professional development opportunities.

KIA aimed to support teachers' understanding of core design principles, including learning from text, in ways that would guide teacher thinking and implementation. Specifically, the KIA curriculum examined in this study was conceptually developed in order to support unfamiliar pedagogical practices (i.e. project-based learning, orchestrating discussions, learning from text). These kinds of practices are well-described as "hidden or otherwise 'hard-to-learn'" (Billet, 2006, p. 33) In his work on curriculum and learning, Billett emphasizes the importance of identifying and "intentionally support[ing] 'hard-to-learn' knowledge" through modeling, guidance, representations, and opportunities to practice. While the KIA approach can offer some supports through curriculum and professional learning opportunities—ideally both—Billet reminds us that, "no amount of external control, or mandates, can ensure that what is intended

⁵ This ability to "change [one's] core competencies and continually expand the breadth and depth of their expertise" is known as being an *adaptive expert* (Bransford, Derry, Berliner, Hammerness, & Beckett, 2005). The development of adaptive expertise is described as a "gold standard for learning" in the How People Learn framework (Bransford, Brown, & Cocking, 1999) and thus represents a complex blend of teacher innovation and efficiency in learning and enacting a curricular approach such as PBL-APES.

will be enacted with ‘fidelity’ [because] the decisions that teachers make in enacting the curriculum are based on their experience, values, preferences, and competence” (p. 39).

Ultimately, this study examines what teachers learned about text-based learning from their interactions with PBL-APES curriculum, their classroom implementation efforts, and the KIA professional development opportunities.

2.1 THE INTERCONNECTED MODEL OF PROFESSIONAL GROWTH

I turn now to a description of the Clarke and Hollingsworth (2002) model that captures the complexity of professional learning supported in the KIA approach to PBL-APES. Clarke and Hollingsworth’s “interconnected model of professional growth” is designed to represent the “process by which teachers grow professionally and the conditions that support and promote that growth” (p. 947). In general, this model posits that the non-linear nature of each teacher’s learning can be identified as recognizable patterns of “enaction” (putting new ideas into action) and reflection among four domains that comprise the teacher’s professional world. In contrast to linear models of teacher learning, the interconnected model highlights how enaction and reflection mediate unique patterns of change and growth for teachers as they draw on sources of information and support (the *external* domain); their own knowledge, beliefs, and attitudes (the *personal* domain); professional experimentation (the domain of *practice*); and salient outcomes (the domain of *consequence*) (p. 951). Next, I explain these domains in greater detail.

2.2 A TEACHER’S WORLD: FOUR CHANGE DOMAINS

The four change domains in the interconnected model are based on Guskey’s (1986) model of four domains for “staff development,” in which a linear progression began with staff development (the external domain) that in turn effected change in the teacher’s classroom

practice (the domain of practice), which then led to changed student learning outcomes (domain of consequences), resulting in changes to the teacher's beliefs and attitudes (personal domain).

The Interconnected Model uses analogous domains to comprise the "teacher's world" situated within the "constraints and affordances of the enveloping change environment" (p. 950).

However, the Interconnected Model presumes teacher learning to be individually unique and interactive, operating on multiple recursive pathways through the domains. Thus, the

Interconnected Model arrays the domains in a circle (see Figure 2.1. The Interconnected Model of Professional Growth), connecting them with double-headed arrows to indicate the multi-directional pathways of teacher learning. The Interconnected Model is designed to identify shifts in teacher thinking and practices in any of the four domains; the kind of change is reflective of the specific domain. For instance, teacher experimentation with a new teaching strategy (e.g., providing a reading purpose) would be reflected in the domain of practice. New knowledge or a new belief (e.g., the belief that learning from text was valuable for students) would reside in the personal domain. A changed perception of salient outcomes related to classroom practice (e.g., students learned AP content effectively through projects) would reside in the domain of consequence (p. 951). The change domains are described as follows:

- 1) The *external domain* incorporates all resources that originate outside the teacher. This is the only domain in which teacher reflection is not typically indicated with an arrow in the original model. For the KIA project, however, teacher opinions and feedback have significantly informed the curriculum's development, so I have included an additional reflection arrow (highlighted in blue) to indicate that teacher engagement with and reflection on curricular revision may well be a meaningful source of learning. In addition to the PBL-APES curriculum, the external domain includes KIA resources such as formal and informal

professional learning opportunities where teachers have the opportunity to reflect on their practice with colleagues and the KIA team. This domain also includes other external sources of support on which teachers may draw, such as teacher communities, colleagues, coaching, and other instructional materials. Significant to this study, the external domain is the primary way in which the KIA approach attempts to support the hard-to-learn task of text-based learning through the curriculum and professional learning opportunities.

- 2) The *domain of practice* is where teachers experiment and try out new ideas and resources in the unique context of their respective classrooms. The moves a teacher chooses to make, and the practices and resources they discard, adapt, or appropriate would be considered in light of the domain of practice. This domain reflects how teachers personally experience and think about their teaching and how they have translated the PBL-APES approach. For example, when teachers felt uncertain about how to promote learning from text in ways they feared might upset student and parent expectations about rigor, teachers' enactment reflected site-specific variations in content delivery; it also resulted in teacher experimentation with new instructional strategies that either became part of the teacher's repertoire or faded away. It is important to distinguish a teacher's typical practice, or "business as usual," from the domain of practice. Rather, teachers' experimentation with new ideas, practices, and materials constitutes this change domain.
- 3) The *domain of consequences* illuminates shifts in salient outcomes for each teacher. "Outcomes" is used here to refer to the basis on which a teacher judges something successful or unsuccessful; thus salient outcomes are tied to teacher values and exert a strong influence on teacher thinking and decision-making. For example, one teacher might view tests scores as an important outcome and consequently emphasize activities she believes furthers that

end, while other teachers might value vigorous student debate, or a quiet and orderly classroom, or a strong relationship with students. Teachers select material, resources, and pedagogical moves that further the outcomes they deem valuable. Thus, this domain strongly reflects a teacher's perceptions of PBL-APES as she makes and communicates instructional decisions.

- 4) Finally, the *personal domain* accounts for changes in teachers' knowledge, beliefs, and disposition. Of particular interest in this study are shifts in teachers' understanding and perceptions of student learning in general and learning from text in particular, as well as their beliefs about project-based learning. For example, changes in a teacher's understanding and thinking about project-based learning, or the role of text in PBL-APES learning, would be seen in this domain. Likewise, a teacher who believes students are not capable of reading independently might change her belief after experimenting with some supports. Prior experience with PBL-APES would also strongly influence this domain. Thus this domain carries significant weight as I examine how previous knowledge of PBL-APES supports or constrains teachers as they work with the newly revised curriculum.

Directly influencing the four domains is the "change environment," as represented in Figure 2.1 by two concentric circles surrounding the change domains. The change environment includes components that may afford or impede a teacher's growth; some examples: School culture and expectations, the upcoming AP Environmental Test at the end of the school year, administrative support (or lack of support) for teachers, and opportunities available to teachers for collaborative planning, etc. Beyond the immediate change environment for teachers is the broader state and national policy context, which is influenced by standards like CCSS and NGSS and school,

district, and state assessments.

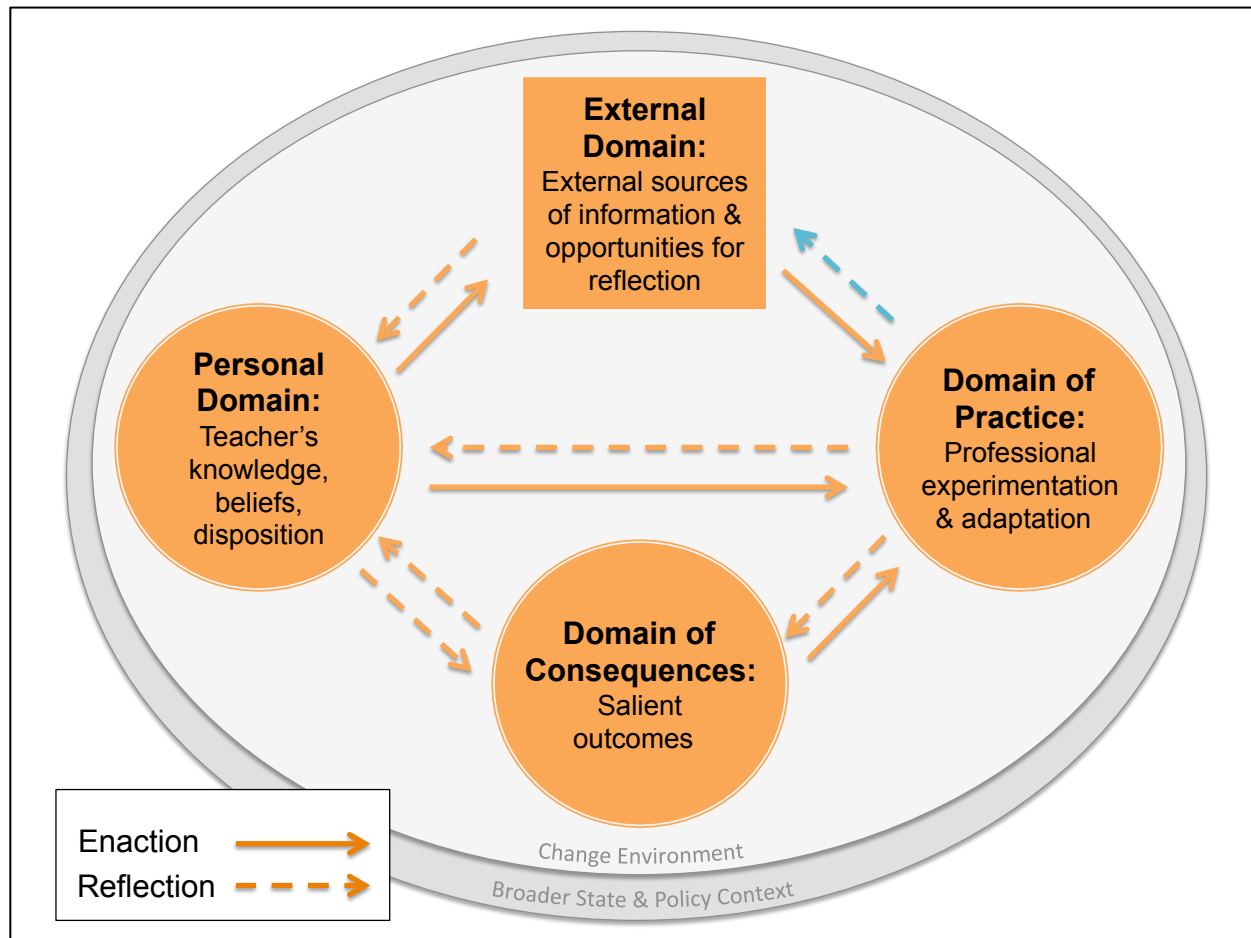


Figure 2.1. The Interconnected Model of Professional Growth

Clarke and Hollingsworth (2002) locate learning in the two mediating processes of *enaction* and *reflection*. These processes are represented by arrows in the model (see Figure 2.1). Clarke and Hollingsworth claim this model is distinguished from other models of teacher growth because it “recognizes the complexity of professional growth through the identification of multiple growth pathways between the domains” (p. 950). In addition, the model’s “non-linear nature, and the fact that it recognizes professional growth as an inevitable and continuing process of learning” (p. 950)

most accurately reflects the KIA emphasis on the necessity of teachers' adaptive expertise to best suit their students and teaching context. I briefly explore each process in turn.

2.3 ENACTION

Clarke and Hollingsworth define *enaction* as the “putting into action of a new idea or a new belief or a newly encountered practice” (p. 953)⁶. In the interconnected model, all teacher actions (i.e., instructional moves, classroom talk, and assessments of learning) are seen as the “translation of a belief or pedagogical model into action” (p. 951). This sounds straightforward, yet putting what one knows into action can lead to a “problem of enactment” (Kennedy, 1999b), a well-identified challenge that begins with novice teachers (indeed, novices in all professions) and persists for teachers embarking on unfamiliar curricular approaches, such as PBL-APES (Ball & Cohen, 1999; Grossman et al., 2009; Hammerness et al., 2005). In short, teachers “need not only to understand but also to *do* a wide variety of things, many of them simultaneously” (Hammerness et al., 2005, p. 359). Many PBL-APES teachers experience the KIA approach as a new array of pedagogical practices and theories of learning; not only in regard to learning from text, but also in regard to KIA design principles such as *engagement-first*, in which students are given a problem before they are provided information for solving it (an approach that goes against the common practice of “frontloading”). It is challenging for teachers to learn and integrate new practices and conceptual understandings, in part because they are not blank slates.

Prior personal experience is known to strongly inform teachers' preconceptions of what high

⁶ The term *enaction* as it is used here to indicate active experimentation with new ideas or practices can easily be confused with the more general term *enactment*, which refers broadly to a teacher's translation of the KIA curriculum into their practice and does not specifically refer to an experimental act. A potential synonym to avoid confusion could be *implementation*, however I believe the term carries a connotation of fidelity; according to Merriam Webster, to implement something implies “actual fulfillment by concrete measures” (<http://www.merriam-webster.com/dictionary/implementation>). As a result, I will use *enaction* only when referring to active teacher experimentation and *enactment* in its more general sense to emphasize the adaptive nature of engaging with curriculum.

school science instruction should look like (Lortie, 1975) and school systems themselves are well-known for establishing and shaping expectations for teaching and learning that are not always conducive to approaches such as PBL-APES, which intentionally disrupts the roles of teachers and students (O'Brien et al., 1995; Tyack & Tobin, 1994).

Because it's not possible to prepare teachers for every complexity of project-based learning, including unfamiliar practices such as text-based learning, the development of adaptive expertise remains a goal of PBL-APES. As mentioned earlier, this means my view of enaction (and any lasting change it fosters) is not designed to measure fidelity to the curriculum, but to understand what kinds of support promote or impede teachers' adaptive expertise as it relates to learning from text.

Specifically in this study, I examined teachers' practice for evidence of enaction, or the putting into action of the PBL-APES principles and specific components of the curricular approach that were new for teachers. For example, when considering the domain of practice, I coded classroom observations for key elements of the learning-from-text approach that would represent teacher experimentation with new practices, such as orienting students to text-based tasks. Likewise, when considering the personal domain, I coded teachers' articulation of changes in their beliefs or thinking around the use of text. When considering the domain of consequence, I coded for teachers' expression of shifts in what they valued or prioritized in their teaching; I looked particularly for evidence of changes related to text-based learning outcomes, but this domain also provided reasons for why teachers at times decided to limit opportunities for learning from text.

2.4 REFLECTION

Enaction in the interconnected model is accompanied by reflection, as defined by Dewey's articulation of "active, persistent and careful consideration" (Dewey, 1910, p. 6). Because reflection has played many roles in various theories of teacher change (Richardson & Placier, 2001) and is also referred to by many names which often overlap in meaning (such as inquiry, metacognition, etc.), I pause to clarify what counts as reflection in this study and why it matters. To do this, I draw on Rodgers' (2002) analysis of Dewey's work and relate it to the *How People Learn* framework, in which reflection (described as metacognitive awareness) is seen as a critical process required for adaptive expertise (Hammerness et al., 2005). Synthesizing Dewey's work, Rodgers (2002) identifies four criteria that characterize reflection as Dewey conceived of it:

1. Reflection is a meaning-making process that moves a learner from one experience into the next with deeper understanding of its relationships with and connections to other experiences and ideas. It is the thread that makes continuity of learning possible and ensures the progress of the individual and, ultimately, society. It is a means to essentially moral ends.
2. Reflection is a systematic, rigorous, disciplined way of thinking, with its roots in scientific inquiry.
3. Reflection needs to happen in community, in interaction with others.
4. Reflection requires attitudes that value the personal and intellectual growth of oneself and of others. (p. 845)

Rodgers distinguishes reflection from other important types of thinking, such as invention, believing, and stream of consciousness (p. 850). Indeed, she argues the pace and complexity of teaching often leaves little room for reflective thinking: teachers are more likely to be "awash in perceptions" while actively teaching rather than taking on the disciplined process of reflection that leads to reasoned, intelligent action (p. 849).

The rigor of reflection is what makes it particularly compatible with community; after all, “merely to think without ever having to express what one thought is an incomplete act” (p. 856). But collaborative reflection offers more than a site for the process: a community can also affirm the value of teachers’ experiences, help teachers look at issues through new perspectives, and provide a greater collective sense of responsibility for undertaking reflective thought than one might feel alone. Rodgers notes that communities also support teachers’ interdependence: “No teacher outgrows the need for others’ perspectives, experience and support—not if they are interested in being what Dewey calls life-long students of teaching” (p. 857). In this respect, reflection is predicated on an attitude and disposition that is open to learning; in other words, teachers will not engage in productive reflection if they aren’t genuinely curious, intellectually available, and interested in their own professional growth. These are also qualities fostered by collaborative curriculum development, where reflective thought and professional sense-making become collectively intertwined in the joint work of aligning curriculum and instructional practices in ways that make sense to the participating teachers.

Dewey’s description of reflection is quite similar to the role of “metacognitive awareness” as it is used by the *How People Learn* framework (Hammerness et al., 2005) to describe teachers who are able to question what they know and don’t know – and how to access resources that will support their decision-making and learning. Similarly, metacognitive teachers “analyze acts of teaching as well as reactions and interactions that occur, so that they can reflect on these outcomes and adapt what they do” (p. 377). For Dewey, reflection must include action – although “intelligent” response to reflection is not definitive, “but an experiment, a testing of one’s theories” (Rodgers, 2002, p. 855). Importantly, both conceptions of reflection lead indisputably toward action. Thus, Rodgers writes, “the process is cyclical: reflection comes full

circle, the testing becomes the next experience, and experiment and experience become, in fact, synonymous” (p. 856). This relationship is represented in the interconnected model’s depiction of learning as the iterative interplay between enaction and reflection.

2.5 IDENTIFYING TEACHER LEARNING WITH THE INTERCONNECTED MODEL

To understand the conditions that influence teacher learning, the Interconnected Model first identifies empirical evidence of change in the four domains and then analyzes the sequence of enaction and reflection that led to the change. Clarke and Hollingsworth (2002) found the teachers they studied all “changed” particular elements of their beliefs or practices, but not all experimentation led to lasting growth. In response, they determined that different kinds of sequences indicated momentary versus long-term change.

Temporary change in the Interconnected Model is described by Clarke and Hollingsworth as a “change sequence” (p. 958). They define a change sequence as change that occurs in “two or more domains together with the reflective or enactive links connecting these domains, where empirical data supports both the occurrence of change in each domain and their causal connection” (p. 958). Consider, for example, a teacher who was introduced to a new practice in professional development (the external domain) who tries out that new practice (enaction) in her classroom (domain of practice). This sequence provides evidence of the external domain linked by enaction to the domain of practice. Although the teacher may reflect on her implementation of the practice (personal domain) or on the outcomes of her experimentation (domain of consequence), this kind of change provides no evidence of durable change.

Lasting change, what Clarke and Hollingsworth describe as *growth*, and what I call *learning*, is viewed in the Interconnected Model as a “growth network.” This is defined as “explicit evidence of lasting change in practice or in teacher knowledge or beliefs” (p. 959) and

is apparent through the enactive/reflective linking of more than two domains. It is frequently seen as a cycle of enaction and reflection that leads to durable changes in more than one domain. These sequences are more involved than a change sequence; indeed, Clarke and Hollingsworth note that teacher growth typically “involves multiple and cyclic movements between the analytical domains of the teacher’s world” (p. 961). They argue that growth, or durable learning, should be the goal of professional development efforts, rather than evidence of change, which may or may not represent lasting changes in beliefs, practices, or dispositions. This aligns with my conception of learning when it comes to text-based instruction, where evidence of adaptive expertise becomes my measure of durable change.

Although the four domains figure prominently into empirical identification of change in the Interconnected Model, it is important to remember the influence of contextual factors on teacher learning. Clarke and Hollingsworth found that the presence or absence of supportive conditions (such as school environment receptive to new practices) in the change environment clearly impacted teacher learning. Thus, this analytical model must be considered as a whole: change domains arrayed against a teacher’s personal and workplace context. Clarke and Hollingsworth argue the Interconnected Model has the capacity to recognize “the situated and personal nature, not just of teacher practice, but of teacher growth: an individual amalgam of practice, meanings, and context” (p. 965). Conceptualizing teacher learning as embedded in complex learning and teaching environments (Opfer & Pedder, 2011) may help researchers better theorize about teacher learning and ultimately how to better support effective professional learning opportunities for teachers. This dissertation’s focus on teacher learning in regard to working with text aims to contribute to theories of teacher learning in general but to the field of disciplinary literacy more specifically.

The Interconnected Model has been used in several studies (Hung & Yeh, 2013; Justi & van Driel, 2006; Voogt et al., 2011; Witterholt, Goedhart, Suhre, & van Streun, 2012), providing evidence that it has been effective at illuminating patterns of supports and constraints on teacher learning across varied contexts and disciplines. Notably, the study by Voogt et al. (2011) found the interconnected model was also useful for identifying the learning processes of collaborating teacher teams.

Chapter 3. METHODS & ANALYSIS

In this chapter, I explain the design and data collection methods of this study. I also introduce each participating teacher and her school context. Then I describe the methods I used to analyze the data.

3.1 RESEARCH METHODS

The nature of the Knowledge in Action project's design-based implementation stance needs to be foregrounded as I present the methods of this study. One reason for this is that teacher learning was viewed as an ongoing process, undertaken continually as teachers worked to integrate the KIA design principles and collaboratively refined projects with APES content and their own classroom context. The Summer Institute and monthly meetings were seen as sites of collaborative work that would serve to deepen teachers' understanding of the pedagogical reasoning behind learning-from-text and other KIA design principles as they engaged with curricular refinement. To this end, we were not "presenting" a new approach for implementation, as might be seen in traditional professional development; rather the collaborative approach was intended to support teacher learning and adaptation through the process of co-developing the PBL-APES curriculum.

In this comparative case study I used qualitative research strategies to understand and interpret the learning experiences of four high school AP Environmental Science (PBL-APES) teachers (Merriam, 2009). Guided by this study's view of learning as dynamic, interconnected, and situated in specific socio-cultural contexts, I ensured teachers' experiences and interactions were recorded across several contexts. For instance, I drew on data from formal and informal professional development opportunities, multiple classroom observations of each teacher, and

three interviews conducted across the five-month study time frame. Underlying this process is the epistemological assumption that knowledge and understanding are socially constructed through activity, talk, and inquiry into meaningful problems (Vygotsky, 1978). Taking a qualitative approach is appropriate for this study as the constant comparative analysis process allows me to organize rich data, describe unique cases, draw comparisons, understand patterns, and identify themes in order to understand how teachers are influenced by their participation in the PBL-APES approach (Glaser, 1965; Merriam, 2009).

A comparative case study is a good methodological match for this dissertation and the questions it asks about complex learning environments comprised of multiple variables (Merriam, 2009). Looking at only one teacher working with the PBL-APES approach would provide a limited view of significant factors, and how they interacted to characterize the phenomenon of teacher learning around text. To increase validity and my ability to arrive at more grounded and more nuanced interpretations, I look within and across four teachers who share some similarities (e.g., years of teaching experience; district support) yet differ widely in other ways (e.g., prior experience with PBL-APES; varying teacher content knowledge; school demographics). I viewed each teacher as the unit of analysis in order to better understand teachers' experiences over the five months of study. Yet the case studies clearly share common conditions and characteristics, such as the district setting, the KIA professional development and the PBL-APES curriculum. Miles and Huberman (1994) suggest that by looking across a range of cases, researchers can better “understand a single-case finding, grounding it by specifying how and where and, if possible, why it carries on as it does. We can strengthen the precision, the validity, and the stability of the findings” (p. 29). Designing a comparative case study afforded a

range of richly detailed, holistic cases from which I could effectively study the phenomenon of teacher learning about text.

The following research questions guide this study:

1. How do teachers enact and think about learning from text while implementing a PBL-APES curriculum embedded with support for learning from text?
 - To what extent, and in what ways, is teacher thinking and practice influenced by the PBL-APES curriculum materials and/or their educative features?
 - To what extent, and in what ways, is teacher thinking and practice influenced by professional learning opportunities?
2. What contributes to variations in teachers' practices and thinking for student learning from text in a PBL-APES class?
 - How do these practices and thinking develop or shift over time?
 - What differences, if any, distinguish first-year and third-year PBL-APES teachers' practices and thinking?
 - To what extent, and in what ways, do personal and contextual aspects of instructional settings influence variations between teachers' practice and thinking?

3.2 PARTICIPANTS

The four teachers who participated in this study were drawn from the larger KIA research project, which worked with all the AP Environmental Science teachers in one district⁷ for the purpose of studying enactment of the revised PBL-APES course during the 2014-15 school year.

⁷ Five teachers participated in the larger KIA study; due to insufficient data across the three projects, I was not able to include the 5th teacher, Mr. Leopold, in this analysis.

As noted earlier, teachers participated in the KIA project as co-collaborators and co-developers of the PBL-APES course. Each high school had a single AP Environmental Science teacher, with one or two sections of APES. Teachers had between two to seven years of prior teaching experience; see Table 3.1 for participant information.

Table 3.1. Participant Data: 2014-2015

Teacher & School*	Years teaching experience	Teaching Credential; Science Background	Previous years teaching PBL-APES	Sections of PBL-APES	Prior AP experience
Ms. Carson Cedar H.S.	7	MAT: Science Education MS Sustainable Agriculture BS Environmental Science	2	2	2 years (APES)
Ms. Earle Elm H.S.	4	BS Secondary Education [Biology, Chemistry, General, Physics]	0	2	None
Ms. Hunter Hemlock H.S.	2	MAT: Science Education [Biology, Chemistry, General, Physics] BS Biology; BS Psychology	0	1	None
Ms. Murie Maple H.S.	3	BS Secondary Education [Biology, Chemistry, General, Physics] BA Chemistry; BA Linguistics	2	1	None

* All names used in this study are pseudonyms

However, teachers differed in the amount of experience they had teaching the PBL-APES curriculum (either two years of prior experience or no prior experience). Because the level of experience teachers had with PBL-APES figures prominently into my analysis, I frequently refer to the teachers as either “experienced” or “new.” By this phrasing I intend to reference only their experience level with the PBL-APES course; it has no bearing on the total years they had taught prior to this study.

Two teachers, Ms. Carson and Ms. Murie, taught PBL-APES for two prior years (Year 1: 2011-12 and Year 2: 2012-13) in the larger design-based KIA study (Bransford et al., 2014). Thus, for the period of this study, Ms. Carson and Ms. Murie were in their third year of PBL-

APES implementation after participating as implementers in the first year of the study and co-collaborators in their second year of the study (see Figure 3.1 for the study timeline).

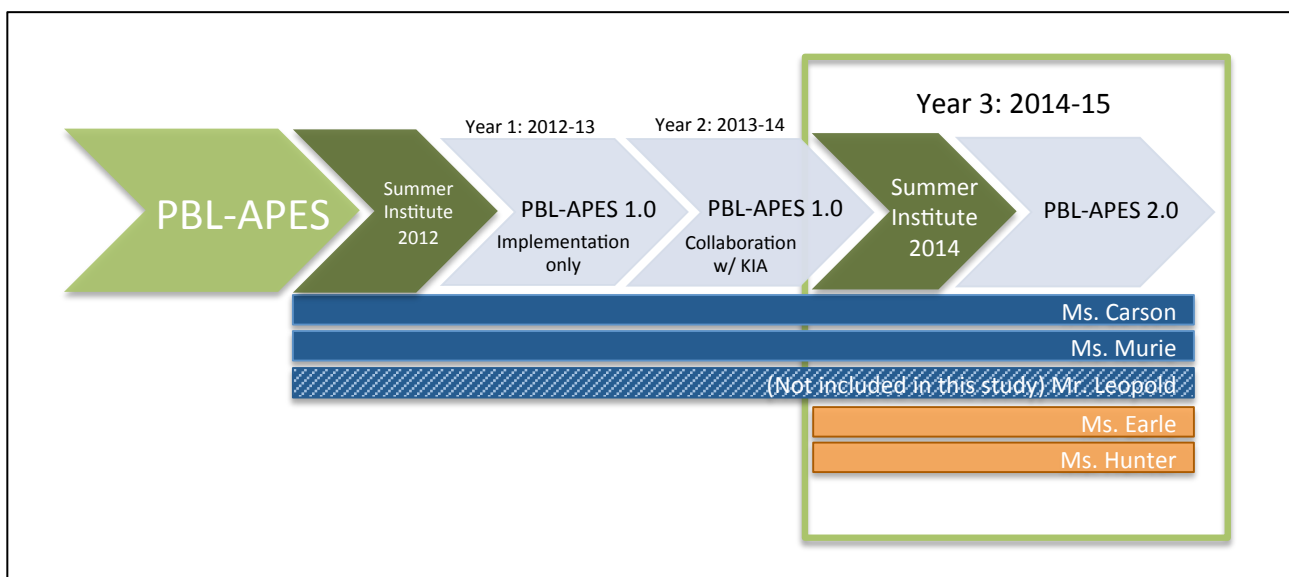


Figure 3.1. Knowledge in Action Study Timeline

In contrast, the other two participating teachers, Ms. Earle and Ms. Hunter, were new to the PBL-APES curriculum; they first encountered PBL-APES during the four-day Summer Institute prior to the start of the 2014-2015 school year. Ms. Earle and Ms. Hunter replaced previously participating PBL-APES teachers who left their teaching assignments (one for maternity leave; the other for a district job opportunity). In both cases, the departing teachers left some materials and guidance for the incoming APES teacher. One of the departing teachers, Mr. Brower, went on to become the district's Science Coordinator and continued to offer informal support to the teacher that replaced him. In addition, he supported the entire PBL-APES team by attending the monthly collaborative team meetings and offering logistics and curricular support.

Although the five teachers worked at different schools within the same mid-sized school district, the teachers had different subject-matter backgrounds and teaching experiences, different

teaching styles, and different student populations; see Table 3.2 for school site demographics.

The diversity of participating teachers seemed like a potential source of substantial variations in PBL-APES enactment and experience, providing rich data from which to address my research questions. These variations were reflected in my coding, as I hoped to illuminate a range of enactment, teacher learning, or the impact of individual or contextual factors that influence the ways teachers engage with the curriculum or respond to learning opportunities. Cross-teacher comparisons helped me better understand what contributed to variations in teachers' practice and thinking.

Table 3.2. District Demographics by School: 2014-2015

	Free/ Reduced- Price Lunch	11 th grade Reading Proficiency *	Asian	Black	Hispanic	White	ELL
Cedar High School	51%	81.6%	5%	24%	12%	52%	7%
Elm High School	82%	47.5%	10%	25%	27%	31%	11%
Hemlock High School	75%	53.9%	17%	24%	19%	33%	23%
Maple High School	79%	63.8	9%	15%	32%	38%	12%

* School-wide reading proficiency rates are based on state-mandated assessment results reported on district and state websites.

3.3 PARTICIPANT PROFILES

In order to establish the change environment in which this study took place, I briefly introduce the district and each participant. To sketch the individual context for each teacher, I describe the

composition of students⁸; salient details about school-specific conditions; and the teacher's incoming stance toward the PBL-APES curriculum.

School District

Arbor Public School District is located in an urban area in a Mid-Western state and contains five comprehensive high schools. The district serves a diverse student body; in 2014-15, 51% to 82% of students qualified for free or reduced-price lunch across the district's high schools. Refugee relocation centers in the area contribute to a relatively large number of immigrant families in the district. Historically, AP courses were offered in a central location rather than in the five high schools; students who wished to take AP courses were bused from their home high schools. In 2010, the district began to offer some AP courses at the high schools, thereby making the courses more accessible to a more diverse population of students. This policy continues, with some AP classes previously offered at the central building now taught at the comprehensive high schools. The KIA courses (AP Government and AP Environmental Science) were among the first AP courses to be offered district-wide; PBL-APES began in 2012.

All high schools in the Arbor Public School District used block scheduling, with each class meeting for 80-90 minutes five times in each two-week period. This schedule allowed for longer, more flexible class periods, but also caused difficulty when inclement weather, student absences, or other events disrupted classes. One day a month teachers met in subject-oriented groups (e.g., all biology teachers) across the district. The PBL-APES monthly collaborative team meeting took place from 3:00-5:00pm after teachers met in their subject-oriented groups.

⁸ Data presented for specific class demographics represents consented students who were still in the class at the end of the school year, even though this study looks at the first half of the year. A few students in each class did not provide consent and there was some attrition over the year; as a result, descriptions of classroom dynamics, such as how many students had taken previous AP classes and the FRL rates, are representative.

Ms. Carson

After teaching PBL-APES for the previous two years, Ms. Carson arrived at the Summer Institute feeling positive about her recent (2013) experience teaching PBL-APES: “I’m coming from a very successful year. I had the best group that I’ve had.” Ms. Carson expressed confidence about enacting the revised PBL-APES course: “I think I have a good understanding of how I’m going to do it. It’s not too dissimilar to last year. I hope we get through it in a timely fashion.” In 2014, Ms. Carson would increase her PBL-APES course load to two sections, which she saw as advantageous because having a “guinea pig block” would allow her to fine-tune her teaching, but also challenging because it would require “double the grading” and complicate field trip logistics.

After an earlier career in agricultural science, Ms. Carson taught at Cedar High School for seven years. Before transitioning to PBL-APES in 2012, she had taught general Environmental Science and two years of (traditional) AP Environmental. Given Cedar High’s status as the highest performing school in the district, many of its students enrolled in multiple AP courses. Expectations of AP rigor and college preparation permeated Cedar High, and student and parent expectations meant Ms. Carson took covering AP content very seriously. Ms. Carson started the year with 51 students (the total in both her sections). Only two students reported taking PBL-APES as their first AP class; seven students had a GPA under 3.0. Breaking with the school demographics, Ms. Carson’s class was 78% white; only 14% were on free or reduced price lunch

Unlike other schools in the district, the PBL-APES class at Cedar High was offered as a “dual credit class” to students who wanted to simultaneously earn community college credits. Despite the emphasis on AP prep and college credits, Ms. Carson noted that her classes still

represented some “students who just aren't interested and don't even know why they were scheduled into the course.” A few of Ms. Carson’s students had enrolled in PBL-APES after taking Ms. Carson’s general Environmental Science class the previous year. Ms. Carson taught a full day of Environmental Science: two sections of PBL-APES and four sections of general Environmental Science.

Ms. Earle

Ms. Earle was new to PBL-APES and felt excited about teaching the course after the Summer Institute. Ms. Earle had not taught project-based curriculum before, but in her previous year at Elm High (2013) as an Intervention Coordinator, she had noticed that students were highly engaged with the course projects in the other KIA course, AP Government. Prior to Elm High, Ms. Earle worked for three years at a small rural high school where she was responsible for teaching every science course from Health to Zoology; yet as she contemplated teaching PBL-APES, she worried about having enough background knowledge to teach Environmental Science.

Ms. Earle began working at Elm High School in 2013; in 2014, when the previous PBL-APES teacher went on maternity leave, the school asked Ms. Earle to split her time between the Intervention position and two sections of PBL-APES. Elm High was one of the lowest performing schools in the district. Ms. Earle described her PBL-APES students as “not necessarily what you would call typical AP students.” Ms. Earle taught two small sections; a total of 26 students. In keeping with school demographics, 85% of Ms. Earle’s students qualified for free or reduced-price lunch. Just over half the class was Hispanic; the rest was 15% Asian, 15% white, 7% African American, 7% mixed race. Although only four students were taking PBL-APES as their first AP class, half of Ms. Earle’s students had GPAs below 3.0. Ms. Earle

worried that Elm High's standards referenced grading policy had sent students the message that homework did not count anymore. She also worried the school's policy of not requiring any prerequisites for PBL-APES meant some of her students lacked necessary background knowledge.

Elm High provided all students with personal iPads; online resources for taking quizzes and other class activities were used frequently. To communicate class expectations and provide digital copies of materials, Ms. Earle established a Twitter feed, a Remind 101 account, and maintained an online school site for classroom resources; she intended for all these resources to "connect the dots" for her students.

Ms. Hunter

Ms. Hunter was also new to PBL-APES. She joined the KIA project in 2014 when the previous PBL-APES teacher left to become the district science coordinator; Ms. Hunter felt her colleague would remain a "really good resource" as she navigated the new course. Ms. Hunter was excited to teach a project-based class because PBL had been the focus of her teaching methods course two years earlier: "I'm very familiar with [PBL] and I try to incorporate it as much as possible." Ms. Hunter had previously taught a general Environmental Science class but this was her first opportunity to teach APES.

Registration issues meant Ms. Hunter started the year with 10 students who had not chosen to enroll in the class. The classroom dynamics proved frustrating for Ms. Hunter, who felt students had been "just shoved in" to the class. Ms. Hunter felt particularly challenged by the presence of four athletes, who she described as caring a lot about grades but very little about the content of the course. Ms. Hunter felt class dynamics improved after three students dropped the class at the semester. With the smaller group of seven students, Ms. Hunter began leading class

seminar-style around a single large table; most of her instruction during the third project, My Community Ecology, was taught this way. Ms. Hunter's class was composed primarily of African American students (80%) and Hispanic students (20%). Nearly three-quarters of the class qualified for free or reduced-price lunch; three students had GPAs below 3.0. Only one student was taking PBL-APES as his/her first AP class.

During the 2014 year, Ms. Hunter felt a lot of pressure to balance a challenging course load with her teaching goals. In addition to PBL-APES, Ms. Hunter taught a single section of regular Environmental Science and three sections of Agriculture that were composed primarily of English Language Learners, a population Ms. Hunter had never worked with before. Ms. Hunter worried she might be "reprimanded by the administration that we shouldn't be doing stuff day-by-day," but found preparing for the three classes meant she constantly struggled to keep up.

Ms. Murie

As an experienced PBL-APES teacher, Ms. Murie stated she was excited to teach the newly revised course after the Summer Institute. Although she felt comfortable heading into the first two projects, Intro to Sustainability and EcoFootprint, Ms. Murie reported feeling a bit nervous that the third project, My Community Ecology was "going to feel like a brand new project" since she had rushed through it the previous year (2013).

A second career teacher, Ms. Murie began teaching Environmental Science and Earth Science at Maple High School in 2011. She began teaching PBL-APES the following year (2012) when the school added the course to its catalog. The job of recruiting students fell to Ms. Murie. Although any student who had taken the prerequisite Biology class could sign up, Ms. Murie noted that, "as far as I know, counselors and the registrars are not seeking students for this course. They leave that up to the teacher. So it's heavy recruiting on my part." Ms. Murie's

classes had been small the previous two years; in 2014 she felt the class had started to catch on and was pleased to find 19 students on her PBL-APES roster. Ms. Murie's other teaching responsibilities consisted of four sections of the general freshman course Conceptual Physics.

Ms. Murie's class in Fall 2014 did not quite reflect the school's racial and socioeconomic diversity: 43% of students qualified for free or-reduced price lunch; the majority of her students were white; 33% were Hispanic. About a third of Ms. Murie's class was taking PBL-APES as their first AP class; more than half of Ms. Murie's class had GPAs under 3.0. Ms. Murie taught PBL-APES during the first period of the day, which started at 7:40am; however, the school's strict tardy policy meant that students rarely entered class late.

3.4 DATA SOURCES AND CODING

Data were collected from four sources: 1) class observations; 2) teacher interviews; 3) formal and informal professional learning opportunities (the Summer Institute, monthly collaborative team meetings; 4) the PBL-APES curriculum for three projects (*Intro to Sustainability*, *EcoFootprint* and *My Community Ecology*), including teacher adaptations. Table 3.3 provides an overview of data collected.

Next I turn to descriptions of each data source, including the collection and/or selection process and provide a detailed account of my analytic method with each source. Then I describe how I brought the data sources together in order to triangulate, analyze, and develop themes.

Table 3.3. Data Collection Matrix

	August 2014	Year 3 2014-2015		
	Summer Institute	Project 1 <i>Intro to Sustainability</i> 3 weeks	Project 2 <i>EcoFootprint</i> 8-10 weeks	Project 3 <i>My Community Ecology</i> 6-8 weeks
Classroom observations (video-recorded)	---	4-5 focal observations per teacher	3-4 focal observations per teacher	2-4 focal observations per teacher
Teacher Interviews (audio-recorded)	Beginning of year interview	---	Post-EF interview	Post-MCE interview
PD sessions (video-recorded)	4 days (20 hours)	---	2 collaborative team meetings (2 hours each)	2 collaborative team meetings (2 hours each)

3.4.1 Professional Development Opportunities

Teacher interactions during formal and informal professional development were filmed in entirety. The Summer Institute (20 hours) captured teacher interactions as they were oriented to the revised learning-from-text approach, participated in the discourse workshop, and contributed to the collaborative curriculum revisions. Four collaborative team meetings held monthly (approximately two hours long; eight hours total) were also video-recorded. These meetings were coordinated with the monthly district-wide teacher meetings. PBL-APES teachers met after their district-organized meeting in Ms. Murie's classroom; in addition to the teachers and the KIA team, the district Science Coordinator, Mr. Brower, also attended. During collaborative team meetings, the KIA team virtually attended the meetings via Skype; however, for the first and last meetings some KIA members, including myself, were physically present with the

teachers. These monthly meetings were intended to support teachers with the PBL-APES curriculum and to continue the collaborative design work. Although the KIA team typically brought a few agenda items, such as hearing where teachers were at in the curriculum and how the revised materials and activities were working, the majority of the collaborative meeting time was intended for teachers to discuss topics of their choosing and ask for any needed support from their fellow teachers, Mr. Brower, or the KIA team.

Because I coded the Summer Institute and the collaborative team meetings differently, I describe each of them in turn. With the Summer Institute video, my first step was to review and transcribe the footage. This allowed me to sketch a topical outline for each day and determine when and how texts and text-based learning was discussed. Of the 20 hours of Summer Institute, approximately six and a half hours were focused on the learning-from-text approach or engaged with portions of the curriculum that were text-based. For those sections, I closely transcribed the entire interaction to identify teachers' interactions (or lack of interaction) with particular topics. Coding of teacher interactions during the Summer Institute used a more compact set of codes than the collaborative team meetings (which used the same codes as interviews and classroom observations). For a list of all codes, see Appendix E. Although I coded the entire Summer Institute for all teachers' contributions and concerns regardless of their relationship to text-based learning (e.g., "T asks any question" or "T understanding / belief"), codes that identified concerns and beliefs about learning from text (LFT) tended to cluster in the portions focused on text (e.g., "T asks question (LFT-related)" or "T understanding / belief (LFT-related)").

During the Summer Institute, teachers were primarily engaged in the work of curricular revision and refinement; consequently, conversational interaction tended to focus on the curriculum and KIA principles at the heart of the collaborative work. Even though teachers had

not yet been able to enact the curriculum and I anticipated little evidence of change during the Summer Institute, I aligned my codes with the change domains of the Interconnected Model to capture all statements of belief, thinking, practices, and goals. My thinking was that teachers would be unlikely to broadcast all shifts in their thinking over the next five months; since I had no way of anticipating where or how changes might emerge, this allowed me to compare what teachers said initially and what they stated later after opportunities for enactment.

The Summer Institute included a half-day workshop on classroom discourse led by a UW professor of secondary science teacher education. During the workshop, PBL-APES pedagogy was modeled, frequently putting teachers in the position of actively “experiencing” instruction that focused on “interacting with ideas” through discourse tools (e.g. sentence frames for academic talk) and moves (e.g. turn-and-talks, interacting with text) (APES_PD_ENHANCED_14-08-05.1of2). The discourse workshop positioned teachers as learners taking up new ideas and moves more than any other point in the Summer Institute.

With the exception of the discourse workshop, teacher thinking was frequently made visible only when teachers asked questions, suggested revisions (and provided a rationale for a particular revision), described how previous experiences or practice related to the work at hand, discussed pedagogical approaches to content and/or conceptual goals, or critiqued the PBL-APES curriculum when it did not align with personal beliefs, practice, or goals. During the four-hour discourse workshop portion of the Summer Institute, there was significantly more discussion that reflected teacher thinking and beliefs about student learning and instructional practices. Thus, when I reviewed the codes, I examined the nature of the thinking that had been tagged for each code and from there drew themes that were captured in detailed analytic memos for the Summer Institute broadly and each teacher specifically.

Table 3.4. Summer Institute Codes

• T asks any question
• T asks question (LFT-related)
• T connects with practice / experience
• T critiques / notes issue with PBL-APES
• T engages in curricular/instructional discussion
• T goals / salient outcomes
• T offers suggestion for revision / process
• T reflects on OTL (opportunities to learn) / PD
• T understanding / belief
• T understanding / belief (LFT-related)

In contrast to the Summer Institute, the collaborative monthly meetings focused much more on teacher enactment and thinking about the PBL-APES curriculum. As I designed my study, I had expected these meetings would allow teachers time and space to reflect on their practice. Transcribing the collaborative team videos allowed me to sketch the conversational trajectory and identify teachers' interactions (or lack of interaction) with particular topics. As with the Summer Institute, I coded all expressions of teacher beliefs and understandings about learning from text (Personal Domain), teachers' goals and priorities (Domain of Consequence), and teachers' perceptions about their enactment (Domain of Practice). Again, these codes did not necessarily represent change, but across the four monthly meetings (September, October, November, December) coding allowed me to identify teacher thinking about text-based instruction and reflection on practice as it was revealed in conversation with colleagues and the KIA team.

I paid particular attention to talk about pedagogical strategies, questions teachers raised about problems of practice (as well as suggestions and solutions they offered); the perspectives on learning teachers articulated, and any evidence of how teachers' drew on prior knowledge and experiences. Coding for reflective discussion—particularly talk about initial enactment, subsequent reflection and experimentation, and reflective thinking about the experience—helped

construct a view of how opportunities for reflection in a community setting impacted teaching thinking and enactment. Further analysis of these reflective discussions identified topics and issues that elicited reflective talk and examined the joint construction of meaning that arose from such discussions. The codes used most frequently for collaborative team meetings are listed in Table 3.5 (see Appendix E for the entire code list).

Table 3.5. Collaborative Team Meeting Codes

• LFT accountability
• T-T support for enactment
• T concern /question / revision re: enactment
• Teacher curriculum influence
• Teacher goals / salient outcomes
• Teacher PK/experience (or lack) influences enactment
• Teacher reflection on changes (practices, beliefs, etc.)
• Teacher reflection on LFT enactment
• Teacher beliefs / perceptions
• Teacher challenges
• Teacher reflection on opportunity to learn

3.4.2 *Class Observations*

Throughout the 2014-15 PBL-APES course, the KIA team targeted specific lessons within each project to be filmed. At the project level, these decisions were based on collective research interests, including significant uses of text or the application of text-based content through activities or discussion. Additional introductory and concluding lessons were filmed that were expected to capture how teachers more generally framed the curriculum and the use of text. School schedules, teacher absences, and videographer availability meant that occasionally targeted lessons or tasks were not recorded as intended. Two cameras and four microphones routinely captured the teacher's audio and two overlapping views of the classroom in order to continuously record the teacher's enactment of the curriculum and interactions with students.

To identify data that informed the Domain of Practice (teachers' experimentation with new practices and ideas), classroom observations were coded for use of key curricular elements related to the learning-from-text approach. These codes were developed to reflect the KIA approach to learning from text. At the broadest level, I coded for what teachers did *before*, *during*, and *after* working with texts; nested within those broad codes, I coded for particular moves within the text-based routine. For example, *before* teachers engaged with text-based learning, the Summer Institute emphasized and the curriculum embedded suggestions for orienting students to text, building or activating students' prior knowledge, presenting a purpose for reading, and giving explicit instructions for how to approach a text. These moves are all captured within the four codes nested under *Before* Reading; see Table 3.6 for a listing of classroom observation codes.

The nested codes for discussion soon revealed that talk about text was used in two different ways; sometimes it was used *during* reading, such as when teachers stopped the class to discuss a section before continuing to read further. At other times, the class finished a section, but discussed it before moving on to an application task; if it served a sense-making role, discussion of this kind of discussion was coded as a *during* reading support. However, if the discussion focused on applying what was read to contexts outside the reading, then small group or whole class discussion was coded as an *after* reading activity.

The twelve codes in the "Other" category were used across class observations, regardless of the *before-during-after* structure. These codes helped me identify patterns of enactment related to types of text (textbooks, articles, video, etc.) or how teachers worked with text in-class versus text assigned for homework. The code for "adaptive expertise" helped me mark moments where teachers appeared to have adapted a text-based task; I returned to these codes for careful analysis

of enactment patterns and cross-referenced teacher interviews and collaborative meeting codes for evidence of reflection on the adaptation. A few codes were developed in open coding, as teacher or student comments illuminated contextual factors of the school or classroom, or areas of specific teacher emphasis, such as citing sources of text-based evidence or attention to key terms and concepts.

Table 3.6. Classroom Observation Codes

<i>Before reading</i>
• Building/activating background knowledge
• Conceptual orientation / Framing
• Explicit instruction / explanation / demonstration for engaging with text
• Purpose for reading
<i>During reading</i>
• During reading: Strategies and activities
• During reading: Teacher interactions
<i>During/After reading</i>
• Discussion - small group
• Discussion - whole class
<i>After reading</i>
• Application / use
• Writing
Other LFT Codes
• Adaptive expertise
• Context / culture
• Citing source of info
• Compliance
• Homework
• Vocabulary/concept
• Materials: Other texts (articles, videos, etc.)
• Materials: Textbook
• Materials: Text-related tools
• Student perceptions about LFT
• Teacher beliefs / perceptions about LFT
• Teacher goals / salient outcomes

In order to make sense of these codes, I carefully reviewed all observation codes within each project and wrote analytic memos describing the nature of teacher enactment for text-based learning as reflected in the focal lessons. This process supported rich descriptions of enactment

generally as well as enactment of new practices and ideas and teachers' adaptations of the curriculum. Classroom observations were also coded for teacher-stated objectives and evidence of their investment in supporting or achieving particular instructional or dispositional outcomes; such data frequently illuminated salient outcomes for teachers (Domain of Consequences), especially as it triangulated with what teachers articulated in other contexts (e.g., interviews and collaboration with colleagues).

3.4.3 *Selection of focal lessons*

From the KIA corpus of data, which had recorded approximately 20-24 block periods (80-90 minutes each) per teacher across the first three projects, I selected six specific data points, two per project, to analyze in depth. My sampling criteria for these data points prioritized the use of different types of text (i.e. video, popular science texts, textbooks) and the use of varied instructional approaches to text (i.e. in-class reading, the assignment and application of text read for homework) across the study time frame. In order to investigate teacher enactment over time, it was important for me to examine different kinds of text used in different ways across the five months. The next priority was to target similar lessons across teachers. Variations in school and videographer schedules limited the number of text-based tasks for which data had been collected across all teachers. Guided by these criteria, I selected two data points in each project, as illustrated by Table 3.7.

Overall, the six data points yielded between 10-13 video-recorded classroom observations per teacher, for a total of 44 observations. This represents approximately half the total observations (89) collected by the KIA project for these four teachers during the first three projects. Two separate data points represent each project; each data point reflects the same lesson and the same texts enacted by all four teachers. The data points occur at rough intervals across

the five months; they are not equally spaced due to variations in the video data collection and because teachers taught the lessons at different times. For this reason, I included the date of each classroom observation. For each teacher I reviewed and analyzed between 900-1000 minutes of classroom instruction.

Table 3.7. Data Matrix of Focal Lessons

	Project 1 <i>Intro to Sustainability</i> 3 weeks		Project 2 <i>EcoFootprint</i> 8-10 weeks		Project 3 <i>My Community Ecology</i> 6-8 weeks	
	Data Point #1 What is Env. Science? Easter Island Case Study	Data Point #2 What is Sustainability? Paper vs. Plastic	Data Point #1 Sources of Energy: Coal	Data Point #2 Where do resources go? Waste	Data Point #1 Should the site be developed? Pro & Con articles	Data Point #2 What is an Ecosystem? Benefits of Biodiversity
Ms. Carson	8/28 (90 min) 9/2 (90 min) 9/4 (90 min)	9/12 (90 min)	9/16 (65 min)* 9/18 (65 min)*	10/20 (90 min)	11/24 (65 min)*	12/1 (55 min)* 12/3 (60 min)#
Ms. Earle	8/28 (60 min)# 9/2 (80 min) 9/4 (80 min) 9/8 (80 min)	9/12 (80 min)	9/18 (80 min)	10/29 (60 min)# 10/31 (80 min) 11/4 (80 min)	12/11 (80 min)	1/6 (80 min)
Ms. Hunter	8/26 (90 min) 8/28 (90 min) 9/2 (90 min) 9/4 (90 min)	9/8 (90 min)	9/12 (90 min) 9/16 (90 min)	10/27 (90 min)	12/1 (90 min)	12/11 (90 min)
Ms. Murie	8/27 (80 min) 8/29 (80 min) 9/3 (60 min)# 9/5 (80 min)	9/9 (80 min)	9/11 (80 min) 9/15 (80 min)	10/23 (80 min) 10/28 (80 min)	11/21 (80 min) 11/25 (80 min)	12/4 (80 min) 12/8 (80 min)
<p>* Ms. Carson's class overlapped with another filmed class; on these days a camera was not left to capture the last 30-35 minutes of class. # These classes were short due to early release schedules</p>						

A quick glance at Table 3.7 indicates that the first data point yielded more video-recorded observations than the other data points. This lesson revolved around three related texts and as such represented not only the first text-based learning in the course, but also the first opportunity for enactment of many new practices and ideas in the KIA approach to learning from text.

Additionally, across the data points there was variation in the amount of time teachers took to

cover the same material; sometimes this reflected the difference between reading in class or for homework, at other times it reflected variation in the way teachers structured the lesson across multiple days. For this reason, the number of minutes reflects length of the entire classroom observation, not the amount of time the teacher spent on the focal task

3.4.4 *Teacher Interviews*

For each participating teacher, three interviews were conducted, transcribed, and analyzed.

- **Interview 1: Beginning of the school year.** As part of the larger KIA project, teachers were interviewed at the beginning of the 2014-2015 school year, immediately after the Summer Institute. This semi-structured interview protocol was developed to reflect KIA's multiple research angles, including questions about teacher beliefs and values, and learning from text. A team of KIA researchers interviewed teachers individually; this means I did not personally interview each teacher as I did in the subsequent interviews. To accommodate the different perspectives of new teachers and returning teachers, two slightly different protocols were used. See Appendix A and B for the interview protocols.
- **Interview 2: Post-EcoFootprint (Project 2).** In November 2014, I interviewed all teachers near the end, or after they completed, the EcoFootprint project. This semi-structured interview protocol probed teacher thinking about learning from text and their enactment of the new curriculum while the experience was still fresh in their minds. See Appendix C for the interview protocol.
- **Interview 3: Post-My Community Ecology (Project 3).** In late January or early February, 2015, I interviewed all teachers after they completed the third project, My Community Ecology. This semi-structured interview protocol again probed teacher thinking about learning from text and teacher enactment of the curriculum, but this

interview also asked about perceived changes between the projects, how teachers used the curriculum and its lesson plans for planning, and followed up on any noted findings from Interview #2. See Appendix C for the interview protocol.

- **Informal Interviews/Conversations:** Over the period of this study, I had several informal conversations (in person and via email) with the participating teachers during which they spontaneously offered opinions, feedback, or raised questions. To the extent these interactions were captured on video, email, or field notes, I have included these informal conversations as data to be analyzed in addition to formal interviews.

Interview analysis was similarly focused on attending to the domains and interactions between them, particularly as a source of reflection on enaction. To this end, codes were designed to identify teachers' knowledge and beliefs about student learning in general and learning from text in particular (Personal Domain). Codes were developed to identify how teachers described their approaches to planning and instruction, how they explained what supported student learning in general and from reading in particular (and why), and how they evaluated and reflected on their instructional decisions. In addition, interviews were examined for evidence of salient outcomes that mattered to each teacher. Codes were designed to capture teachers' references to their instructional and dispositional goals – and related explanations of what they counted as evidence of effective learning and attainment of stated goals/outcomes (whether personal, district, AP-related, or state-mandated). Coding also attended to teachers' evaluation of and reflection on perceived and measured outcomes, such as student engagement with text and student work that reflected content learned from text. Collectively, these indicators of teacher thinking helped construct a nuanced view of how teachers understood and thought about learning from text and their role in supporting such learning at different points across the three PBL-APES projects.

When teacher thinking appeared to change over the course of that time, additional analysis attempted to identify experiences, support, and/or learning opportunities that influenced the noted changes.

Codes used for teacher interviews are presented in Table 3.8; the same codes were also used for collaborative team meetings.

Table 3.8. Teacher Interview Codes

• LFT accountability
• T-T support for enactment
• T concern /question / revision re: enactment
• Teacher curriculum influence
• Teacher goals / salient outcomes
• Teacher PK/experience (or lack) influences enactment
• Teacher reflection on changes (practices, beliefs, etc.)
• Teacher reflection on LFT enactment
• Teacher beliefs / perceptions
• Teacher challenges
• Teacher reflection on opportunity to learn

3.4.5 *The PBL-APES Curriculum*

Key design principles of PBL as it is conceived in the KIA study include rigorous projects at the center the course, project cycles that cover important concepts multiple times from different perspectives (looping), and an “engagement first” design that provides students with a *need to know* so learning is purposeful and meaningful to students (Parker et al., 2011, p. 539). The course poster for PBL-APES is presented in Figure 3.2.

This study examines teacher enactment of three projects. The first two projects are *within* EcoFootprint (the first project on the course poster). At the beginning of EcoFootprint is an introductory unit called Intro to Sustainability. This unit takes teachers about three weeks to complete. I consider this stand-alone unit the first project. The second project is called

EcoFootprint; instruction takes 8-10 weeks. Finally, the third project is called My Community Ecology; instruction typically takes teachers 6-8 weeks.



Figure 3.2. PBL-APES Course Poster

Previous analysis of the PBL-APES curriculum implemented in Years 1 (2012) and 2 (2013) suggested teachers took up surface features of the literacy framework that were prominently present in the curricular materials (e.g., reading purpose), but interviews and observations indicated the literacy framework was insufficiently integrated into the curriculum (Nachtigal, 2013). In response, the KIA team coordinated its Environmental Science content and literacy researchers to develop a revised curriculum (in tandem with corresponding professional development) that was responsive not only to the PBL-APES findings, but also to what had been learned from the PBL-AP Government & Politics course's literacy revisions (Valencia,

Nachtigal, & Adams, 2014). We hoped to embed the curriculum with features that would sustain teacher learning and ultimately foster adaptive expertise; such an approach has been described as *educative* curriculum (Ball & Cohen, 1996; Davis & Krajcik, 2005).

Importantly the original literacy framework evolved into what we now call an approach to learning from text. The revised curriculum is viewed in this study as “researcher-generated document[s]” (Merriam, 2009), and allows close comparison between suggested and actual instructional moves made by the teacher—as a way of observing the individual nature of enactment, adaptive expertise, and the resulting relationships to both the intended and enacted curriculum; *not*, as emphasized earlier, to measure fidelity of implementation. The purpose here is to examine how teachers viewed and used the revised curriculum; in short, I am interested in how it supported teacher as a resource (External Domain). The following is a description of the changes made to the first three projects of PBL-APES in order to support text-based learning, with an eye to the educative nature of the changes.

Framing:

The Year 1 and 2 curriculum gave a thumbnail sketch of key activities and related resources; in contrast, the Year 3 curriculum consisted of fully developed and consistently formatted lesson plans that included suggested teacher framing for introducing lesson content and learning from text. The move to include framing grew out of KIA observations that teachers needed support establishing a “need to know” for project tasks. KIA conceived PBL-APES as a way to achieve deeper learning; to that end, students are tasked with a project *before* learning content in order to “create a readiness for telling so that the information students gain by it, whether through reading a textbook chapter or listening to a lecture, is *needed* for making progress on the project and constructing suitable understanding” (Parker et al., 2011, p. 539). Without teacher talk to frame a

task, however, it is not apparent to students why they should read, watch a video, or conduct research. In order to imbue text-based assignments with the sense that it was critical for students to learn from text in order to accomplish a project task, suggested framing was added to all lessons. When reading carried a particularly key role, additional framing for the reading purpose was added as well. This suggested framing was written in a “teacher voice” to reduce transfer issues and set off in the curriculum through the use of italics and a shaded box. An example from EcoFootprint:

We've just hypothesized why we think Easter Island collapsed. Now we're going to read what one scientist concluded about the collapse. We'll see if our hypotheses are consistent with that scientist – his name is Jared Diamond and we're going to read an excerpt from his work.

This strategy aligns with Davis and Krajcik's (2005) “high-level guidelines” for designing educative curriculum by highlighting how to relate tasks and units by framing lessons in the larger curricular picture, and by making visible the developers' pedagogical judgments so that curriculum materials “speak to” teachers about the rationales underlying tasks and sequences rather than “through” them (Remillard, 2005, p. 232) in order to merely guide their actions.

A Structured Reading Experience:

A clearly delineated *before-during-after* reading routine (Graves & Graves, 1995) was designed for each assigned text. In Year 1, this approach had been promoted in professional development but left to teachers to implement independently. After data made it evident teachers were not going beyond purpose setting, we decided to develop a routine for implementing the *before-during-* and *after* approach. This is in line with the educative curriculum goal of providing *implementation guidance*, which Beyer and colleagues (2009) describe as conceptual guidance

(*why* these steps are important) in addition to procedural guidance (*what* steps to take). For example, the highlighted script above establishes a purpose for reading the Easter Island excerpt *before* students read; in addition the lesson suggests teachers model annotating with the author's bio and the first section of text in order to address students' potential misconceptions and build background knowledge. To support students *during* reading, the lesson suggests a note-taking tool to guide student thinking and supports teachers with possible prompts for making connections and building knowledge. *After* students completed the text, teachers are provided with discussion questions with an emphasis on supporting student use of evidence from both the video and text. Finally, whereas the initial curriculum provided external reading guides and handouts about the literacy framework, all suggested instruction was contained within the lesson plan, with very few exceptions (such as material designed for presentation on supplementary PowerPoint slides; see below for Homework Application).

Metacognitive Annotation (a strategy for *during* reading):

The annotation process was greatly simplified from earlier efforts. Instead of four symbols and a list of possible questions to guide annotation that teachers and students frequently found confusing and often skipped, we focused on two symbols: *checkmarks* (✓s) to indicate material that supported the reading purpose and *question marks* (?s) to indicate questions or confusion that students wanted to clear up in the discussion. As a metacognitive strategy, the annotation symbols were designed help students read actively. By putting a checkmark next to information that related to the purpose for reading and penciling question marks whenever something was unclear or confusing, students were prompted to think as they read, to be in constant dialogue with what the text was saying to them. When using textbooks that could not be directly written on, sticky notes were one suggestion for maintaining this annotation approach. The option of

writing more than the symbols was left open for teachers to adapt to their particular students and setting.

Homework Application (a strategy for *after* reading):

The development of this curricular addition came directly from research findings in the PBL-AP Government course: simply giving a purpose for homework reading was not sufficient for motivating students to read outside of class. A strategy that appeared to work better was telling students up front *why* the reading was important, *what* they would do with it in the next class period, and *how* they should go about the assignment. This led to the development of what we called “Homework Application” – in practice it was a PowerPoint slide that explained the following: **Purpose** (why students should read), **Use** (what they would do with it) and **Procedure** (how they should go about it). This approach reiterated the “need to know” with text that was being sent home: prior research had highlighted that homework was more likely than in-class reading to be assigned without a clear purpose. It also foregrounded for teachers and students that this text would be *used*—ideally in the very next class period. An example:

- **PURPOSE:** Read to find out an alternative hypothesis for Easter Island’s tragedy. What evidence supports this alternative hypothesis? Which scientific disciplines led to these new findings?
- **USE:** We will use this information to compare the new hypothesis and evidence with Diamond’s hypothesis and evidence. We will discuss the implications for living sustainably.
- **PROCEDURE:**
 1. As you read, identify Hunt’s new evidence and hypothesis with checkmarks (✓). Mark any words, sentences, or ideas that are confusing or you’d like to discuss with question marks (?).
 2. Write (1/2 page) your answer to the Critical Thinking Question at the bottom of the page. Be ready to discuss it.

Text Selection:

For the first iteration of PBL-APES, we were faced with the issue of supporting implementation across districts and schools that used different AP Environmental Science textbooks. This made developing tightly integrated literacy support particularly challenging. For the purposes of the Year 3 revisions, we developed learning from text support to work directly with the textbook used by all teachers in the Arbor Public School District. We began by tightly aligning the reading selections with the content-based learning objectives in each task of the EcoFootprint Unit. We were aware that some teachers and students had perceived short reading selections as not rigorous enough for AP classes, so we took care to balance text and concept complexity with the content goals. For example, although students read the entire chapter on Waste Management, they did so in three separate chunks when it applied to their learning (*municipal waste* when considering their city's waste management system and their family's impact; *hazardous waste* when considering e-waste and industrial waste; and a third section on *recycling, reusing, reducing, and composting* when they were considering solutions). Although the textbook was frequently read out of order, we prioritized manageable chunks that answered the questions raised by the project.

More Discussion:

Previous KIA research highlighted the prevalence of teacher talk over student talk. This was not surprising; discussion is uncommon in most secondary classrooms, and even more rare in poverty-impacted classrooms (Cazden, 2001; Nystrand, 2006). Yet text-based discussion is an important premise of project-based learning as conceived by the KIA team; PBL-APES is designed for students to do the work of learning and discussion is an important avenue for sense-making (Applebee, Langer, Nystrand, & Gamoran, 2003). For this reason we included a 4-hour

workshop on classroom discourse led by a professor of science education at the Summer Institute and followed it with a parallel emphasis on guiding discussion after in-class and homework reading. This meant every lesson with reading was designed to help teachers structure class discussions, including suggested prompts and key topics on which to press on students' comprehension. This approach was designed to offer teachers formative assessment opportunities for student understanding of the concepts covered in the reading, as well as to provide important opportunities for students to make sense of the content in a supportive context. Finally, this approach allowed teachers to set disciplinary expectations structured on the scientific process of developing hypotheses, supporting claims with evidence, and engaging in subject-matter discussions.

More In-Class Reading:

In the Summer Institute and in the curriculum materials, we strongly suggested that teachers emphasize in-class reading for the first unit. We did this for two reasons: 1) teachers reported it was very difficult to get students to read at home; 2) we wanted teachers and students to build stamina and experience with reading and annotating for a purpose, and then immediately applying what they had learned through a discussion or application activity. We hypothesized that if teachers *and* their students became accustomed to the value of learning from text they would be more likely to have success with reading homework later in the year. To this end, we wrote lessons that accounted for the time it would take to read most material in class for EcoFootprint, and when reading was intended to be sent home, we suggested reading the first portion of it in class and wrote lessons plans accordingly to reflect that structure.

Tools for Bridging Content and Project:

In order to provide a framework to help students make connections between what they learned in the readings and their projects, and to manage the cumulative impact of the readings, we developed a notebook-based organizer for recording new learning from text, lecture, and other sources. In EcoFootprint, for example, we called this the *Note-Taking Tool* and designed it to organize the different types of information students would need to draw on in order to complete their cumulative project, in this case a Family Proposal for reducing each student's family footprint. This organizer allowed students to conclude discussions of the text with a concrete record of their learning, and also provided a tool to keep track of material they would need throughout the project, as well as for the AP Test.

3.1 ANALYTIC METHODS

In keeping with qualitative research methods, my goal in data analysis was to develop rich descriptions of each teacher's thinking and practices that illuminated teacher learning about learning from text, as well as the personal and contextual factors that promoted or impeded learning. A major focus of data analysis was to identify and examine the unique pathways of enaction and reflection that linked teachers' change domains and to analyze patterns of learning that emerged within and across teachers.

My data analysis began with transcription of all interviews, observations, and professional development sessions. I entered transcripts into Atlas.ti, a qualitative data analysis software program. Throughout data analysis, my research questions and the Interconnected Model guided my development of codes and articulation of themes as they arose (Meriam, 1998; Yin, 2006). After open coding the entire Summer Institute, I ran reports in Atlas.ti that grouped each teacher's quotations by code and after constant comparative analysis, I wrote detailed

analytic memos for each teacher to track emerging themes. I took a similar approach when coding and analyzing the collaborative team meetings and teacher interviews.

When analyzing classroom observation data, however, I considered each teacher's data as a three-part data set. For example, the four classroom observations that comprised Ms. Carson's enactment in the first project were coded, analyzed by way of Atlas.ti and constant comparative analysis, and described in a memo that captured my initial thoughts about what themes had arisen in that particular project space. Then I coded, analyzed, and wrote a memo about Ms. Carson's three classroom observations in the second project, and so on with the observations for the third project. In this way, I reviewed all video consecutively, one teacher at a time, coding and analyzing as I went. Once finished with all three projects for a single teacher, I looked across the data to identify themes and trends that spoke to the entire study time frame for that teacher.

This process allowed me to focus closely on instances of enactment and whether new practices persisted, faded, or were adapted in some way. I considered enactment that led to consistent use of a new practice, belief, or goal (e.g., the practice of framing text-based tasks, or the belief that in-class reading supported students, or the goal of ensuring students could apply text-based knowledge) to be *durable* learning. I also discovered enactment that did not lead to changes in beliefs, practices, or goals; what had been enacted either began to mirror previously held beliefs, practices, and goals, or it faded out of instruction. I followed both momentary and durable shifts by looking across the entire data set for evidence of teacher reflection on that practice or belief. I then looked further, moving between data sources, for evidence of what influenced or supported temporary or lasting shifts: for this analysis, I examined data reflective of the change environment, external sources of support (colleagues, team meetings, the curriculum), teachers' prior knowledge or experience. My previously written analytic memos

were helpful here, even as they often sent me back to the original data to review the context and focus of related teacher reflection. I looked for teachers' initial thinking (often found in the Summer Institute or the beginning of the year interview) and later thinking (frequently present in the collaborative team meetings or teacher interviews) that supported my findings of durable change (or lack of change) with empirical evidence. After tracing durable changes, I looked for evidence of adaptive expertise in teachers' enactment of text-based learning. Sometimes, I noticed adaptive expertise first and followed it backwards through the data in a reverse process of analysis.

This process helped me identify patterns within and across teachers that suggested which contextual factors and conditions promoted or impeded learning about particular components of the PBL-APES approach to working with texts. Triangulation between observations of teacher learning opportunities (professional development; the curriculum), classroom enactment (observations), teacher-reported perceptions (interviews; professional development), and the curriculum provided internal validity across and within the cases (Merriam, 2009). Finally, to ensure credibility, I also carefully scanned the data for disconfirming evidence that could support alternative explanations (Merriam, 2009; Patton, 2002).

As described above, and as illustrated in Figure 3.3, the theoretical framework of the Interconnected Model directly informed my analysis of the data. Take for example, setting a purpose for reading. This was presented and modeled at the Summer Institute and is clearly embedded in the curriculum (the External Domain). Should a teacher decide to enact this new practice, her enactment would be portrayed as the mediating arrow, linking the External Domain (the source of the new practice) to the Domain of Practice, where the experiment would play out

in the teacher's specific classroom context. What the teacher thinks about her enaction is visible as the dashed arrow of reflection; the direction of the arrow represents the kind of reflection that is generated. If the teacher perceived setting a clear purpose for reading helped her students read more effectively, then the reflective arrow would point toward the Personal Domain, where the teacher might add this perception to her other knowledge about supporting text-based learning. If, on the other hand, the teacher felt the purpose helped her students learn the content more effectively and she values content learning that prepares students for the AP test, then the reflective arrow would point toward the Domain of Consequence, where the teacher might add purpose setting to her repertoire of effective content learning strategies.

For me to draw these kinds of conclusions it was imperative to align my data sources consistently with the framework. As Figure 3.3 illustrates, enaction was visible through classroom observations; however, reflection was invisible until presented in teacher interviews and/or the monthly collaborative meetings. Two or three data sources, however, inform each the change domains, and using all available sources increases the validity of analysis. For example, substantiating a teacher's salient outcomes in order to understand shifts in the *Domain of Consequences* relies on triangulating data collected through classroom observations, teacher interviews, and the professional development sessions. Although a teacher may state particular goals during an interview, those priorities may be absent from classroom enactment, or presented differently when talking with colleague. Before any claims about teacher changes or learning can be made, there must be sufficient empirical evidence as to what changed, and why. For this reason, the arrows of enaction and reflection—and the active learning processes they represent—are critical features that will be referenced repeatedly throughout this dissertation.

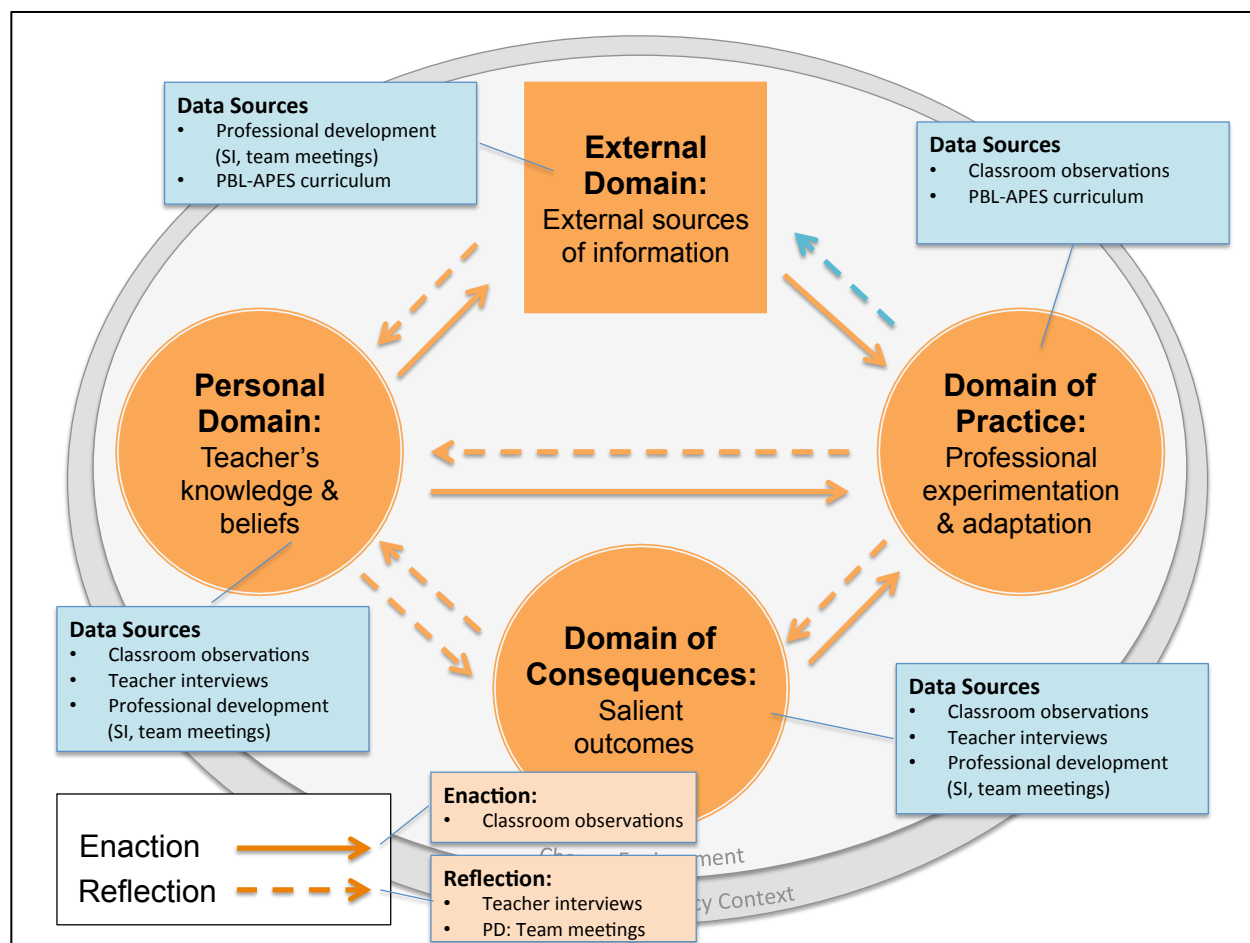


Figure 3.3. The Interconnected Model aligned with Primary Data Sources

3.2 SITUATING THIS STUDY IN THE KIA RESEARCH

Because this study derives from the larger KIA study, it has been influenced in several ways that warrant clarification. One important impact is that I have not personally collected all data that will be examined in this study. Data sources that have been solely authored in the interest of this study, and collected by me, are the teacher interviews after the two focal projects (Interviews #2 and #3: eight interviews total). In contrast, the classroom video footage was primarily shot by a videographer employed by the larger KIA project, although I spent several days in each teacher's classroom recording video as well. An affordance of this arrangement is the general absence of researcher effects on teacher performance. As documented in an earlier pilot study, researcher

presence can strongly influence teacher enactment, particularly for literacy elements that are unfamiliar to the teacher (Nachtigal, 2013).

Secondly, it is important to note that the monthly collaborative meetings with teachers were a collective, joint effort between the KIA research team and all five PBL-APES teachers. Teachers generally directed the content and focus of these meetings, but researchers asked and answered questions as well. In addition to curricular development, these meetings were intended to provide teachers with support from the KIA team as well as provide the teachers with opportunities to support each other.

In these ways, the larger KIA team and its broader goals influenced not only the data available to me, but also my interpretation of teacher roles and interactions as shaped by the expectations of the KIA team and our DBIR approach. Similarly, three previous years of research on the KIA team undoubtedly informs my interpretations of data, as what I see in these data reflects layers of prior knowledge about the curricular evolution from the PBL-AP Government course to PBL-APES and into the PBL-AP Physics course currently under development. For much of this time, the experienced teachers in this study have been present, so I also have knowledge of their evolving roles that is not reflected in the scope of this study's data analysis.

As for influences on data analysis, the KIA team had analyzed very little of the data presented in this study prior to my analysis. With the exception of some targeted analysis for a cross-course (AP-GOV and APES) paper that included limited data for Ms. Carson and Ms. Murie, the KIA team had yet to examine the influence of the revised curriculum on the four teachers represented in this study and through the third project, My Community Ecology. In many ways, this afforded me a fresh look at the data. Although this dissertation is

unquestionably juxtaposed against the larger project, the analysis presented here is primarily my own.

Chapter 4. FINDINGS: DURABLE TEACHER BELIEFS & PRACTICES

This chapter describes durable teacher beliefs and practices that influenced how teachers supported text-based learning. By using the term *durable*, I intend to convey teachers' beliefs and practices that persisted over time even as teachers experimented with new approaches and strategies. Durable beliefs clearly influenced how teachers enacted key components of text-based learning, such as orienting students to text and setting purposes for reading. My analysis highlights some prominent differences between the experienced and the new teachers in this regard. As a result, the findings presented in this chapter reflect and amplify the diversity within and across teachers. However, one key background component was shared by all the teachers and is important to keep in mind: Collectively, Ms. Murie, Ms. Carson, Ms. Hunter and Ms. Earle arrived at the PBL-APES Summer Institute with little experience using texts in their teaching and even less confidence that their students would be willing to work with texts as a source of learning. Before turning to the core findings, I briefly pause to emphasize the incoming knowledge and dispositions of both the new and experienced teachers in this study.

All teachers in this study reported that they rarely used texts in their other classes. When asked how the reading in her PBL-APES class compared with her four sections of general Environmental Science class, Ms. Carson laughed:

Ah-ha-ha. Yeah. There's not a whole lot of reading that goes on. [...] You know, I mean it's not that I don't do any... You have to, right? There's a little bit of reading that comes in. We don't typically use the textbook. (Post-EF Interview: T552_14_11_3)

Similarly, Ms. Murie reported that in her other five sections of freshman Conceptual Physics, there “isn’t a whole lot of reading, aside from knowing how to read the word problem” (Post-EF

Interview: T532_14_11_5). The two other classes Ms. Hunter taught (Agriculture, regular Environmental Science) assigned textbooks to students but reading was still not part of the instructional routine:

We don't read just because the kids won't read. They will just sit there, and flick their pencils across room and do that stuff. [...] We have those activity sheets that are up there and so it's the purpose for the day, and then their activity, and then completion questions. (Post-EF Interview: T543_14-11-3)

Teachers frequently used combative terms when talking about how students would react to the new and increased reading expectations. Ms. Hunter anticipated it as a necessary skirmish requiring active defense on her part: "I think at first it will be a battle. I'll have to put my foot down. I'll have to stay very diligent on these students if they're not big on attendance" (Summer Institute Interview: T543_14-8-7). Ms. Murie expected students would consider reading a "waste or time," or as "way too much work." She believed their reactions were related to the fact that students are not typically asked to read in high school:

I think at first they're going to rebel. Because... I don't think they're used to reading as much. With the 21st century skills that we're pushing on students, I think a lot of textbook reading has gone by the wayside. And we're encouraging reading and using the textbook as one of your sources. I think there's going to be quite a few students that are probably going to not want to participate. And I'm expecting that in the beginning. I'm hoping that they see there is a reason why we're doing this. (Summer Institute Interview: T532_14_8_5)

Ms. Earle echoed this belief. In her role as an intervention coordinator, she had worked the previous year with Elm High School science teachers and reported that the department recognized the need to increase opportunities for text-based learning. Although she anticipated students would "hate" being asked to read, she also believed students were not in the habit of reading:

They're just not really used to reading scientific material, because it takes so much *time!* Not a *bad* use of time, but just a use of time. So... it's gonna be new. It's gonna be new. And it's gonna be hard for them. (Summer Institute Interview: T513_14-8-7)

A similar school culture existed at the other district schools; Ms. Hunter noted that at Hemlock High, “There's not a lot of textbook use that I'm aware of” (Post-EF Interview: T543_14-11-3).

For all the reasons cited above, incorporating texts and expecting students to read was itself a big shift for teachers. In light of this context, the rest of this chapter examines how teachers’ beliefs and practices developed through this project influenced their approach to learning from text as they enacted the first three projects of the PBL-APES curriculum.

This chapter is divided into two sections. The first section describes durable beliefs that influenced how teachers did or did not orient students to learning from text. The second section looks at the kinds of support teachers provided while students worked with text, and how enduring beliefs informed the nature of that support. Both sections highlight differences between experienced and new teachers.

4.1 ORIENTING STUDENTS TO LEARNING FROM TEXT

The approach to text-based learning in the PBL-APES course was designed in response to the typical absence of text in classrooms. As a result, both the Summer Institute introduction to learning from text and the curriculum itself encouraged teachers to take significant class time in the first weeks of school to orient students to the new approach. The aim was that teachers would initially work with text *in class* for the purpose of establishing strategies and expectations with students about learning content from text. This early investment of time throughout the first project, Intro to Sustainability, and into the beginning of EcoFootprint, the second project, was intended to demonstrate to students that learning from text was not only useful, but an essential component of the PBL-APES course.

How teachers enacted this orientation, or “onboarding” of students, to learning from text was distinctly different between the experienced and the new teachers. First, I will focus on Ms. Carson and Ms. Murie, both experienced PBL-APES teachers, who clearly oriented their students to learning from text. Second, I will explore the relative lack of orientation provided by Ms. Hunter and Ms. Earle, who were new to PBL-APES.

4.1.1 *Making sense of “go slow to go fast”*

Both Ms. Carson and Ms. Murie took up the PBL-APES emphasis on explicitly modeling and orienting student to learning from text. Beginning on the first day of the Summer Institute and continuing throughout the three focal projects, Ms. Carson used the phrase “go slow to go fast” as shorthand for her approach to text-based learning. Ms. Murie also took up the phrase, using it in two interviews and with her students during the year. The teachers’ initial use of the phrase suggested they saw introducing students to learning from text as akin to a gradual release model: thus, students would go from time-intensive, supported learning from text to time-saving, independent student learning from text, presumably allowing teachers to cover AP content at a steady pace once students knew how to learn from text. The teachers’ enactment of explicit orientation of students to text, or “going slow,” developed their belief in the value of orienting students to text. As Ms. Carson and Ms. Murie introduced students to multiple texts over time, their thinking about orientation, or “going slow,” became more nuanced and increasingly durable.

Before exploring the subtle evolution of Ms. Carson and Ms. Murie’s understanding about the role of orientating students to text, it is important to highlight that the two teachers arrived at the Summer Institute with different expectations for working with text. At the beginning of the Summer Institute, Ms. Carson reported that her previous attempts to support

text-based learning⁹ had not been well received by her students; as a result, she described a tension between her belief that supporting learning from text was valuable and her students' perception that AP students do not need support:

The first year we did this and had those literacy strategies right at the start, I could sense around the room "We're AP kids, why is she doing this SPED [special education] stuff with us?" So it could be an issue for me to try and help them admit or accept that maybe they're not as genius [at reading] as they think they are, they're *told* they are, and their parents KNOW they are. (Summer Institute Interview: T552_14_8_7)

In contrast to Ms. Carson's incoming concern about alienating her students, Ms. Murie was more receptive to incorporating learning from text. Three factors supported Ms. Murie's relative interest and comfort with the learning from text approach. First, she taught at one of the lowest performing schools in the district, whereas Ms. Carson taught at the highest performing school. This meant Ms. Murie's students were likely to have considerably less academic preparation for AP work¹⁰. Second, Ms. Murie was interested in refining her approach to reading; in the interview after the Summer Institute she reflected on her previous experiences incorporating text-based learning:

The first year - eh - I went through the motions but I just didn't feel comfortable at all. The second year I didn't go over it as much as I should have. I did it once and expected the students to continue it and obviously they didn't, or maybe not obviously, but they didn't. (Summer Institute Interview: T532_14_8_5)

Later in the interview, Ms. Murie recalled how a student had surprised her at the end of last year by sharing he thought they had not read enough in her class. Third, Ms. Murie's openness to learning from text seemed to be related to her relatively recent experience in her teaching

⁹ Recall that the 2014 Summer Institute presented a revised version of the PBL-APES curriculum. As described in Chapter 3 (Section 3.4.5), the previous curriculum suggested relevant "literacy strategies" that teachers could use to support text-based tasks. The revised curriculum aimed to eliminate external layers of literacy in favor of a more tightly integrated approach that related all supports directly to learning content from text.

¹⁰ Assessment data reported across the district's schools by the state indicates 63.8% of 11th graders at Ms. Murie's school, Maple High, scored at or above the proficiency level for reading on the annual State assessment test; 81.6% of 11th graders at Ms. Carson's school (Cedar High) scored at or above the proficiency level. See Table 3.2.

certification program's "reading class." That experience led Ms. Murie to ponder during the interview how she might consider integrating strategies from her reading class; she was also considering giving quizzes to hold students accountable for homework reading. This reflection on her teaching suggested Ms. Murie was interested in refining her instructional practices with text when she arrived at the Summer Institute.

Both teachers, then, were looking for a way to "fit" learning from text with their instructional contexts when the KIA team introduced teachers to the revised approach to learning from text on the first day of the Summer Institute. An overview of approximately 30 minutes took place in the morning session; another hour and 15 minutes in the afternoon were spent guiding teachers through the prominently text-based introductory project, *Intro to Sustainability*, which was embedded with learning from text supports. The KIA team modeled how a teacher might orient students to learning from text. Afterward, Ms. Murie commented to the group that the orientation had made sense to her; she understood the need to teach learning from text to students who were not yet convinced reading would be worthwhile: "I think having done this, I feel comfortable with it and I know students in the beginning are like 'argh - why you teaching us how to read?'" It was at this point that Ms. Carson used the phrase "going slow to go fast" in a way that suggested careful orientation to learning from text could avoid the dissonance she had previously experienced when presenting text-based strategies to her students. Rather than presenting such strategies as "remedial" fixes to AP students who did not believe their reading skills needed improvement, Ms. Carson reframed learning from text in the light of rigorous academic skill instruction. Importantly, however, she also suggested it would fulfill what she viewed as a temporary instructional need; once students understood "obvious" learning from text lessons, the class would get up to speed:

I think it's all going to be in the framing, you know. [As though talking to students]: “Well, I know this might seem like it's starting real slow and may be kind of obvious to you, especially that first reading... it's *going slow to go fast*, and that it's going to be a skill that will really help you down the line.” (Summer Institute-APES_PD_14-08-04.2of2; emphasis added)

The phrase was used just once by Ms. Carson during the Summer Institute, yet the idea of explicitly teaching students how to learn from text, and then releasing them to independence, had staying power. Ms. Carson referred to the idea again when interviewed at the end of the Summer Institute, suggesting the concept had resonated with her incoming concern to better align text-based supports to her students' perceptions of AP instruction:

I think it's going to come down to how I phrase it. This is based on last year students who were AP veterans, a lot of them came in with, "I can do all this." I think I really need to sell it as preparing them for college. If I do that they'll buy in *to go in slow and then bearing with that, and then speeding up*. (Summer Institute Interview: T552_14_8_7; emphasis added)

Although Ms. Murie did not specifically reference the “go slow to go fast” approach in her Summer Institute interview, she did describe committing to an initial process that she felt would benefit students over time. Even though she expected students to “rebel” against the PBL-APES reading expectations, Ms. Murie said,

I'm hoping that the first project [Intro to Sustainability] can really bring them in and be engaging enough to where they'll want to see it [learning from text] through. [...] And *I want to stick to the reading [supports]* because I think in the end, in the second semester it will create stronger readers. (Summer Institute Interview: T532_14_8_5; emphasis added)

Whereas Ms. Carson tended to emphasize the goal of “speeding up” for her academically prepared AP students, Ms. Murie forecast a more generous timeframe for supporting learning from text when she imagined better readers by second semester. Both teachers, however, committed to early and explicit orientation to learning from text.

Independently, when school started two weeks after the Summer Institute, both Ms. Murie and Ms. Carson oriented their students to text-based learning with a stated emphasis on their commitment to explicitly teach and practice working with texts. This conceptualization of learning from text was directly conveyed to their respective students, and informed enactment in both their classrooms, as documented through classroom observation evidence. Both teachers carefully tuned their learning from text orientation to encourage buy-in from their students; they each stressed college readiness and disciplinary expectations, such as considering multiple sources of information and sharing ideas. When introducing the first text, a section from the textbook about the nature of Environmental Science, Ms. Carson put it this way to her students:

So what I have for you is a page out of our Environmental Science textbook. Before I give you reading to do at home, I think it's important that we collectively think about how to best read college level texts. [...] So, what I'm going to do is model and use some annotations that I am going to encourage you to use as we go through the year to develop college-level reading skills. Because reading the textbook is very different from reading in a novel, as I'm sure you've experienced.

So although this might seem kind of elementary at the start, *we're going slow now* because as the course progresses you're going to be expected to do more reading independently at home and I want to make sure you're doing it with an end goal in mind, OK? (CO_E1_V_APES_T552_PD3_14-08-28; emphasis added)

During five subsequent focal classes (three in Intro to Sustainability, one in EcoFootprint, and one in My Community Ecology), Ms. Carson explicitly oriented her students to learning from text by reading text aloud to model her thinking, by modeling metacognitive annotation strategies, and emphasizing the ways learning from text would be useful now, later in the project, and in the future. To demonstrate that learning from text was indeed serving a valuable purpose, Ms. Carson followed readings with immediate opportunities for application. For example, after the reading introduced above about the interdisciplinary nature of Environmental Science, she asked students to come up with an environmental issue that required multiple disciplines, as

suggested in the curriculum. To remind students of the long-term benefits of strategic reading, Ms. Carson related learning from text to college readiness: “Remember, one of the goals of the course is to help you be ready for college so you are successful. You'll be the killer freshman in college because you'll already have college reading down.” Ms. Carson also reiterated that her learning from text approach was purposefully paced and would soon lead to independent work: “*we're going slow now*, but in a few weeks here, you're going to be doing a lot of this at home on your own -- and you don't want to give up your social life to do it” (CO_E1_V_APES_T552_PD3_14-09-2_C5; emphasis added).

Across the district at Maple High, Ms. Murie began her second PBL-APES class of the year by stating “I’m going to take a little time to teach you how to read.” She also emphasized college preparation, sharing her own college experience, where she felt “up a creek without a paddle” without strategies for reading effectively. Ms. Murie related that part of the problem was that college level books, like the PBL-APES Environmental Science textbook, had “so much information in them.” She then assured students, “I’m going to teach you how to dissect some of this information.” When she introduced the reading on the nature of Environmental Science, Ms. Murie explained:

I am going to read it out loud to you. I hope I’m not offending you, offending your intelligence. I’m going to model your thought process while you’re reading this. When we get to the next reading I’m going to ask you to do some reading on your own in order to gather information, so just bear with me. *We go at this at a slow pace for right now*, so when I ask you to do it on your own you’ll be confident enough that you can do it at a fast pace. *We have to learn how to crawl before we walk. We have to learn how to walk before we can run.* (CO_E1_V_APES_T532_PD5_14-08-27_C5; emphasis added)

Like Ms. Carson, Ms. Murie strategically oriented students to learning from text in the first weeks of school and across the three projects. Also like Ms. Carson, she consistently emphasized how learning from text was put to use in classroom activities and discussion, ensuring that she made explicit connections between the learning goals, what students were reading, and how that

learning would be useful to them.

This was not necessarily easy or natural for teachers. For Ms. Carson, the initial learning from text approach competed with her concerns about pacing and the importance of covering content before the AP test. As she put it during the first collaborative team meeting: “time is always a-ticking” (CTM1_PD_V_APES_DMPS_14-09-03). When students were engaged in pair-reading a lengthy article about Easter Island in the first project, she described her challenge moderating students who read at different speeds and annotated with different levels of proficiency. In addition, Ms. Carson was concerned not all students felt the activity was representative of AP rigor, and she was frustrated that students were not all in the same place in the text. As a result, Ms. Carson said she considered sending the reading home for homework, but she decided against it. She recounted to her colleagues in the first collaborative team meeting that she explained to the students that in order to stick to her “go slow to go fast” approach, they were going to read the article together in class. Ms. Carson reflected on how she felt compelled to address any potential student concerns that her approach to text-based learning would not equate to expected AP rigor:

Especially today's block: I could tell [reading] wasn't the highlight of the day -- but because we're *going slow now to go fast later*. And I tried to stress: ‘You don't have homework just now, but that's not the way it's going to be.’”
(CTM1_PD_V_APES_DMPS_14-09-03; emphasis added).

Ms. Murie did not specifically reference the “go slow to go fast” approach in this first collaborative team session (in fact, after reading a majority of the Easter Island article in class she had assigned a portion of reading for homework), but she shared that she felt good about both pacing and the learning from text approach after spending two days in class modeling, and then reading and annotating the article with students.

In the classroom, both Ms. Murie and Ms. Carson kept their commitment to the “go slow” approach by reading all texts in the first project, Intro to Sustainability, in-class (with the exception of a one-page reading suggested as homework) and leveraging the embedded curricular supports to emphasize the use of text. When transitioning into the second project, EcoFootprint, they began to release some responsibility, as promised, to their students. But they ensured the process was gradual. For example, both teachers followed the curricular suggestion to read the first portion of a reading about energy sources in class, and then sent the second portion (on the extraction and use of coal) home for homework. Both teachers then put that reading to use in the next class with a homework application task and discussion. Late in EcoFootprint, Ms. Carson assigned multiple reading assignments at once as homework due to scheduling issues that reduced the number of classes she had with PBL-APES; she followed the large reading assignment with a quiz.

When they reached the third project, My Community Ecology, both teachers again demonstrated awareness of new learning from text demands as the project and its text-based tasks changed. For example, they both worked extensively with initial readings in-class, regardless of whether students read the texts for homework or in-class. Ms. Carson and Ms. Murie oriented students to the texts (two local articles making arguments for and against the proposed development site) in order to frame and launch the new project. Table 4.9 demonstrates the teachers’ consistency of supporting learning from text in their respective classrooms across the data points.

Table 4.9. Teaching with Texts: Enactment data for Ms. Carson & Ms. Murie

	PBL-APES Texts in selected focal lessons	Ms. Carson	Ms. Murie
Aug-Sept	Intro to Sustainability texts: 1. What is Environmental Science? (Textbook section; 1 p.) 2. Easter Island videos (BBC: Intro videos) 3. Easter Island article (Jared Diamond, book excerpt; 8 pp.) 4. Easter Island revision: Hunt's hypothesis (Textbook, 1 p.) 5. Paper or Plastic? (WA Post graphics-based article; 2 pp.)	ITS enactment 1: in class 2: in class 3: in class 4: HW & application 5: HW & in class review, application	ITS enactment 1: in class 2: in class 3: in class 4: HW & application 5: in class
Sept-Nov	EcoFootprint texts: 1. Sources of Energy (textbook section #1) 2. Coal (textbook section #2; 3 pp.) 3. Waste: Fresh Kills case study (1 st textbook section; 2 pp.) 4. Waste: Municipal management (2 nd textbook section; 8 pp.)	EF enactment 1: in class 2: HW & application 3: in class 4: HW (quiz)	EF enactment 1: in class 2: HW & application 3: in class 4: HW & application
Nov-Jan	My Community Ecology texts 1. Pro/Con articles (2 local articles; 4 pp.) 2. Benefits of Biodiversity (textbook section; 5 pp.)	MCE enactment 1: HW & application 2: HW & application	MCE enactment 1: in class 2: HW & application

In addition to the orienting students to the texts, both teachers viewed and implemented note-taking tools (called *Note-Taking Tools* in EcoFootprint, and referred to as the *Field Notebook* in My Community Ecology) as deeply text-related tasks that necessitated the same kind of orientation as text-based tasks. One illustrative example of this occurred during the December collaborative team meeting when Ms. Murie described her approach to the Field Notebook in My Community Ecology for approximately ten minutes, a notably lengthy turn of talk for the team meetings. Ms. Murie shared how she modeled setting up and using the notebook to bring together students' site data and research: "every single time I referenced the Field Notebook, I was writing along with them, so they could see. I was kind of modeling." She also shared how she conveyed its usefulness for the long-term goal of the final project: "I told them they'd be referencing this a lot, coming back to this a lot" for the final project products (CTM4_PD_V_APES_DMPS_14-12-10).

Looking across Ms. Murie and Ms. Carson's interviews, classroom enactment, and contributions in the collaborative team meetings reveals a strong continuity in their approach to strategically orienting student to text-based tasks. The way both teachers engaged with texts and note-taking tools in the second and third projects demonstrated how they returned to modeling and working through text collectively when projects introduced new tools and tasks. Taken as a whole, this suggests that "going slow to go fast" was perhaps an inaccurately coined term in that it came to represent a more durable and elastic approach in Ms. Carson and Ms. Murie's teaching beliefs. By the end of the third project, My Community Ecology, both teachers understood that slowing down to explicitly teach and scaffold learning from text was an ongoing process that required adaptation and practice whenever text-based tasks and goals changed.

Both teachers reflected on their enaction of orienting students to text in the interviews after EcoFootprint and My Community Ecology. Ms. Carson noted that her purposefully framed orientation had worked as intended to "sell" students on the approach: "You know, I sold the 'interrogate the text, and this is different from other reading that you've done.' And they were prepared to go slow at the start." Yet Ms. Carson was also "sold" too; whereas she had been wary possible student pushback to text-based learning, she now believed that orienting students to those tasks had served a larger goal of acclimatizing students to the role of text in PBL-APES. Ms. Carson thought "going slow" had developed readers who understood the reading they did would be used in class: "[In My Community Ecology], we could pick it up a bit, because we worked on EcoFootprint very deliberately and slowly. Now, they know they have reading to do, so... 'Get it done!' [And] we still do a little bit of reading in class." Although she may have initially thought she would be done orienting students to learning from text after modeling and providing in-class reading in the first project, in actuality, Ms. Carson oriented students anew in

each project, a move that frequently involved reading texts during class. Over three projects, this experience helped Ms. Carson develop a new value for reading in class; whereas at the beginning of the year she talked frequently about pacing concerns, after the third project, My Community Ecology, her perspective on reading in class was no longer described as a burden on her instructional time. When asked why she still spent time reading in class, her answer conveyed value for collectively approaching new content, for ensuring students learned from text, and awareness that reading had become part of her classroom routine: “It makes sense [...] I think, at [the beginning] of the project, it's a good thing, too. Perhaps some in-class discussion; and then, at least you know they did do their reading, too.” Rather than viewing learning from text as something that happened primarily at the beginning of the year, Ms. Carson now conveyed a belief that learning from text “is helpful” for students, explaining that they now expect to use texts for learning: “I think they get that [learning from text]’s an important thing to do now” (Post-MCE Interview: T552_15-01-27).

Ms. Murie felt similarly and her comments also reflected the durable view that orienting students to text was important. Despite using the phrase “go slow to go fast,” in actuality Ms. Murie was still providing consistent learning from text scaffolding. By the end of the third project, she still regularly did short readings in class, usually to prepare students for homework reading: “I still make sure we do some of it together. I do plan to continue on with that” (Post-MCE Interview: T532_15_2_6).

When asked after the third project, My Community Ecology, what she would change about the learning from text approach, Ms. Murie responded, “After teaching it three years now I see... Okay, that makes sense. We really do have to start slow to go fast” (Post-MCE Interview: T532_15-02-06). Later in the interview, when asked what she thought about the level of learning

from text support provided to her students, Ms. Murie remembered reminding students in the beginning of the year when they were “going over it very slowly that they have to realize that they’re reading out of a science textbook and it’s not going to be as easy as they think it will be.” Midway through the year, she thought students had “a better grasp of what they’re expected to do when they read” and are having “an easier time getting through the material.” This reflective perception of how orientation leads to improved student-learning links Ms. Murie’s enactment to her beliefs. It also appears to be the actual meaning of “going fast” for Ms. Murie, rather than the implied independence of the literal phrase. Ms. Murie recalled a recent in-class reading experience to ground her belief that orienting students to text-based tasks had benefited students by imparting support and value for learning from text:

I was able to ask them questions that were suggested in the lesson and then they were just popping off the answers left and right so it was like, “Okay, you guys got the argument. You understood exactly what you read. Let’s move on.” I think it has helped them, maybe not all 100%; there are still some people here that struggle with the reading. But I think for the most part, no one has slammed a book on the floor and walked out. I think we’re good. (Post-MCE Interview: T532_15-02-06)

Both Ms. Murie and Ms. Carson credited the productive and integrated nature of learning from text in their classrooms to the explicit orientation they had provided for text-based tasks. By the end of the third project, My Community Ecology, they had not gone slow just once at the beginning, nor did they eventually arrive at an ideal cruising speed. When teachers started out “slow” to teach learning from text, they developed students who expected and knew how to learn from text; perhaps more importantly, Ms. Carson and Ms. Murie knew how to flexibly adapt and to slow down whenever they felt texts or tasks would benefit from more support.

4.1.2 *Absence of an Orientation to Text-based Learning*

The previous section described how Ms. Murie and Ms. Carson believed it was important to explicitly orient students to text and maintain responsive support for learning from text. While much of the KIA approach to text was launched with orienting moves, learning from text cannot happen without the core activity of reading itself and practice with the approach. What happens to learning from text when teachers enact only some aspects of the learning from text approach? Data from Ms. Hunter and Ms. Earle's practice provide two very different answers to that question. In the remainder of this section, I explore how the durability of the two new teachers' pre-existing beliefs and practices influenced their approaches to text-based learning. First, I describe how Ms. Hunter committed to reading in class but provided her students with limited orientation to learning from text. Second, I examine how Ms. Earle's approach to learning from text eventually sidestepped both orientation and reading altogether.

Ms. Hunter: A procedural approach provides limited orientation to text

Analysis of Ms. Hunter's classroom observations and interviews suggested her belief that students were independently capable of making sense of text and her unfamiliarity with the curriculum largely supported a procedural enactment of text-based instruction that emphasized in-class reading and led to limited orientation to text. To this end, Ms. Hunter followed the curriculum's suggestions to read all texts in class throughout the first project and then continued to assign in-class reading for nearly all texts during the second and third projects. Ms. Hunter attributed her decision to "stay pretty on the curriculum" to her unfamiliarity with the overall course. She described the beginning of her year as "feeling insane" and "hectic" due to the demands of teaching three different courses. Ms. Hunter also commented in both post-project interviews and the December collaborative team meeting that she was preparing "day-by-day,"

without much time to prepare for texts, or for reflection or adaptation: “Even though things are written and prepared for me outside of the classroom, it takes a lot of preparation just to understand what the kids are doing” (Post-EF Interview: T543_14-11-3; Post-MCE Interview: T543_15_1_30). Compounding matters, Ms. Hunter felt her background knowledge of environmental science was insufficient for teaching PBL-APES.

Ms. Hunter’s students read frequently in class. I hypothesize this approach supported Ms. Hunter’s limited understanding of the PBL-APES curricular trajectory and the content covered within it in two ways. First, reading in class solved compliance issues after students demonstrated to Ms. Hunter that they would not read for homework: “I’m having a really tough time with kids actually doing the reading unless we are in class and I’m walking around watching them read” (Post-EF Interview: T543_14-11-3). Second, in-class reading supported Ms. Hunter’s need to minimize her preparation for teaching unfamiliar content; classroom observation evidence of her discussion facilitation after students read in class suggested she was not familiar with the content of many of the texts students read in class.

Ms. Hunter approached text-based learning with limited orientation to the reasons *why* or *how* students should read. Although the curriculum provided suggested purposes for reading, she rarely conveyed reading purposes to her students. Again, this seemed related to Ms. Hunter’s lack of familiarity with the curriculum arc and the materials, in combination with her inexperience using texts in general. In short, her capacity to orient students to text was limited because she was in the midst of so much learning herself that she did not have the capacity to engage with the learning-from-text approach. With the exception of two lessons in the second project, EcoFootprint, where she established clear purposes by reading directly from the curriculum, Ms. Hunter was typically vague about what she expected students to learn from text.

For example, when Ms. Hunter oriented her students to the first learning from text opportunity in the course, the textbook section on the nature of Environmental Science, she did not explain why students should read, although the text would potentially confirm or expand on a class brainstorm they had just conducted about the discipline of Environmental Science. Rather, Ms. Hunter provided a procedural approach (i.e., highlight or checkmark “super important” information; mark questions) for the general goal of “having an idea of what you read,” but she did not provide a conceptually driven reason to read, such as the one suggested in the curriculum. Nor did she demonstrate how one might go about reading a text in this way nor how students would know that an idea was “super important.” What follows is the entirety of Ms. Hunter’s first orientation to a text-based task for her students; after this point, she oriented students to texts in this project with even less detail:

I gave you an article. It's about Environmental Science and what it entails. Please read through this.

A couple strategies to read through it, you guys... If you think something is super important, you can highlight it. Please don't highlight the whole thing; that's not going to help you.

OK, you can highlight. Or you can put a checkmark by it. This isn't a suggestion. I want you to actually do this. If you have a question: you don't know a word, you're like, “I don't know what that sentence means,” please put a question mark by it.

I do this because when I was-- even now, I read though stuff, especially educational type things and I'm like *blah de blah blah*. I read through it and I'm like wait; I didn't actually just read any of that. I have no idea what that just said.

So if you can take the time to actually process it: You're like, yes OK, I understand that, it's probably important; check. Or I really don't know what they're talking about here: question mark. It'll help you not read for no reason.

It will help you internalize the meaning of the article. OK, so go ahead and read that. You have 10 minutes left.

(CO_E1_V_APES_T543_PD2_14-08-26)

Although Ms. Hunter provided limited orientation to reading tasks, she did provide regular reminders for annotating and she conveyed support for students who were tasked with what she viewed as an effortful assignment. Even though she rarely clarified the content students should take away from a text, she consistently requested that students read to understand: “So read slowly, read to comprehend. Highlight. Star. Put some question marks in there if you don’t understand.” Ms. Hunter also conveyed she would support students by providing sufficient time for reading, explaining how her own experience as a “slow reader” had sensitized her to the potential pressures of in-class reading. During the first collaborative team meeting, Ms. Hunter stated her belief that her students were capable of reading independently; they just needed enough “encouragement”:

With my kids it just takes encouragement for them to do it. I tell stories of how I'm not the greatest reader and how this would help me. I think that they see why it's important, but it may be just a laziness factor... Actually just picking up your pencil and doing it takes a little bit of encouragement. (Skype1_PD_V_APES_DMPS_14-09-03)

Evidence from classroom observations, however, suggested Ms. Hunter’s students needed more support for approaching text-based tasks. For example, after Ms. Hunter gave the orientation referenced above, the following exchange occurred as students independently read the textbook excerpt about the nature of Environmental Science:

Ms. Hunter: [To table group]: What do you think, guys?
 Maya: I don't know. I don't understand this article.
 Ms. Hunter: Are there certain parts, or the whole thing in general?
 Maya: I can't read it because it's boring.
 Ms. Hunter: Uh yeah -- that happens [cheerful tone]. What are some things you highlighted to help draw out...?
 Derrick: All these. [Points to Maya’s highlights]
 Ms. Hunter [Looks at Maya’s page]: So how they interconnect with Environmental Science... You have "How earth's natural systems function and how humans influence." That's a big thing: Humans influencing.
 [Ms. Hunter walks away to the next group]
 (CO_E1_V_APES_T543_PD2_14-08-28)

Although Ms. Hunter interacted with her students with the intention to support them, it is not clear that encouragement was sufficient for ensuring purposeful reading or comprehension. Her assistance in this case missed an opportunity to provide a reason why Maya should persist in reading a difficult text, or how she might understand why the sentence she highlighted was important. Provided sufficient class time and encouragement, however, Ms. Hunter's students read the majority of texts in class throughout all three projects.

As the previous example suggests, Ms. Hunter's orientation to text-based tasks was also limited by her developing understanding of what it meant to learn from text, for both teachers and students. Despite Ms. Hunter's philosophical embrace of project-based learning, her belief that the readings were "applicable and necessary for the kids to understand" was not linked to a clear understanding of *how* students would learn from text or what kind of supports would benefit them in that process ((Post-MCE Interview: T543_15_1_30; CTM4_PD_V_APES_DMPS_14-12-10). In an interview after the third project, My Community Ecology, Ms. Hunter conveyed that she primarily supported her students with understanding "vocabulary [that's] a little above their heads" and by providing additional examples when needed (Post-MCE Interview: T543_15_1_30). Beyond that, she expected students were able to (as she described the learning process) "extract" what they needed from text. Evidence from classroom observation data of Ms. Hunter giving instructions to students suggests she believed they were capable, on their own, of making sense of unfamiliar concepts and determining the relative importance of information they were asked to read. When students did ask for help with learning from text, she encouraged students to work harder to understand the material independently. The following exchange is representative of how Ms. Hunter responded when students needed support for productively interacting with text:

Ms. Hunter: If you don't know what we're talking about look at your articles.
 Dmitri: Hey, we don't know
 Ms. Hunter: Look, my friend, do some checkmarks, some highlights...
 Dmitri: They lost all their resources. That's all we know...
 Ms. Hunter: So your partners have that already.
 Derrick: We don't know anything else.
 Ms. Hunter: [exasperatedly] Then start reading!
 Dmitri: There's nothing else.
 Ms. Hunter: Help yourself! [Ms. Hunter leaves the group]
 (CO_E1_V_APES_T543_PD2_14-09-04_C5)

Multiple interactions of this nature suggested Ms. Hunter did not provide additional support, even when students indicated they did not understand texts. Based on available evidence, I cannot determine whether Ms. Hunter chose to emphasize independent sense-making in accordance with her belief that students were capable or whether she was unaware of how to help students engage with, and learn from text, rather than simply mark it up.

Regardless, Ms. Hunter's commitment to in-class reading persisted. When her students were assigned to read (individually, or in pairs), class observation data indicate her students typically settled down to read texts. Ms. Hunter described what one text-based lesson looked like:

[T]hey read a small, little case study [...] they were cleaning up a landfill and they were going to turn it into a park. We did the economical, social, environmental aspects of that. Then, the next part was supposed to be homework, so I had them reading. That's where class ended. [...] So it was reading, discussing, then reading. (Post-EF Interview: T543_14-11-3)

Despite Ms. Hunter's worries at the beginning of the year that her students would resist reading, her classroom was frequently marked by long, quiet periods of reading where nearly all students focused on the texts in front of them, highlighting and writing on sticky notes, usually without complaint. A key takeaway from Ms. Hunter's enactment of learning from text is that regular reading appeared to develop student stamina and expectations for reading: "As soon as they can

get their cell phones away and stop chatting about basketball and all that stuff, it calms down and turns silent after a few minutes” (Post-MCE Interview: T543_15_1_30).

Table 4.10 compares the consistency of Ms. Hunter’s in-class reading with Ms. Earle’s text-based enactment in their respective classrooms across the selected data points. The same table with Ms. Carson and Ms. Murie’s enactment data (Table 4.9) showed the experienced teachers selectively oriented students to texts and released responsibility to students over time; I presented evidence suggesting this approach was supported by the teachers’ durable belief in the value of explicitly teaching students how to engage productively with texts.

Table 4.10. Teaching with Texts: Enactment data for Ms. Hunter & Ms. Earle

	PBL-APES Texts in selected focal lessons	Ms. Hunter	Ms. Earle
Aug-Sept	Project 1: Intro to Sustainability texts: 1. What is Environmental Science? (Textbook section; 1 p.) 2. Easter Island videos (BBC: Intro videos) 3. Easter Island article (Jared Diamond, book excerpt; 8 pp.) 4. Easter Island revision: Hunt’s hypothesis (Textbook, 1 p.) 5. Paper or Plastic? (WA Post graphics-based article; 2 pp.)	ITS enactment 1: in class 2: in class 3: in class 4: in class 5: in class	ITS enactment 1: HW & in class review 2: in class 3: HW & in class review 4: HW (no review) 5: in class
Sept-Nov	Project 2: EcoFootprint texts: 1. Sources of Energy (textbook section #1) 2. Coal (textbook section #2; 3 pp.) 3. Waste: Fresh Kills case study (1 st textbook section; 2 pp.) 4. Waste: Municipal management (2 nd textbook section; 8 pp.)	EF enactment 1: in class 2: in class 3: in class 4: in class; finish as HW	EF enactment 1: copy chart only 2: copy notes / lecture 3: answer 2 Qs, compile class answers 4: answer 2 Qs, compile class answers
Nov-Jan	Project 3: My Community Ecology texts 1. Pro/Con articles (2 local articles; 4 pp.) 2. Benefits of Biodiversity (textbook section; 5 pp.)	MCE enactment 1: in class 2: in class	MCE enactment 1: HW & brief review 2: Use textbook index to find terms

In contrast, Table 4.10 depicts how the new teachers demonstrated very different approaches. As described in the previous section, Ms. Hunter did not orient students to text, nor did she support them to read independently outside of class. As noted earlier, her procedural approach may have been influenced by her belief that students were capable of reading independently and further reinforced by her unfamiliarity with the curriculum. Her procedural implementation lacked many

embedded supports for text-based learning, including orientation to text. Ms. Earle demonstrated some initial enactment of the text-based approach, including limited orientation to text-based tasks. After the first project, however, Ms. Earle rarely expected students to engage with text. I explore what influenced her decisions in the next section.

Ms. Earle: An Approach to Avoiding Text

Ms. Earle also provided limited orientation to her students. A key difference between her enactment and Ms. Hunter's, however, was that she imbued her orientation with the sense that it would continue to inform interactions with text in her classroom. What, then, influenced Ms. Earle to abandon text? First, I describe how she oriented students to text and then I examine evidence of Ms. Earle's beliefs that appear to have outweighed her consideration of the learning-from-text approach.

During learning from text opportunities Ms. Earle oriented students more to tasks and tools than to reasons why they were learning the content at hand. As was noted with Ms. Hunter, this was likely influenced by Ms. Earle's unfamiliarity with how the texts fit into the course and student learning. For example, Ms. Earle sent students home with the textbook section on the nature of Environmental Science with the assignment to record their thinking before and after reading. She did not explain why the class was thinking about the nature of Environmental Science and minimized the role of text by suggesting the source of student knowledge was not of importance:

So we're going to have a chat. So with your crews, try to figure out the best definition [of Environmental Science]. Like what I said on Tuesday, it can be from the reading, from your head, a combination of both... doesn't really matter.
(CO_E1_V_APES_T513_PD4_14-08-28)

Later in the lesson she highlighted key terms (*environment, sustainable, interdisciplinary*) but did not refer to their use in the text; throughout the following application task, the text remained peripheral to

student learning. Likewise, when getting students prepared to watch introductory videos on Easter Island, Ms. Earle oriented students to the note-taking tool, but not to why they were learning about the case study of Easter Island.

By the time Ms. Earle arrived at a long, difficult article in this project, she provided more direct guidance on why students were reading and clearly oriented them to a strategic approach for using metacognitive annotations (checkmarks, question marks). In addition, Ms. Earle described strategies embedded in the text itself, such as chunking: “The star is really there to be like ‘take a break.’ Stop reading for a second and think about it, process it. See if you can answer any questions.” She noted to students that such strategies would have “helped [her] a ton” in high school and college, where Ms. Earle told students she felt she lacked strategies and thus avoided reading assignments because she “hated” reading. Although she empathized that students might feel the strategies as “tedious,” she asked students to view them as important for test preparation. This suggests Ms. Earle might not have grasped how the strategies were intended to support understanding the text, rather than distilling content:

All this is doing is so you don't have to keep flipping back and forth between all of your pages. It's as you read through it's reminding you where it is, to help answer the question, so then you can go back into the tool and actually write it. I know right now you're probably like "This is so much more work, can I just read it and then just answer the questions?" No. The reason is, I want you to get good at these strategies so that when you're given a reading on the AP test, or even on any of my tests, because there's going to be readings on them, that you have a way to tackle it without stressing yourself out.
(CO_E1_V_APES_T513_PD4_14-09-02_C5)

Immediately after this lesson, Ms. Earle shared her internal conflict about the annotation approach, stating that although neither she nor the students were “big into using reading strategies” she could see “the benefit behind it.” While Ms. Earle reported suggesting similar strategies in her work as an intervention specialist, she expressed little conviction that she or her students would actually take up this kind of text-based approach. Her doubt suggests she may have needed more support understanding the role of such strategies in science texts.

When Ms. Earle led a discussion of the lengthy Easter Island article in the following class, her process emphasized reviewing key points in the text, which aligned with her interpretation of how the annotation strategies were to function. Students raised several text-based questions and issues; at times students challenged Ms. Earle's initial interpretation of the text and at other times they actively marshaled additional information to make sense of the text (for example, Googling the size of their city and population to compare it to Easter Island's size and its suggested population after Ms. Earle had compared it (inaccurately) to Rhode Island). Although Ms. Earle appeared to take such student challenges in stride, she gave little airtime to students' text-based contributions or questions that could have productively engaged the class, and continued to review main ideas; it is possible this experience further emphasized her unfamiliarity with text-based learning or her limited knowledge of the texts. As an opportunity to orient students to text-based learning, however, Ms. Earle's enaction reflected interest and effort in working with text. In fact, by the end of the first project, Ms. Earle referred to the work they had done over six block periods as "getting you comfortable with reading texts, talking to people, sharing your opinion" (CO_E1_V_APES_T513_PD4_14-09-10_C5). Yet the energetic interactions that had been fostered by text were apparently in tension with what Ms. Earle believed students needed to learn about content.

After the first project, in interviews and the collaborative team meetings throughout the rest of the analysis period, Ms. Earle repeatedly reported that taking a text-based approach was not appropriate in her classroom because her students were ultimately not capable of reading:

The question marks and check marks, that's not helpful, purely because my kids don't do a lot of reading outside of class, and they do reading very poorly. Really, when I give the assignment, it has to be very specific. They don't really like, okay, look at this big generalized question and see what little bits I found to help answer this question. They need much more of a specific... like I'm looking for *this* answer. Which I realize is not necessarily the best way to go about reading, but if it's too broad, I found that they

completely shut down. I've had to modify that one out. We can't do a whole lot of reading, like big chunks of reading, in class at a time, because they get really, really, really burned out. That's a struggle. Post-EF Interview: T513_14-11-3

Despite initial experimentation with the learning-from-text approach, Ms. Earle's belief that recall activities and minimal reading supported students led to a departure from the PBL-APES texts in the next project. First, she introduced the Princeton Review AP prep book, from which she began to routinely assign homework reading and vocab that was to be done entirely outside of class and was assessed every other week by a teacher-developed quiz. Ms. Earle acknowledged that poor scores were "bringing a lot of kids down and opening their eyes, but they're not willing to change it." On one hand, Ms. Earle said "I don't even believe this is super-rigorous, but I'm not going to make it any easier for them." On the other she described providing reading guides that "basically hand them all the answers" (Post-EF Interview: T513_14-11-3).

Content learning in the second and third projects were handled with none of the focus on using texts or the approach to strategic reading that Ms. Earle had briefly presented in the Intro to Sustainability. For one reading, students were asked to copy down a chart of energy sources: "We're going to figure out how humans make and create energy. We don't have a ton of time left, so what I want you to do -- instead of reading it -- I just want you to write this chart in your notebook" (CO_E1_V_APES_T513_PD4_14-09-18_C5). For another EcoFootprint reading assignment, Ms. Earle created "very specific" questions from the text that she described as "read and find the answer style." She then asked students to enter their answers on a padlet, "basically like an online bulletin board. It's pretty cool. Instead of me having to lecture all their notes, they created their own lecture" (Post-EF Interview: T513_14-11-3). To students that day, she explained that she converted the original "death-boring" lesson into something "more exciting" for them. Her instructions also emphasized the rote nature of the task:

Just go get a book. I pulled it straight from like four pages. The ones that are right there: 631-634. If it's a vocab word, you're just defining it, if it's asking for a list, give a mini list. Put it in the padlet... [...] So your notes turn into OUR notes. That's the goal.
(CO_E1_V_APES_T513_PD4_14-10-29_C5)

The variety of approaches Ms. Earle used appeared to be driven by her belief that students needed learning to be novel and exciting; she explained including a video from “Hoarders” that she thought would interest students because “I don’t see a lot of them being super excited about the content that we’re covering” (Post-EF Interview: T513_14-11-3).

By the time Ms. Earle began teaching My Community Ecology, she had established a habit of presenting hand-written lecture notes on the document-camera to students rather than working with text in class. She initially described the approach as the most effective route to covering content:

The biggest bang for my buck information-wise would be this sort of route [note taking]... because I can get kids 100% engaged, even the ones who don’t want to participate are all writing it down. When I ask them to read, I can see ... there are a variety of kids, but some of them don’t even flip a page. They get it, but they’re not there yet. (Post-EF Interview: T513_14-11-3)

In December, Ms. Earle reported to her colleagues that, “My kids really, really appreciate my handwritten notes” (Skype4_PD_V_APES_DMPS_14-12-10). However, her comment did not resonate with her fellow teachers; the collaborative meetings conveyed that Ms. Earle was alone in her dissociation from text.

After teaching My Community Ecology, Ms. Earle described in an interview that her approach to text had become an “internal struggle that I’m still in.” On one hand, she wanted to teach PBL-APES content and prepare her students for the AP test, but on the other she doubted they were capable and leaned on strategies that she suspected were not on par with AP preparation, nor with the PBL-APES course:

I feel like if it’s something that I’m going to have to test them on or if I’m going to have to score

them on, I have to cover it, I have to explain it. I can't just rely purely on what they've read in class and hope that it went well. I've found success giving them the guided specific questions to look for and I realized that it's slightly elementary like a hunt and peck kind of find, but it gives them the background of something that they have no background on. (Post-MCE Interview: T513_15_2_5)

Although Ms. Earle continued to experiment with different approaches to keep content learning novel in My Community Ecology, her primary approach was to convert text into “the old school traditional route” of lectured notes: “I try to spoon-feed it because my goal is for them to understand the content” (Post-MCE Interview: T513_15_2_5).

Ms. Earle struggled to accept this lecture-based practice that she “disliked” even though she quickly justified it based on students’ abilities and lack of experience with academic texts. When reflecting on the reading support she provided, Ms. Earle considered that learning from text might have needed more time to develop for both her students and herself:

My kids, granted, I only did it for the first couple of readings way at the beginning of the year, they didn't really seem into it and maybe that's because I was not delivering it well. Because I guess I was a little unsure with it, even going into it, or it could be the fact that they are just bad readers...

Ms. Earle went on, considering an approach that would ask more from students. But then she reflected, “I don't know if I'm ready to implement that quite yet. I think I have to get a little bit ahead of my pacing if that's going happen” (Post-MCE Interview: T513_15_2_5). Like Ms. Hunter, Ms. Earle repeatedly emphasized the challenge of learning new curriculum and a new curricular approach in interviews throughout the three projects: “What really stuck out to me was just my lack of knowledge in that material. I feel like [my instruction] could have been so much better and I put 100% blame for that on myself” (Post-MCE Interview: T513_15_2_5). Navigating unfamiliar curriculum clearly had an impact on Ms. Earle's instruction, and—as with Ms. Hunter—she drew on her beliefs about students in order to make sense of the curriculum and its content.

Although Ms. Earle's driving goals appeared to be content coverage and keeping students

interested, she had actively, albeit briefly, experimented with text-based learning before going back to more traditional interactions with content, even going so far as to orient her students to a process she had implied would serve them well. This underscores both the stability of teachers' beliefs in how students learn and Ms. Earle's lack of confidence in her knowledge of the content. What would it have taken for Ms. Earle's experience in the beginning of the year to convince her students were capable and interested in grappling with texts? There certainly was evidence from an outside perspective, but it was not sufficient for Ms. Earle. It seems the combination of Ms. Earle's unfamiliarity with the content, her need to "get ahead of her pacing" to understand the larger curricular scope, and her steadfast belief that students need to be "spoon-fed" ultimately led her to shelter students from opportunities to learn from text.

4.2 READING PURPOSES MATTERED: DIFFERENCES BETWEEN EXPERIENCED AND NEW TEACHERS

Data from classroom observations suggests that teachers who set clear, conceptually driven purposes for reading were able to facilitate productive learning from text opportunities to accomplish a content-driven task. On the flip side, data collected in this study suggested that use of text was not productive without an established purpose. By "conceptually driven," I mean here that teachers articulated (or invited students to consider) both the content-based goal for reading *and* how that learning related to the larger project's driving question and/or culminating product, such as a family proposal (EcoFootprint) or an impact statement (My Community Ecology). In other words, conveying a conceptually-driven purpose required that teachers understood the role of learning particular content from text. Usually this purpose setting was accomplished within broader framing that described how the reading fit into what students had just done and how it would productively lead to what they would do

next¹¹. When enacted, the articulation of a conceptually driven purpose seemed to ground both teachers and students in reading that led to productive discussion and application opportunities of the text-based content; illustrative examples will be provided in the next section. Evidence from interview data demonstrates that teachers who set clear purposes viewed this element of learning from text as a necessary and meaningful pedagogical move. Teachers who intermittently established reading purposes were also able to set the stage for productive learning from text, but did not take up purpose setting as a valuable move that supported student learning.

Teachers familiar with the curriculum, Ms. Carson and Ms. Murie, consistently framed learning from text within the course and almost always set clear, conceptually-driven purposes for reading. The few instances when they did not set clear purposes aligned with new elements in the curriculum, suggesting there is a relationship between understanding how learning from text fits into a larger curriculum sequence and purpose setting. Importantly, however, both experienced teachers expressed in interviews and to their students the belief that purpose setting supported student learning. The section that follows provides examples of this. After that, I present evidence from Ms. Earle and Ms. Hunter demonstrating what purpose setting looked like in their interviews and classrooms.

4.2.1 *Beliefs and curricular knowledge support purposes*

Ms. Carson and Ms. Murie saw purpose setting as important and this belief came through in interviews and in their classroom practice. Ms. Murie reflected in her interview after the Summer Institute that she suspected tackling the challenges she had previously encountered with reading would benefit from setting purposes: “I'm going to have to really let them know, this is the reason why you're reading this. [...] No, you're not reading the whole chapter. You're reading

¹¹ Suggested framing statements and reading purposes were both embedded in the curriculum. How teachers used the curriculum for support will be examined in more depth in Chapter 6.

this and this is why you're reading this” (Summer Institute Interview: T532_14_8_5). Ms. Carson described reading with a purpose as “focused reading,” explaining, “I think that's helpful, to give them a purpose for [reading]” and then, illustrating her understanding of the interconnectedness of text-based learning in PBL-APES, she went on to explain how learning from text would be used to first inform a lab, and then inform decisions students would make in their project (Post-MCE Interview: T552_15_1_27).

Both teachers regularly conveyed the importance of clear, conceptually driven purposes to their students. Especially in Project 1, the Intro to Sustainability, teachers emphasizing how reading with a reason was fundamentally important when approaching academic text. In the second project, EcoFootprint, Ms. Murie directly linked purposes to effective reading: “In order to be successful with your readings in this course, you have to stop and think about what you're reading. Can it add to my question? Your initial question is: *What happened to these people and the environment?*”) (CO_E1_V_APES_T532_PD5_14-09-03_C5). Ms. Carson also emphasized that purposes were useful for students in focusing their approach to reading: “So before you start reading, you should know why you are reading. What is the purpose of reading this page? What do we want to know?” (CO_E1_V_APES_T552_PD3_14-08-28).

Conceptually-driven purposes did not simply guide reading in Ms. Carson and Ms. Murie's classrooms. They also guided interaction with reading throughout a project. Classroom observation data suggest that after Ms. Carson and Ms. Murie set purposes, they also returned to them regularly, particularly after reading, in order to remind students to think about the relevance of learning from text to near and far learning goals. For example, Ms. Carson, after a homework reading in EcoFootprint, asked her class to make connections: “Tell me this though: What does this have to do with how can my family live more sustainably? Am I just going off on a tangent

here? Or does this make sense to you given that the whole project cycle is about *How can my family live more sustainably?*” (CO_E1_V_APES_T552_PD3_14-10-20_C5). Likewise, conceptually-driven reasons for reading permeated application tasks by linking them to the larger project. Ms. Carson’s enactment in My Community Ecology illustrated the integration of a specific reading purpose with a conceptual view of the entire project:

Ms. Carson: So before you start reading, you should know why you are reading. What is the purpose of reading this page? What do we want to know? [wait time]

Emmett: What's the textbook about?

Ms. Carson: What was the purpose of your homework?

Neil: To find out what environmental science is.

Ms. Carson: Right. To find out what environmental science is. We're still asking that question. We've got our initial ideas down. We've shared them out a little bit. But now we're going to use some new information to find out a bit more. What does the textbook—this is only one of the resources we'll use this year—what do they tell us environmental science is about? So that will be one of our purposes for reading. And what's the second one? [wait time] What was the second part of your homework?

Neil: How is it different?

Ms. Carson: Right. How is it different? So that's our second purpose for reading. (CO_E1_V_APES_T552_PD3_14-08-28)

After establishing this purpose and framing it within the larger project goals, student interactions in small groups and the ensuing whole class discussion were targeted and productive.

The supporting role of curricular knowledge that underlies conceptually-driven purposes such as the one in this example (read to understand what environmental science is, and how it is different from other sciences) cannot be underestimated. It would be difficult for Ms. Carson to convey these explicit instructions without her having a clear sense of where she will go next in this lesson, and then after that. The fact that these texts and the specific task were new to her (she

focused on a different project for My Community Ecology the previous year) suggests that exact prior experience was not the critical factor in her enactment, but her prior experience with similar PBL-APES projects and her grasp of the big picture mattered immensely. The same can be said for Ms. Murie. Although her framing of learning from text was less clear with texts and tasks she had not taught before, she tended to convey a sense of confidence with the overall PBL-APES curricular trajectory that, along with the curriculum supports, enabled her – like Ms. Carson – to consistently provide clear purposes for learning from text.

The importance of a conceptually-driven purpose for reading became fully integrated into Ms. Carson and Ms. Murie’s teaching practices and thinking and informed their reflection on enactment. For example, when Ms. Murie found students were struggling with a particular reading, she reflected that the problem appeared to be an unclear purpose; or as she asked of the text when considering whether to cut it or revise its use, “Well, what exactly are we trying to learn here?” (Post-MCE Interview: T532_15_2_6). She concluded that students were confused because the purpose for reading was unclear. This suggested Ms. Murie saw a direct connection between conceptually driven reasons for reading and successful student learning.

Across the three projects, both Ms. Murie and Ms. Carson consistently conveyed and focused students on reading purposes when assigning in class reading, homework reading, and for learning from text application tasks that used the reading.

4.2.2 *Unclear Purposes Lead to Confusion*

In contrast, Ms. Earle and Ms. Hunter typically did not consistently provide clear purposes for reading throughout the three focal projects. However, both teachers were aware of the purposes suggested in the curriculum and they occasionally made use of those purposes. For instance, Ms. Earle included reading purposes on handouts she developed for her students, and

Ms. Hunter used reading purposes as entry tickets to review content in the Intro to Sustainability and in class on a few occasions during EcoFootprint and My Community Ecology. Yet establishing a purpose before assigning text-based learning was not typical. One recurring feature that defined both teachers' approach to assigning reading was vagueness, or a sense of disconnection from the content at hand. The text-based tasks about the Easter Island case study in the first project provide an illustrative example of this vague purpose setting. It is also a particularly interesting example to consider due to the extended length of the lesson, which stretched across two days. The increasing specificity of the teachers' instructions suggested that purpose setting became more focused as teachers became more familiar with content and materials.

At the beginning of the lesson, neither Ms. Earle nor Ms. Hunter specified clearly why students were viewing videos about Easter Island or explained what students were to learn from studying the island. The sense of ambiguity was enhanced by teachers' references to "mysteries," rather than actual questions to be answered. The questions were presented to students on the handout, which students were expected to read independently: 1) Who created the Easter Island civilization? 2) How and why were the statues built? 3) What happened to the civilization and the environment?

Ms. Earle, for example, phrased the task this way: "[T]here are three mysteries. We are going to hit up two today, if we can get there. [Directions given on where to take notes.] So let's watch the first part" (CO_E1_V_APES_T513_PD4_14-08-28). The task was broken into three distinct questions (Mysteries #1-3) on the note-taking tool and was designed to support both the videos and the subsequent reading about Easter Island. As teachers began to understand the texts (short BBC video clips first, then the lengthy Easter Island article) and the task better, they also

began to more convey more specific reasons for viewing/reading to students; both teachers referred more specifically to what students should focus on as the lesson progressed. For example, after referring previously only to “mysteries,” Ms. Hunter stated midway through the video clips: “OK the video's going to go into WHY the statues were built, so pay attention to that” (CO_E1_V_APES_T543_PD2_14-08-28). This progression suggests that knowledge of the curriculum and understanding the relationship between texts and tasks mattered for teachers’ ability to set purposes and support them throughout a text.

Although I searched for a pattern that explained the sporadic use of purposes by Ms. Earle and Ms. Hunter across the three projects, there was no discernable change in their practice after they experienced some success with setting purposes. For example, Ms. Earle eventually established a clear purpose for the Easter Island reading, as she also did during the last lesson in the first project (Paper vs. Plastic); thereafter, she noted purposes almost exclusively on handouts she developed in the second and third projects and referenced them vaguely in class, if at all.

Ms. Earle: Purposes guide worksheets

Based on interview data with Ms. Earle, it appeared her belief that student learning was best supported by recall tasks led to a kind of personal “teacher-proofing” approach of the PBL-APES curriculum in that she condensed information originally intended to be delivered through instruction into handouts. Ms. Earle described how she reviewed the PBL-APES curriculum for its embedded suggestions for approaching text – “like the *set the purpose* and the *T-chart...*” – and developed it into a student worksheet:

I took [the lesson plan’s suggestion of] what we should be doing: like here’s why we’re doing it, here it is in your notebook, you could do this... As I said, my kids really don’t mind filling in blanks; so giving them blanks to work with, they’re going to do it. (Post-MCE Interview: T513_15_2_5)

Ms. Earle then noted that despite a “really bad sub,” students completed the worksheet successfully in her absence; she added that if she had “talked through this” students would have been unlikely to do as well. She attributed the specificity of the information (“this is what goes here, this is what goes *here*”) as what “really, really helped them” (Post-MCE Interview: T513_15_2_5). Although a lack of curricular knowledge may have influenced Ms. Earle’s belief that the curriculum distilled into a worksheet was more effective than her instruction, the combination of her curricular inexperience and her belief that students learned most effectively with simplified tasks appears to have led her to view purpose setting as an objective to be stated at the top of a worksheet. Although it may have still guided students in filling out their T-chart, Ms. Earle did not see it as part of a larger, interrelated approach to text-based learning.

Ms. Hunter: Tasks and procedures guide reading

Throughout the focal projects, Ms. Hunter’s purposes generally specified a task rather than a reason for reading; as a result, the content and any reasons for learning the content were often tangential to her instructions. For example, when asking students to read about sources of energy, Ms. Hunter conveyed the procedure clearly, but she did not provide a reason for reading:

In this reading, whether you're using the [text]book or [the printed copy], you're going to do this for me: Put an A for something that is an advantage for whatever source you're reading about. And a D for disadvantage... or P for problem, let's go with P for problem.

So like with nuclear, an advantage is that it doesn't produce— [S: —it's clean.] It's clean. A problem would be that if it explodes, some people in that area might die. So go ahead and read over Part 2. Do your advantages and your problems. If you're using your book, I have these little sticky notes you can stick in your book. (CO_E1_V_APES_T543_PD2_14-09-16_C5)

This type of instruction, presented without context or an overarching purpose (such as why students should pay attention to advantages and problems), often appeared to lead to student confusion; on the day described above, a student commented, “I’m so lost right now.” On other

days, vague instructions often led to Ms. Hunter re-explain the task to each table group, often with increasing frustration on the part of both students and teacher. Ms. Hunter's enactment suggested she was frequently grappling with unfamiliar curriculum. As a teacher who was familiar with project-based learning from her credential class, and excited to have an opportunity to teach a project-based class, Ms. Hunter was aware of how the project-wide driving questions developed a "flow" and sense of purpose that was not present in her regular Environmental Science class:

It's definitely different in the fact that [in PBL-APES] they always are looking towards a purpose. They know they'll have this big family proposal, not that they necessarily care about it, but they're going towards that. Whereas in my regular environmental it's almost choppy, like, okay today we're doing this, next time we're doing something different that kind of connects, and it's all about populations. It's nice that [PBL-APES] flows better. (Post-EF Interview: T543_14-11-3)

Yet she did not see how purposes for reading tasks within the project made similar connections in the same way; this may have been related to her limited familiarity with the texts: "Some of this information is even new to me [...] I'm doing the kids' reading before they do" (Post-EF Interview: T543_14-11-3). Ms. Hunter reported that reviewing the curriculum in preparation for teaching highlighted her unfamiliarity with the approach: "Sometimes I have to pause and be like, 'Okay, do I say that? Where do I go next?' I don't know, I've never done something quite like [PBL-APES] before" (Post-EF Interview: T543_14-11-3). Although she found the lessons somewhat confusing, Ms. Hunter described that her planning approach for all her classes was to write instructional notes about the lesson – "a very, very mini version" of the lesson on a 3x5 card for quick reference, although she reported keeping the full lesson plan nearby in case she got "lost or stuck." It was notable then, that on the two occasions when Ms. Hunter clearly set purposes during two text-based tasks in the second project, she read them directly off the lesson plan, which was open on her computer. This suggests Ms. Hunter was perhaps not yet

experienced enough with the curriculum to reduce lessons to such a small cue card. This may explain the brevity that characterized the majority of her instruction.

Conclusion

The data presented in this chapter show how teachers' enactment of the learning-from-text approach was strongly guided by their beliefs about students and student learning. The two experienced teachers, Ms. Carson and Ms. Murie, were guided by recently established beliefs about the learning-from-text approach and the two new teachers, Ms. Earle and Ms. Hunter, drew primarily on their pre-established beliefs.

The experienced teachers came away from the Summer Institute with a newly developed conviction that text-based learning was important and an understanding of the learning-from-text approach (External Domain). Importantly, the learning-from-text approach spoke to instructional issues the teachers had wanted to address in the PBL-APES course; this may have grounded their belief that students would benefit from support for text-based tasks (Personal Domain). Their new understanding of how to support text-based tasks—the “go slow to go fast” approach—encouraged their enactment of the learning-from-text approach (*enaction*); examples provided in this chapter focused on how teachers oriented students to texts and provided conceptually driven purposes for reading. Instead of encountering the resistance they had anticipated, Ms. Carson and Ms. Murie's students were receptive and responded to the learning-from-text approach by productively engaging with texts. This in turn led the teachers to reflect on the value of the approach for students (*reflection*) and they continued to incorporate the practices into their teaching (Domain of Practice). And when students did not respond productively, as with Ms. Murie's experience with the text that lacked a clear purpose, it indicated something was amiss; this indicated Ms. Murie was beginning to think adaptively about text-based learning.

Throughout the study time frame the experienced teachers' belief that supporting text-based learning provided valuable support for students did not waver. The durability of their belief supported the use of new practices that supported learning from text.

The new teachers' beliefs also informed their respective enactments, but as a retreat from the learning-from-text approach. The new teachers, Ms. Earle and Ms. Hunter, also left the Summer Institute with enthusiasm for the PBL-APES approach, but their understanding of how to support text-based learning was as fragile as their grasp of the curriculum and the content (External Domain). Despite some experimentation with text-based learning (*enaction*), Ms. Earle felt her students were not equipped to learn from text independently and she made instructional decisions to take on the work she felt they could not or would not do. Ms. Hunter believed students were capable of independent learning from text and thus she provided little scaffolding or guidance (Personal Domain). As both new teachers grappled to comprehend the curriculum and stay one step ahead of their students, it appears they adjusted their use of the PBL-APES curriculum to fit their pre-existing beliefs and familiar instructional practices (Personal Domain). They did not appear to reflect on their enaction; either to consider how it impacted students or on the nature of their enactment. Instead, both teachers reflected on the challenges they faced learning the course.

A recurrent theme in this chapter was teachers' knowledge of the curricular approach. Evidence suggested experienced teachers' familiarity with the curriculum bolstered their ability to orient students to the big picture, a task that was out of reach for the new teachers. The thread of curricular knowledge continues to inform the findings in the next chapter, which examines teachers' shifting beliefs.

Chapter 5. FINDINGS: SHIFTING BELIEFS & PRACTICES

The previous chapter described teachers' durable beliefs and practices about student learning that influenced teachers' enactment of text-based learning. This chapter examines two distinct shifts in beliefs and practices that occurred across teachers during the five months analyzed in this study. The first section of this chapter describes how teacher practices and thinking changed in regard to accountability for text-based learning. Although "accountability" meant different things to different teachers (to be described shortly), all teachers reported changing their practices to increase students' accountability for learning from text. Analysis of this trend suggested the shift was strongly related to teachers' goals and salient outcomes. The second half of this chapter explores how and why the metacognitive text annotation strategies to support students during reading that were introduced in the first project, Intro to Sustainability, faded out of all teachers' practices soon after they began the second project. By considering how teachers oriented students to learning from text and how they used the annotation strategies, this analysis explores whether teachers took up the kind of strategic reading that the metacognitive annotations were intended to foster.

5.1 THE VARIABILITY OF ADAPTATIONS FOR ACCOUNTABILITY

"Accountability" was a frequent refrain in teacher interviews and the monthly collaborative team meetings; concerns about accountability proved to be a key driver of teacher adaptations in PBL-APES enactment. Although teachers tended to describe accountability for text-based learning as a way to "get kids to do the reading," a close examination of teacher adaptations suggested teachers' goals and priorities directly affected the kinds of accountability they hoped to achieve, and the steps they took to get there. Whether teachers intended to improve

compliance, content knowledge, or participation outcomes (see Table 5.11), all four teachers specifically adapted their enactment of PBL-APES to increase particular kinds of accountability for text-based learning. Even Ms. Earle, who often presented content from text without asking students to read the text itself, made changes specifically related to accountability for text-based content. Significantly, some accountability goals led to enhanced learning from text opportunities while others detracted from text-based learning.

Before embarking on this next section, it is important to note two curricular points of emphasis that prove relevant background to this analysis (a full description was provided in Chapter 3, section 3.4.5). The first point is the *before-during-after* framework for learning from text. This routine structured all text-based learning in PBL-APES. With the exception of Ms. Earle after the first project, the other three teachers regularly followed reading with some of the suggested discussion prompts or application tasks, which were also frequently discussion based. The second point is the embedded assumption that putting text-based learning *to use* in discussions and other sense-making tasks would serve to motivate students to be prepared to participate (that is, to read what was assigned) and also provided teachers with formative assessments of what students had understood from the reading. As teachers described their adaptations, they frequently referenced these underlying structures of the learning-from-text approach.

To examine how different goals led to different adaptations, I have organized my analysis into three sections. First, I describe how Ms. Murie and Ms. Hunter's different priorities nonetheless led them both toward the same adaptation of increasing the amount of in-class reading. After that, I examine Ms. Carson and Ms. Earle's respective instructional decisions. Finally, I look across the teachers to draw conclusions.

Table 5.11. Variations in Teacher Adaptions for Accountability

	Teacher Goals & Priorities	Changes / adaptations for text-based accountability
Ms. Carson (experienced)	<ul style="list-style-type: none"> • Support student compliance for text-based learning • Ensure students can apply and/or use text-based learning for project tasks • Prepare for AP test 	<ul style="list-style-type: none"> → Created one reading quiz → Added five application tasks
Ms. Earle (new)	<ul style="list-style-type: none"> • Cover course content • Assess content learning regularly 	→ Developed weekly vocab & reading quizzes from AP Test Prep book
Ms. Hunter (new)	<ul style="list-style-type: none"> • Cover course content • Support student compliance for text-based learning 	→ Increased in-class reading (nearly 100% text-based learning in-class)
Ms. Murie (experienced)	<ul style="list-style-type: none"> • Support student compliance for text-based learning • Ensure students can discuss and/or use text-based learning for project tasks 	→ Maintained high level of in-class reading (approximately 50% text-based learning in-class)

5.1.1 *More in-class learning-from-text opportunities*

Ms. Murie and Ms. Hunter both increased in-class reading to address compliance issues. Because they believed their students would not reliably read independently, this move allowed Ms. Murie and Ms. Hunter to oversee reading and thus hold students accountable for reading in class. However, underlying the shared goal of compliance were very different instructional aims. Ms. Murie cared deeply about fostering her students' ability to learn from text and to apply what they had learned in discussions and to the unit project. Ms. Hunter, on the other hand, was more concerned to give her students access to the course content and materials. Although her students did discuss reading, Ms. Hunter did not view discussion as motivating nor as a measure of accountability for learning from text; rather, for that she looked to her in-class note-taking system. In the remainder of this section, I contrast Ms. Murie and Ms. Hunter in order to demonstrate how their different goals led to a similar adaptive move.

Motivated by her previous two years of experience with PBL-APES, supporting opportunities for text-based learning was an important goal for Ms. Murie. During an interview, she described her commitment to supporting learning from text:

Last year I did an awful job with the reading. [...] We really didn't do as much as we should have and so this year my focus was, "I'm going to make sure that we actually do the readings and if we're going to do them in class, then I'm going to make sure we do them in class" (Post-MCE Interview: T532_15_2_6)

Ms. Murie was reluctant to send too much reading home; rather than gradually increasing the amount of homework over time, she did roughly the same amount of in-class and homework reading throughout the second and third projects. Whenever Ms. Murie did assign homework, she highly scaffolded the assignments, usually reading an initial portion in class and following up with an application task (usually discussion-based) immediately the next day. Regardless of where students read, Ms. Murie viewed discussions as her measure of accountability because classroom talk demonstrated to her that students were, "actually doing the reading" (Post-EF Interview: T532_14_11_5). For Ms. Murie, this meant more than just compliance; it was also evidence that her goal of supporting text-based learning and student understanding was succeeding. Whereas Ms. Murie recalled "hearing crickets" after asking students about readings the previous year, she was pleased her approach now led to discussions. She reflected on her revised view of accountability: "In the beginning I said I was going to do quizzes but since we're actually able to talk about [what students understood from the reading], I haven't had to do that" (Post-EF Interview: T532_14_11_5). Ms. Murie spoke positively about how her students engaged in text-based discussion; she felt students were interested in the discussions and demonstrated understanding when referencing text-based evidence. Despite a high level of satisfaction with her approach to text-based learning, Ms. Murie did not consider the compliance problem completely solved. When she looked ahead to the fourth project and anticipated

assigning more independent reading to “keep up with the pacing,” she immediately worried about how to hold her students accountable: “I’m trying to think of how I can monitor that, like if there isn’t a tool created for them, perhaps I can give a reading quiz or something...”(Post-MCE Interview: T532_15_2_6).

Ms. Hunter had much less confidence than Ms. Murie that her students would read outside of class; in December she estimated only two of her nine students would do a reading assignment for homework (CTM4_PD_V_APES_DMPS_14-12-10). In the last collaborative team meeting, she told her colleagues, “my kids just don't care if they do homework or not. They don't care if they look silly the next day, like saying they don't know or they'll make something up. They just don't care.” Whereas Ms. Murie believed reading enabled students to participate in discussions about learning from text, Ms. Hunter felt the opposite: “So when they have specific questions they're looking toward, or goals, and it's just a discussion for the next day, they're like “Whatever. If we're just talking about it: no big deal” (Skype4_PD_V_APES_DMPS_14-12-10). As a result, Ms. Hunter did not believe post-reading discussions motivated students to read outside of class. As will be discussed in more depth in Chapter 6, Ms. Hunter’s discussions emphasized recall of facts; students rarely engaged with ideas or key concepts in the course. Although Ms. Hunter stated her students were “grade-driven,” she also reported that giving quizzes after reading only improved compliance a little (Post-MCE Interview: T543_15_1_30). This is how Ms. Hunter came to believe that reading in-class was the most effective approach to solving her compliance issues. In-class reading ensured students actually read the course materials, but it also allowed Ms. Hunter to leverage note-taking tools (also used in class) for accountability: when students found “something was relevant in the reading, they would take a sticky note and put it wherever it went in their notebook” (Post-MCE Interview: T543_15_1_30).

This practice conveyed to Ms. Hunter that students were accessing the content while they read in her class.

Although Ms. Murie and Ms. Hunter had different goals for increasing in-class reading, and different ways of assessing how students put what they learned to use, they were both satisfied with the increased compliance and goal attainment their adaptation afforded: more in-class reading succeeded in providing more opportunities for students to learn from text. While students in both classrooms read quietly in class, the nature of their interactions with text was quite different. Ms. Murie's embrace of the learning-from-text approach meant she framed texts in the context of the course; her students read with purpose and reading was followed by tasks that required application of what had been read. When students were assigned reading for homework, they were provided with support and, in keeping with the *before-during-after* routine that informed in-class reading, students knew they would engage with the text during the next class period. In contrast, Ms. Hunter's classes were more procedural: students were not provided with context or a purpose for reading; they read silently in class and then they recalled what they had read. Few opportunities for application were provided.

5.1.2 *Application opportunities held students more accountable for learning*

Like Ms. Hunter, Ms. Carson also believed that discussions were not sufficiently motivating for student compliance. At the end of the first project cycle, EcoFootprint, Ms. Carson felt that the expectation to read at home and come prepared to discuss was insufficient: "That's not persuasive enough, it's not motivating enough for them" (Post-EF Interview: T552_14_11_3). Although Ms. Carson routinely framed texts in the context of the course and provided purposes and guidance for homework reading, she felt holding students accountable for homework reading with discussion was problematic in that it could only hold *some* students

accountable, while other students could get by “chiming in with background knowledge” or rapidly skimming text when they had not completed the homework reading (Post-EF Interview: T552_14_11_3; Post-MCE Interview: T552_15_1_27). Ms. Carson felt a quiz, “Whether it's really graded or just believed to be graded,” would provide individual accountability; and when she had to assign a significant amount of reading during EcoFootprint due to scheduling issues, she developed a quiz for that very reason. But although Ms. Carson considered quizzes a viable solution, she only used this strategy once. Much more frequently (five times) she relied on adding application tasks. For example, twice Ms. Carson assigned unannounced quick writes that asked students to apply text-based learning (one each in EcoFootprint and My Community Ecology) and three times she developed application tasks (students twice presented assigned jigsaw reading¹² and developed a food web of the project site based on the textbook reading). Ms. Carson’s aim in these tasks was to assess students’ conceptual understanding. For example, Ms. Carson designed the quick-write in the third project, My Community Ecology, to “see if everyone’s on the same page” with the important concept of an *ecosystem*. Based on what students had read (and any notes they had taken), Ms. Carson asked students to answer the question: “Is our proposed development site an example of an ecosystem? Justify your answer with evidence.”

Similarly, Ms. Carson explained her rationale for asking students to create a food web using their collected site data and applying what they had read about food chains, food webs, and trophic levels in the textbook:

I really felt like we needed to see a food web of our own ecosystem, which isn't in [the curriculum], but I just thought it was really worthwhile for us to actually do one. [...] I had them construct the food web based on that, and then used vocabulary [introduced in

¹² Ms. Carson noted that a limitation of the jigsaw presentation tasks was the possibility students might not adequately learn enough about content presented by their peers; although she told students they were expected to read all jigsaw sections, she acknowledged her approach provided accountability only for a portion of the entire text.

the text]: Identify a producer, a primary consumer, a secondary consumer. [...] It helped to address, you know, "Do the arrows show the direction of energy flow?" because there were a few who wanted not to have arrows, or had arrows going the wrong way. And they're things that might trip them up on the AP test. (Post-MCE Interview: T552_15_1_27)

Ms. Carson felt her additions were necessary for learning from text: "It's that accountability piece. I feel like they have to be responsible for bringing something to me, for me to know that they did it, and for them to feel like they have to do it" (Post-EF Interview: T552_14_11_3). Interestingly, when it came to grading such assignments, Ms. Carson "deliberately left it kind of vague" because she believed students should do work despite grades (Post-MCE Interview: T552_15_1_27). Her primary goal in each application task was to ensure students were learning – and could apply – important content and concepts, but she also felt a pressing need to heighten students' sense of accountability. Ms. Carson found she could align her content and compliance goals by developing application tasks that served student learning on both accounts.

5.1.3 *Recall tasks limit mediated learning from text*

Ms. Earle's adaptation was to provide access to course content in a way that allowed her to assess what students learned. Her adaptation was to regularly assign portions of the supplemental AP Test Prep book in addition to the PBL-APES curriculum and to hold students accountable for independently learning the material. These Test Prep reading assignments were done exclusively outside of class; other than assigning page numbers and a list of vocabulary words, Ms. Earle did not address or otherwise discuss the Test Prep assignments during class. Ms. Earle developed her own quizzes of the Test Prep material: every other week she quizzed students on the vocabulary list she had identified and on the reading she had assigned.

Ms. Earle described her instructional adaptation as a way to "go a little bit deeper" into the PBL-APES content. She reported selecting content from the AP Test Prep book that aligned

with the current PBL-APES topic; this approach suggested that she did not believe her enactment of PBL-APES sufficiently covered APES content. Although Ms. Earle reported “always [feeling] behind” the other PBL-APES teachers, she considered her weekly AP Test Prep quizzes worth the time they took away from the PBL-APES curriculum, although she expressed surprise that some of her students felt the same way:

By personal choice of my own, I make [students] do a reading and vocab quiz generally every Wednesday [...] I feel that’s a very valuable use of my time and their time, and I’ve actually had kids that are like, “I like them, I like the vocab quizzes.” And I’m like “*Why?*” And they’re like “Well, it pads our grades. And they’re easy.” And I’m like “Awesome! If you think learning a crap-ton of vocab is easy, you’re going to do great!”¹³
(Post-MCE Interview: T513_15_2_5)

In this statement Ms. Earle appeared to view text from the AP Test Prep Book as primarily useful for short recall tasks and coverage of key terms. When describing how she developed the quizzes, however, Ms. Earle became animated and eagerly shared her approach; what struck me during the interview was how she appeared to be describing her *own* learning process. For example, to create the reading portion of the quiz she described, “giving [herself] guided reading” to identify key points in the text; her goal was to develop ten questions that were “purely reading-focused: like, what did this thing *say?*” By taking this approach, Ms. Earle felt she would be preparing her students for “actually reading [the text] with a purpose” (Post-MCE Interview: T513_15_2_5). Engaging purposefully with text-based content is educative; although Ms. Earle was preparing to hold her students accountable for learning APES content, her work with the supplemental text appeared to be a productive and valued learning experience for her as well, as she alluded to later in the interview.

¹³ In a previous interview Ms. Earle reported many students struggled to pass her weekly quizzes (Post-EF Interview: T513_14-11-3). No data was collected that can corroborate whether student scores increased on the AP Test Prep quizzes.

Indeed, shortly after making the comment cited previously, Ms. Earle characterized her experience teaching PBL-APES as a struggle to stay one step ahead of the students when it came to understanding the content:

I'm fighting in the trenches with them and I think that they respond well to me saying, "I'm learning with you guys; I'm no expert." You want me to teach you chemistry? I'm here all day; I *got* you. You want me to teach you about ecosystem services? I got to research that a little bit. I don't know what that means! (Post-MCE Interview: T513_15_2_5)

Here Ms. Earle reflected on what she perceived as a primary obstacle to her instruction; in order for her to teach PBL-APES, she needed to first learn the content herself. One interpretation of both Ms. Earle's excitement and her invocation of learning-from-text terms (*reading with a purpose, reading-focused*) was that she felt she had arrived at a good compromise: Although she reported feeling unprepared to teach PBL-APES, and by extension its related text-based materials, Ms. Earle seemed pleased to have discovered another text-based route – the AP Test Prep book – for her students to access course content. Ms. Earle portrayed the Test Prep book as an accessible and palatable source of content: "I promise it's not hard. And actually, I started reading through it... it's written really nicely. Like it's not written super boring. It's not like an epic novel of adventures, but it's not super boring" (CO_E1_V_APES_T513_PD4_14-09-16_C5). Indeed, Ms. Earle's report that several students cited the AP Test Prep book in their final projects signaled that both Ms. Earle and her students viewed the prep book as a source of content knowledge—and for her, that "knowledge" was critical.

Grading concerns also played a role in Ms. Earle's decision to hold students accountable for learning content through AP Test Prep quizzes. Ms. Earle felt PBL-APES work was difficult to grade because its discussion-based, formative nature did not accurately assess individual content knowledge. To provide a sense of individual accountability for PBL-APES work, Ms.

Earle tracked only completion of PBL-APES work (complete, incomplete, or missing). In other words, PBL-APES classwork, including any text-based learning, provided Ms. Earle little record of what content students knew until the end-of-unit exam. This explains not just the appeal, but also possibly the necessity of the AP Test Prep quizzes. Ms. Earle may have sidestepped much of the PBL-APES curriculum (see section 4.1.2 for an earlier discussion of Ms. Earle's modifications to PBL-APES) because of her challenges getting up to speed with the content, but she still needed to give students a grade.

Ms. Earle told her students when introducing the Test Prep book that the bulleted list of core content at the front of the book would guide both her and her students; she asked them to highlight each topic they covered in a homework reading: "You know this is the first time I've taught this course. So I need as much help keeping track of life as you do. [...] Basically this is going to be our checklist: you're checking me, I'm checking you"

(CO_E1_V_APES_T513_PD4_14-09-16_C5). Taken together, the regular AP Test Prep quizzes appear to have served several purposes; in addition to providing a track record of individual student content learning, the use of the AP Test Prep book gave Ms. Earle's students access to content that did not require teacher mediation, and the process supplemented Ms. Earle's content learning at the same time.

5.2 METACOGNITIVE ANNOTATION STRATEGIES: FADING, FADING, GONE?

In this section I turn to the metacognitive annotation strategies introduced in the learning from text approach and explore why and how these strategies faded out of teachers' practice and thinking. They were tiny strategies, just a checkmark and a question mark, but they were intended to usher in a way of thinking that belied their size. In truth, I questioned whether their fate warranted examination, but the fact that some teachers apologetically mentioned moving on

from them after the first project, EcoFootprint, seemed to suggest even teachers suspected they had potential that had not been realized. A reflective comment from Ms. Murie, who had given students little yellow stickies so they could put checkmarks and question marks in their textbooks longer and more consistently than any other teacher, all the way into the beginning of EcoFootprint, also made me wonder about their use: When interviewing Ms. Murie after the third project, she described how she had introduced the metacognitive annotation marks to her freshman students and reiterated how in PBL-APES she still believed in “doing this slowly so we can do this faster later on.” In response, I asked her what she saw in her PBL-APES students that suggested they were getting to that point and she replied by invoking a random incident as evidence that her students were developing into independent readers:

Somebody turned a textbook into the main office, and I noticed that there were little yellow stickies all over in it. I don't know whose textbook it is, but it was little yellow stickies of things that we haven't read in class so I'm like, “Oh, they're actually doing their reading and they're actually annotating it as they read along.” (Post-MCE Interview: T532_15_2_6)

This anonymously annotated textbook presented as evidence of strategic reading made me wonder if the annotation symbols had indeed served their intended purpose or if they had never gotten off the ground. On the one hand, annotation strategies are a private metacognitive approach that should require less and less teacher attention over time. But on the other hand, this comment suggested a teacher who believed in these strategies viewed the existence of sticky notes as evidence of strategic reading without knowing what (or who) was behind the yellow stickies.

The annotation strategy represented by the checkmark and question mark was presented as an entry point to the learning-from-text approach (see section 3.4.5 for a fuller description). It was introduced with the *before-during-after* framework in the Summer Institute, modeled with

teachers using texts from the curriculum, and promoted as a way to support strategic reading. In addition to supporting students *while* they read, the strategy was intended to provide reference points that would support discussion and application *after* reading. In the PBL-APES curriculum, these annotation strategies were embedded as suggestions in lesson plans throughout the first three project cycles.

Although the annotation symbols had been streamlined in the curricular revision, the approach was not new to Ms. Carson and Ms. Murie, who recognized the check and question symbols from their previous experiences with PBL-APES. The strategies were also familiar to Ms. Earle; she described them as “good reading strategies that I forget about” (Summer Institute Interview: T513_14-8-7). Given our aim not to suggest content area teachers “layer on” literacy strategies that distract from, rather than enhance content learning, the annotation approach was purposefully geared to leverage content. The goal was not only buy-in from teachers, but durable student learning of important content and strategies for productively using texts for learning.

Classroom observation data confirmed that all four teachers requested students use these metacognitive annotation strategies throughout the first project. Given the range of ways that teachers oriented students to learning from text (as described in Chapter 4), it was somewhat surprising that every teacher enacted the annotation strategies. It was curious then, that once teachers began the second project, the annotation strategies quickly faded from all teachers’ instruction. The disappearance of the strategic reading strategies raises some questions: Did the strategies fade out or did they get taken up in another way? Did anything take their place? And at the end of three units, what, if anything, had teachers taken up about strategic reading? I engage each of these questions in the rest of this section.

5.2.1 *Where did the annotation strategies go?*

Data from interviews and classroom observations suggest that the learning from text annotation strategies faded primarily because they were more easily assigned than actually put to use. In other words, while teachers were successful at suggesting students should use checkmarks and question marks while reading, making productive use of that strategy *after* reading proved more difficult. Classroom observation data show all teachers introduced annotation symbols while reading the first or second text in the first project. All three texts in the Intro to Sustainability project were hospitable sites for test-driving annotations: students were given photocopied handouts that could be directly written on, each text had a clear reading purpose to guide the checkmarks, and they all contained challenging words and concepts that students in most classrooms did not know (i.e., *interdisciplinary*, *conservationist*, *BTUs*). But while the annotation procedure was conveyed without difficulty, it proved trickier to support once students began making marks on the page.

Most teachers spent three to five block periods working with text in the Intro to Sustainability project, during which they consistently requested students use the annotation strategies. This prolonged experimentation period suggests teachers hoped the annotating would “stick” or pay off, but then teachers did not promote the strategies after the second project, EcoFootprint, got underway. Analysis of enactment suggests there were two reasons teachers easily initiated annotation but were less likely to follow through. First, although instructing students to annotate seems like a procedural task, supporting students in the practice requires significant conceptual understanding from the teacher. Second, making productive use of annotation strategies after reading involves both content knowledge and discussion facilitation. While experienced teachers made these moves, new teachers did not attempt to facilitate talk

about annotations; however, eliciting student questions seemed to be particularly challenging for all teachers.

To the first point: Teachers thought this was going to be easy. All teachers had prior experience highlighting and underlining. They viewed annotation symbols in the same light and had no trouble providing students with clear instructions, sometimes even inviting students to choose whether they used checkmarks or highlighters. But it was much more challenging for teachers to explain *how* the strategy would help students. Ms. Hunter regularly assured students the strategies would be beneficial, but she was unable to explain how they would help: “I promise guys: the highlighting, the checkmarking – it’s really going to be helpful” (CO_E1_V_APES_T543_PD2_14-09-12_C5). Ms. Hunter’s tendency to not provide a clear purpose for reading in the Intro to Sustainability meant that her students had a more challenging task of identifying “super important” information without guidance. Ms. Carson and Ms. Murie invoked college readiness, and framed annotation as an important skill in that regard, but they did not provide a rationale for how annotating “worked.” Ms. Earle followed her instructions for annotating with an empathetic nod to the bad taste of beneficial medicine:

I know right now you're probably like "This is so much more work, can I just read it and then just answer the questions?" No. The reason is, I want you to get good at these strategies so that when you're given a reading on the AP test, or even on any of my tests, because there's going to be readings on them, that you have a way to tackle it without stressing yourself out. What I'm going to ask you do is practice trying this strategy. It might be tedious, it might be hard. But please, please, please practice it. (CO_E1_V_APES_T513_PD4_14-09-02_C5)

Most teachers conveyed that checkmarks would encourage answering the purpose question and identifying questions, but the idea of *thinking* while reading did not come through clearly. This unintentionally emphasized the procedural element of annotating and implied only that annotating was somehow good for you. When teachers reflected on the practice, they gave similar reasons why it didn’t work: Students already had strategies; it was too general. Perhaps

both teachers and students could have used more practice. Teachers also may have needed more support to leverage annotation conceptually.

Working with annotations after reading was completed required knowledge of the text and a conceptual understanding of how the text fit into the big picture of the project. Ms. Murie and Ms. Carson, experienced teachers who were generally quite clear on the underlying goals of text-based instruction, used annotations to stimulate talk and understanding of text with questions like the following:

What did you annotate on pg. 2? What did you find interesting? What questions? What word choice was interesting to you?" (Ms. Carson: CO_E1_V_APES_T552_PD3_14-09-04_C5)

With the people around you, discuss anything you have underlined and see if you can add to your [video-text tool] based on what you've read so far. Whether question or check, discuss it -- see if you can come up with a conclusion. (Ms. Murie: CO_E1_V_APES_T532_PD5_14-08-29_C5)

The bundling of prompts (annotations, interests, questions, word choice; underlines, tools, questions, checks) suggests that teachers did not view the role of question and checkmarks as serving distinct purposes, or as discussions that they could productively channel. While both experienced teachers were comfortable engaging in talk about the text, they did not approach it particularly strategically with regard to annotation strategies. Rather it seems as though they set aside their conceptually-driven goals for a text when opening the floor to any kind of student contributions that annotations might surface.

Ms. Hunter and Ms. Earle did not ask what their students had marked. Perhaps the unfamiliarity of the material inhibited them. The lack of interaction seemed to negate one of the promised benefits of the approach: addressing questions. Every teacher had encouraged students to put a question mark when they had questions or needed clarification. This process implied there would be time to engage with such questions. Ms. Earle convincingly put it this way:

When you go, "Man, I don't have a clue what *riveting* means," you underline it and put a

question mark. A lot of the time what happens when people do readings is that they get very fixated on a little chunk that they don't know. What this is going to allow you to do is to not know something and then just go on through. And know that it will be answered. If you have a question on something, that's what I'm here to do: to help you answer that.
CO_E1_V_APES_T513_PD4_14-09-02_C5

Yet Ms. Earle did not follow through to ask what questions students had about the text. Nor did Ms. Hunter. Throughout the first project, Ms. Murie regularly asked her students what questions they had, but more often than not, her requests for questions were met with silence, despite reasonable wait time. Midway through the second project, she stopped asking.

Although Ms. Murie and Ms. Carson were both initially successful at calling for annotations (of any kind) to support discussion of text, they soon transitioned to giving reminders to annotate, and by the early days of the second project, EcoFootprint, they had stopped incorporating annotations into discussions. Ms. Carson explained that she felt her students already knew how to approach academic text strategically:

We did do some highlighting. We didn't really stick with the check marks and question marks. Really because I didn't feel like they ... A lot of them came in with their strategies. As I walked around, they already were annotating and doing different things that they had already acquired before they came into the class. (Post-EF Interview: T552_14_11_3)

While several of Ms. Carson's students did demonstrate their own approaches to annotation or appeared to be proficient readers, there was also evidence some students struggled to make sense of the texts. During a textbook reading in the second project, one student told a classmate: "I read it all but I don't know what it's saying." After listening to a nearby group for a bit, he asked his classmate for an interpretation of the text, but the response he received conveyed little understanding (CO_E1_V_APES_T552_PD3_14-09-16_C5).

When Ms. Murie's class began using the textbook for the second project, EcoFootprint, she passed out sticky notes to use for annotation. Seeing references to the annotation approach in the lesson plans spurred her to give reminders: "The teacher lesson plan saying, "Okay, use your

stickies. Write your questions." That's a reminder for me to tell them every single time" (Post-EF Interview: T532_14_11_5). But while she did give reminders, they were rhetorical gestures in that there was very little follow through. At the end of EcoFootprint, Ms. Murie reflected that the role of stickies in supporting a discussion was not evident to her. Although she had one student who put questions on stickies and talked to her after class, Ms. Murie did not see stickies supporting discussions in general: "So the stickies are working for [questions], but as far as the discussions, I haven't really seen it yet really. I haven't seen it specifically" (TI_A_APES_T532_14_11_5).

Ms. Earle dropped annotation strategies at the end of the first project because she felt her students struggled to understand how a "big generalized question" could be answered with "little bits," such as those that might be marked by a checkmark. Rather, she believed her students "don't buy into checkmarks and question marks. But they love having a directed question that they're looking for" (Post-EF Interview: T513_14-11-3; CTM2_PD_V_APES_DMPS_14-10-01). Ms. Hunter continued to require highlighting until she got to the note-taking tool in EcoFootprint (she printed copies of the first EcoFootprint textbook readings). Since Ms. Hunter did not engage with students' highlights or check their sticky notes after beginning to work with the note-taking tool, it appeared Ms. Hunter relied on the strategies to keep students actively reading. She did not provide opportunities to discuss what students marked or questions they had noted.

5.2.2 *Did anything take the place of annotation strategies?*

After experimenting with annotation strategies in the first project, teachers did not pick them up again; however, this did not mean teachers were opposed to metacognitive strategies in other forms. To the contrary, Ms. Murie, Ms. Carson, and Ms. Hunter consistently used note-

taking tools and other structured approaches to texts. For example, these three teachers¹⁴ readily used and reported success with the following kinds of metacognitive tasks for text-based learning:

- Recording relevant information from text in project-specific note-taking tools (EcoFootprint and My Community Ecology)
- Organizing information from a text into a graphic organizer depicting a system
- Labeling advantages and problems of energy sources presented in a text
- Making a T-chart of arguments for and against a proposal
- Identifying three kinds of issues in a text (environmental, economic, social/cultural)
- Labeling information in a text with varying degrees of relevancy to a specific site

Teachers gravitated toward approaches like these that offered a task-specific alignment with texts. At the end of the third project, My Community Ecology, Ms. Carson distinguished between different kinds of supports for text-based tasks that she now viewed as necessary for student success: “reading tools” were interfaces that supported close reading, such as a T-chart for pros and cons, while “note-taking tools” described organized pages where students could record and categorize relevant information applicable to the larger project. Ms. Carson believed that these “tools are the key to doing the big product at the end; that's what [students] actually need to use. I think they're helpful in that – and the focused reading” (Post-MCE Interview: T552_15_1_27).

The nature of structured tools had an impact on learning from text. For example, Ms. Murie returned to modeling, as she had done previously when orienting students to learning from text, to demonstrate how to use a note-taking tool with text before she “put the onus on [the students] to go back and make any revisions [...] I wanted them to be a little bit more active on their own, and I figured modeling at least two [sections of the tool] would give them enough of what I was expecting them to have in there” (Post-MCE Interview: T532_15_2_6). Ms. Murie

¹⁴ After the Intro to Sustainability, Ms. Earle rarely used text as suggested in the PBL-APES curriculum.

reported emphasizing how the note-taking tool was directly linked to their final project, “hoping it would be their motivator to continue with it,” especially since she did not plan to assess their tools (Post-MCE Interview: T532_15_2_6). Ms. Murie was not alone in setting up tools and then setting students free with them; Ms. Carson did the same. Both teachers felt that checking on student tools more in the future would be beneficial since they recognized they did not know how students utilized the tools after the first ones had been completed collectively. This brings up echoes of Ms. Murie’s recollection of yellow sticky notes in a textbook, suggesting that perhaps all learning from text strategies, from checkmarks to highly organized notebook pages, are eventually released to students to be used independently, in the hope they are ultimately useful.

Ms. Hunter found that her students seemed focused when putting sticky notes into note-taking tools. By the end of the second project, EcoFootprint, Ms. Hunter decided it was an effective approach for keeping students actively engaged with texts; she then transferred the model to the third project, My Community Ecology. Ms. Hunter’s description of how the note-taking tools were a good fit highlights the fact that their project-aligned structure inherently provided a purpose for reading, an element that was at times lacking in her instruction:

We started out doing some of those question marks and the checks and stuff like that. One thing that they liked to do even better is when they find an important thing they'll take a Post-it note and write down that important fact on the Post-it note rather than just putting a check. Then they can take those Post-it notes and put them directly into the sections of their binder where it goes. ... as long as the Post-it notes stay there, it'll help them be organized, I think, when we start writing the big proposal. I think that's why I went more towards the Post-it notes. So they knew a specific purpose: "Hey, you'll use these notes later on."(Post-EF Interview: T543_14-11-3)

Notably, Ms. Hunter’s reflection on the efficacy of the notebook tool emphasized the active nature of the activity, yet even when sharing a students’ notebook, she did not comment on the quality of student thinking or comprehension of what they had read.

Finally, there is an argument to make for the role of discussion in supporting metacognitive thinking with texts. If checkmarks and question marks proved too challenging to leverage conceptually, perhaps teachers simply shifted their efforts from supporting internal dialogue through annotation to external dialogue supported by discussion. There are no data indicating that teachers made this choice consciously. But discussion did not fade and text-based talk certainly played a large role in the facilitation of note-taking tools that worked well for teachers. Although Ms. Murie and Ms. Hunter typically asked students to read silently in class, Ms. Carson supported pair- and small-group reading for this reason: “I think there's a benefit for the groups who choose to read aloud. You know, I've heard some great discussion down there with those guys, when they do read aloud and discuss. But then it takes time, so ... yeah” (Post-MCE Interview: T552_15_1_27). Interestingly, when she first asked students to read in class, Ms. Carson worried that reading aloud would be distracting for students and possibly provoke push back; yet after seeing it in action, she came to promote the practice of discussing text while reading (having a regular shortage of textbooks in class also encouraged the practice). Even as some teachers found it difficult to let students take on the work of thinking in whole class discussions (more on this topic in Chapter 6), it is possible that teachers found it was more effective to support active thinking about texts through text-based discussions than annotations.

5.2.3 *What, if anything, did teachers learn about strategic reading?*

Although teachers used the annotation symbols in the first project, the approach did not have staying power as a procedure or as a metacognitive strategy. Once beyond the opening texts, teachers looked past curricular suggestions in the second and third projects to use the checkmarks and question marks. The data described in the previous two sections suggests that teachers felt the learning from text symbols were too general to carry forward into content

specific text, but observation data also suggest teachers did not take them beyond a procedural level. The critical feature that teachers referenced when judging the functionality of other tools was how well it aligned with a purpose for reading. Perhaps this is where the checkmark fell short in communicating its intent.

One element that did not carry forward was the emphasis on using these strategies to help students identify their own questions and confusions. There are no data in the second or third projects to suggest teachers continued to foster awareness of questions. There are, however, data suggesting the practice went against both teacher and student expectations. Ms. Carson worried after the Summer Institute that students would be reluctant to raise comprehension questions: “I don't know that it's going to be easy to encourage students to raise their hand and say, “I don't understand this word or I don't get the sentence” (Summer Institute Interview: T552_14_8_7). The concern did not come up again, but Ms. Carson spent little time pressing students to share what confused them¹⁵. On the flip side, on the rare occasions when students asked questions that went beyond unfamiliar terms, it often put teachers into uncomfortable spots. As Ms. Hunter put it, she wished there were supplemental readings to prepare teachers before lessons, “to help me look a little more knowledgeable because sometimes the kids are like, ‘Don't you know this?’ I'm like, ‘No, I didn't go to school for this.’ Something to help me out, just to know a little more in-depth, in case they have those above and beyond questions that I can't answer” (Post-EF Interview: T543_14-11-3). From pronunciation questions to interpretation questions, there are data suggesting student questions frequently highlighted what their teachers did not know. For teachers who were stretched in their content knowledge, inviting questions was not likely an approach they wanted to foster.

¹⁵ I feel it is important to note that many students, in Ms. Carson's class as well as in all teachers' classes, asked for definitions of unfamiliar words, like *paleontologist*, when reading. However, very few students questioned confusing phrases or sentences; it was even less common for students to raise questions about larger concepts.

CONCLUSION

This chapter examined what teachers changed in their practice and thinking as they enacted PBL-APES. As noted earlier, curricular knowledge continued to influence both new and experienced teachers. New teachers made moves that compensated for their limited curricular and content knowledge while experienced teachers attended more to student understanding. Ms. Carson's adaptations demonstrated adaptive expertise of the learning-from-text approach as she developed ways of holding her students accountable for understanding text-based learning.

Given that Ms. Carson was reluctant to impose an annotation approach on students she deemed academically capable of using their own strategies, it makes sense that she found other ways to check students' knowledge. Because Ms. Carson did not report on her perceptions of student performance, it is difficult to know what she learned about how well students understood key concepts or if she adjusted her instruction in any way. Classroom observations in her class provided hints that not all Ms. Carson's students were successful at interpreting the text independently; however, it is not clear whether she recognized this or addressed it.

Ms. Carson's approach of asking for explanation and evidence aligned with the kinds of application opportunities that were embedded in the curriculum. Ms. Murie elected to rely much more on discussions, where by her own account not all students participated, rather than student work as a measure of students' understanding. Ms. Hunter viewed Post-its as evidence of student engagement, and Ms. Earle relied entirely on quizzes of the supplemental AP Test Prep book as a measure of student content knowledge. This raises some questions about what teachers considered meaningful or sufficient learning from text. Proceeding without evidence of what students understood or could articulate about the content and ideas they learned from text seems problematic.

Chapter 6. FINDINGS: INFLUENCES FROM THE EXTERNAL DOMAIN

In this chapter, I describe how teachers interacted with the PBL-APES curriculum and opportunities for professional learning (the Summer Institute and the collaborative team meetings) in ways that supported more or less teacher learning about working with texts. To structure this chapter, I first look at how teachers were influenced by the curriculum and its embedded supports for text-based learning. Then I examine the role of the PBL-APES professional learning opportunities.

6.1 CURRICULAR INFLUENCES ON TEACHER LEARNING

As intended by the KIA design-based approach, all four participating teachers approached and used the PBL-APES curriculum in unique ways: they each had their own routines for preparing to teach, they took up and leveraged elements of the curriculum differently, and they tailored their enactments to the specific students and school settings in which they taught. Since portions of the curriculum were newly revised, even returning teachers at times reported feeling ‘like a new teacher again’ as they worked to make sense of and enact those segments of the curriculum (Ms. Murie; Post-MCE Interview: T532_15_2_6). Looking across teachers’ use of the curriculum, there were distinct differences in how experienced and new PBL-APES teachers used the embedded supports for learning from text.

In the sections that follow, I look at how new and experienced PBL-APES teachers used the learning-from-text supports of framing and the *before-during-after* structure differently, how embedded supports fell short for most teachers when it came to supporting discussion of text,

and how teachers who prepared to teach by closely reading the course texts found themselves particularly engaged in the process.

6.1.1 *Experienced teachers view supports as educative*

Experienced PBL-APES teachers, Ms. Carson and Ms. Murie, consistently referred to and incorporated curricular supports for framing text-based learning and using the *before-during-after* framework with text. Both Ms. Carson and Ms. Murie described them as particularly helpful. The consistency of clear examples in the curriculum appeared to support Ms. Carson and Ms. Murie’s learning of the learning-from-text principles and practices over time.

When it came to framing, Ms. Carson and Ms. Murie reported understanding that the suggested framing statements, written in teachers’ words, was a resource to use as they thought best. An example of framing from My Community Ecology:

Before reading 1st Chunk:

*You’ve just identified the critical features of an ecosystem. But **how** are living and nonliving things connected by energy? As we find out about this, you will learn why it is important to consider when thinking about development at our site. Let’s read from the textbook to find out more...*

Ms. Carson felt it was important for her to paraphrase framing statements in her own words, while Ms. Murie said she went back and forth between reading framing statements verbatim and paraphrasing them in her own words. Both teachers viewed framing as “definitely valuable” in that it conveyed a curricular “rationale” for how learning from text fit into the “big picture” of the course (Ms. Carson; Post-MCE Interview: T552_15_1_27). Ms. Murie appreciated framing statements when planning but, like Ms. Carson, she also viewed framing as important for students:

I just really have enjoyed the way it's been worded and phrased, so sometimes I'll say it verbatim. I have it copied onto my notes. Sometimes I'll just glance at it so that way I can paraphrase what it said, but I think more for the students it's actually helped them to see where we're going from one project to the next. (Post-MCE Interview: T532_15_2_6)

Classroom observation data indicated that Ms. Carson and Ms. Murie consistently provided framing for learning from text, and typically in their own words. Their framing almost always linked what students did previously to the text at hand, why it was worth learning, and how what they would learn related to the larger task or project.

In fact, Ms. Carson and Ms. Murie typically adapted the curriculum's suggested framing by extending it, often making it more explicit in regard to the text-based learning approach. Still, the clarity of a teacher's framing appeared to be related to the level of familiarity teachers had with the content. Ms. Murie, in particular, framed unfamiliar portions of the curriculum with less certainty than materials she had previously taught. But framing also reflected teachers' investment in developing deeper, conceptual learning, and for that reason both Ms. Murie and Ms. Carson seem to have given the practice considerable thought.

Ms. Murie's adaptive framing is evident in the following example. When she introduced students to the article about Easter Island in the first project, Intro to Sustainability, Ms. Murie extended the framing provided in the curriculum materials to include the previous Environmental Science reading, the learning from text approach (chunking), and the purpose for reading¹⁶.

Suggested curriculum framing for Easter Island reading:

We've just hypothesized why we think Easter Island Collapsed. Now we're going to read what one scientist concluded about the collapse. We'll see if our hypotheses are consistent with that scientist – his name is Jared Diamond and we're going to read an excerpt from his work.

¹⁶ Ms. Murie did not emphasize reading to compare students' hypotheses with the article; it is likely that Ms. Murie downplayed that aspect because her class did not have time to discuss their current hypotheses (although students had written them).

Ms. Murie's framing:

You just gathered some information based off a film. What we're going to do next is we're going to get more information based off an article, an article that a scientist wrote. His name is Jared Diamond. This is a pretty long article that he wrote. And we're not going to sit here in class and read all the way through it and discuss it, alright? That would be counterproductive to what we're actually doing here. We're going to chunk this reading.

So if you take a look at the bottom of the first page, it has a little box with an X through it. Anytime you see the box with the X through it, that means where we're going to stop and discuss.

As we're reading this—if you take a look at the top—as we're reading this article, by this scientist, Jared Diamond. Up at the very top is the purpose: Why did Easter Island collapse? Through this we're hoping to be able to answer this. WHY did it collapse? Read to find out what happened to the civilization and the environment of Easter Island. And how environmental science helped solve these mysteries.
(CO_E1_V_APES_T532_PD5_14-08-29_C5)

It is important to note that Ms. Murie and Ms. Carson's understanding of framing was consistent with the PBL-APES approach and led to their adaptive use; as Ms. Carson put it: "I do feel like I make an effort to help them know *why* they're doing what they're doing, and how it relates to what they did, and where they're going" (Post-MCE Interview: T552_15_1_27). Both teachers demonstrated an inclination to incorporate framing whenever necessary, sometimes several times throughout a lesson, sometimes posing questions to students, all in an effort to bring student awareness and their learning from text back to the big picture. Ms. Carson in particular, tended to frame learning from text as *useful* and routinely highlighted how students' text-based learning would inform the driving question broadly and upcoming tasks specifically. For example, in the third project, My Community Ecology, she framed one text-based task like this:

What is our big cycle driving question for this project cycle?

[Student responds]

Right. How can our community develop more sustainably? The big focus is our project site, which most of us went to already. And now we're getting into our arguments for and against the proposal.

This is the first time you've seen articles one way or another and I asked you to make a T-chart. [...] So get your T-chart out, get your articles out. You have 5 minutes to share T-charts with the person next to you; and if they have something on their T-chart you missed, add it to your T-chart. These are going to be important, right?

If our big thing is how we can develop more sustainably, we need to know the arguments for and against. So share, discuss, add to your T-chart. And then we will continue.
(CO_E2_V_APES_T552_PD3_14-12-01_C5)

In addition to framing, Ms. Carson and Ms. Murie also consistently incorporated the *before-during-after* framework for learning from text into their planning and teaching. Both teachers supported learning from text *before* reading (by setting purposes, preparing students to read strategically), *during* reading (suggesting note-taking tools or other text-related structures such as T-charts; also by interacting with students while they read), and *after* reading (providing application tasks and/or discussion opportunities).

Ms. Murie felt supported by this embedded approach; she commented that when planning she paid “particular attention to the reading portions” and tended to transfer them directly from the original lesson plan to her shorter page of instructional notes. When asked why she focused on that section of the curriculum, Ms. Murie explained:

The way it's set up actually makes sense to me. So [the lesson will] tell you, “This is the article you're going to be reading. Before they're reading, here's the purpose. Make sure you set it up. These are some suggestions to help set the purpose. I think it's laid out really well, to where it's Step 1, do this. Now Step 2, do this. That's why it's helped, because I'm not a reading teacher. I don't have a reading background, and so any kind of help I can get with that has always been helpful to me. (Post-MCE Interview: T532_15_2_6)

Ms. Murie's perception that she felt capable of supporting text-based learning despite a lack of previous experience seemed to indicate that the embedded supports were functioning educatively. Ms. Carson also felt the *before-during-after* “sequence” made sense, and when she felt something was missing (for example, application tasks like the food web described in the Chapter 5) she added it. Although Ms. Carson reported that pacing concerns meant she skipped

some activities, she did not skip texts. On the whole, she felt the embedded curricular supports helped her enact text-based learning. When reflecting on her adaptive use of the curriculum, Ms. Carson said:

I think it's good to have it all there, because it really helps me in the extent of all of it. And then I think I can do a better job of helping [students] make sense of it, even if I don't explicitly end up talking through all this, and sharing, doing every part of every lesson. It's just helpful. And you know, for the people who haven't taught it before... yeah, it's got to be really beneficial. (Post-MCE Interview: T552_15_1_27)

Data from classroom observations indicate that Ms. Carson and Ms. Murie enacted all the text-based lessons across the three projects. Although both teachers consistently adapted and personalized their instruction, they typically framed learning from text opportunities and drew on the *before-during-after* approach to texts. Overall, their experience of the curricular supports for text led teachers to feel like “it’s been working” (Ms. Murie; Post-MCE Interview: T532_15_2_6) and led to lessons that, in Ms. Carson’s opinion, “worked pretty well” or “went down really well” with her students (Post-EF Interview: T552_14_11_3; Post-MCE Interview: T552_15_1_27).

Although the examples above are drawn from classroom observations, both teachers left the Summer Institute feeling the revised approach to learning from text not only made sense, but had a better “flow” and felt more “streamlined” (Ms. Murie; Post-MCE Interview: T532_15_2_6; Summer Institute Interview: T532_14_8_5). To Ms. Carson it seemed “more purposeful and more aligned than last year” (Ms. Carson; Post-EF Interview: T552_14_11_3). Ms. Carson attributed the sense of alignment to both the curriculum revisions and her increased knowledge of the curricular trajectory: “Either the lesson plans are written in a way that is easier for me to find the right thing at the right time... Or I'm better at it this year than I was last year. Or both” (Post-EF Interview: T552_14_11_3).

Taken as a whole, it appears that the curriculum, in tandem with how it was explained and collaboratively refined during the Summer Institute, increased teacher knowledge of the course and its materials, not only supported Ms. Carson and Ms. Murie's use of framing and the *before-during-after* framework for text-based learning, but also enabled them to adaptively enact the approach throughout the three projects.

6.1.2 *New teachers focus on procedural supports*

The new teachers, Ms. Earle and Ms. Hunter, attended more to procedural elements in the curriculum. Again, the teachers linked their limited enactment to the steep learning curve for understanding PBL-APES. During interviews, classroom instruction, and the collaborative team meetings, both teachers described how the process of teaching an entire unit eventually clarified the curricular arc, at which point they could retrospectively understand the unit's goals and how the texts and tasks fit together; but until then, they felt uncomfortably lost. When looking ahead to a new unit, Ms. Hunter described feeling "like a curtain is drawn and I don't know what's behind there yet" (Post-EF Interview: T543_14-11-3) while Ms. Earle described her daily experience as being "in the trenches" with her students (Post-MCE Interview: T513_15_2_5). Both teachers reported in interviews and to their colleagues that they were moving "day-to-day" with the material¹⁷, indicating that they were not familiar enough with the curriculum to plan ahead; more importantly, this suggested they had a difficult time seeing how learning from text played out over time. Although Ms. Earle and Ms. Hunter used texts differently throughout the study, they were both sensitized to their own learning process as they moved through the curriculum; each believed that acclimatizing to the PBL-APES curriculum, although stressful,

¹⁷ Even Ms. Murie reported being unable to plan ahead when in the midst of the third project, My Community Ecology, which she had not taught before. However, her unfamiliarity with the project did not impact her ability to incorporate text-based learning, as it did for Ms. Earle and Ms. Hunter.

would eventually pay off in future enactments. As Ms. Earle put it, “Next year I’m going to be so much better at this” (Post-MCE Interview: T513_15_2_5).

In keeping with the analysis made in Chapter 5 (section 4.1.2), I hypothesize that the overwhelming demands of the course content and project-based learning pedagogies may partly explain why Ms. Earle and Ms. Hunter paid scant attention to some text-based elements of the curriculum. Another possible explanation is that pre-PBL-APES beliefs influenced teachers’ interpretation of the curriculum. When reflecting on their use of the curriculum, both Ms. Earle and Ms. Hunter described their inattention to the specific text-based elements of the curriculum, such as the framing statements and the embedded *before-during-after* framework.

Ms. Earle and Ms. Hunter’s beliefs about teaching and student learning seem to have given rise to an early perception of curriculum supports for learning from text as extraneous. As a result, the embedded curricular supports did not strongly inform their instructional planning or enactment. Framing provides an illustrative example. Data from class observations indicate that Ms. Earle and Ms. Hunter rarely framed learning from text opportunities with reasons why learning from text would matter for the unit. In an interview after My Community Ecology, Ms. Earle thought in retrospect that she could have done “a better job” with framing, explaining that her propensity to “do things in little chunks, like ‘this is what we’re talking about *today*’” meant that on her first pass through the curriculum she did not think about using framing to “kind of weave [tasks] together” (Post-MCE Interview: T513_15_2_5). In addition, Ms. Earle related her lack of framing to her experiences with students; for example, she felt chronic student tardiness made framing ineffective because few students were present to hear it.

Ms. Hunter, on the other hand, believed framing was a practice she already had in her repertoire; as a result, she felt she didn’t need to reference the framing embedded in the

curriculum. Ms. Hunter described framing as something she would “naturally do anyways” in all her classes. Yet Ms. Hunter’s description of framing’s role suggested her understanding of framing differed in nature from what she enacted in practice, and also differed from the intended role of framing in PBL-APES. Although Ms. Hunter described framing both as a “reminder” of what had been covered previously and as a teacher move to provide “that spark of why this information is important” (Post-MCE Interview: T543_15_1_30), in her PBL-APES class she rarely framed text-based learning in ways that provided purposes for reading or conveyed why it was important. During her interview after the third project, My Community Ecology, Ms. Hunter illustrated her typical use of framing with an example that demonstrated communicating curricular shifts from a previous topic (cells) to the current topic (DNA), but did not explain what students should take away from either: “Last time, we looked at cells under the microscope, so now let's go in deeper and now we're going to look at DNA” (Post-MCE Interview: T543_15_1_30). When Ms. Hunter explained that she did not “feel obligated to read exactly” the suggested framing statement in the lesson plan, she meant she would communicate the same idea in her own way. However, there appeared to be a discrepancy between Ms. Hunter’s understanding of framing and the more conceptually focused framing suggested in the PBL-APES curriculum. An illustrative example of Ms. Hunter’s framing in the third project, My Community Ecology, demonstrated her emphasis on providing a task (to identify benefits of biodiversity) without a reason for *why* this information will be important or useful. As written in the curriculum, this reading was suggested as a homework assignment; accordingly, the purpose for reading was accompanied by explanation of how it would be used and how it would support the larger project:

- **PURPOSE:** Read to learn how biodiversity can benefit both ecosystems and humans, and what benefits might exist at our site.
- **USE:** We will discuss this reading at our next class in two ways. 1) How does this information about the benefits of biodiversity relate to what we know about the site from our data collection and reading? 2) How does this information help us determine the potential benefits or consequences of developing the site?
- **PROCEDURE:** Use what you know about the site while you read (pro/con articles, site data). While you read, think carefully about how what you read is relevant to our site. Mark three kinds of biodiversity benefits with different sticky notes:
 - (1) Mark biodiversity benefits you think are **HIGHLY** relevant to our site – and be ready to talk about what data you have (or want to get) to provide evidence for those benefits.
 - (2) Mark biodiversity benefits you think are **REGIONALLY** relevant – this might be something that matters for your region in general, but most likely isn't present at the site.

Mark biodiversity benefits you think are **GLOBALLY** relevant – these are benefits that are exciting but are very unlikely to exist at the site.

[MCE_T2_L1_0_Ecosystems]

Ms. Hunter presented the reading assignment this way:

Ms. Hunter: What I want you guys to write down and what this talk today is going to be about is biodiversity. [addresses student's side-conversation] Benefits of biodiversity. And then we're going to look back at our field trip. So kind of get back in that mindset. [students ask which field trip she's referring to] So what I want you to write down with your partners first is... How biodiversity can benefit ecosystems and humans. And this is just from your book right now.

Dmitri: How many things do we need? Everything in the book?

Ms. Hunter: I'd go for everything you can muster up.
(CO_E2_V_APES_T543_PD2_14-12-11_C5)

Ms. Hunter believed she already knew how to make connections between topics and that her understanding of framing aligned with the PBL-APES. As a result of this belief, she reported not closely examining key supports such as framing for learning from text when preparing to teach.

She appeared to be unaware of the difference between her personal framing and the specificity of the framing suggested in the lesson plan.

That both Ms. Hunter and Ms. Earle skimmed supports when they seemed superfluous to their personal teaching approaches suggests they might have benefited from more in-depth professional development on the role of learning-from-text components, such as framing.

6.1.3 *Insufficient curricular support for facilitating discussion*

Of all the interactions teachers facilitated with text, one of the most challenging was leading discussions. Not only did teachers need to understand the texts well, but they also needed to keep instructional goals in mind when guiding discussions that supported students in making sense of what they had read. Although much evidence supports the benefits of discussion for reading comprehension, the practice has also been found to go against the culture of “teacher telling” in secondary schools (Nystrand, 2006; O'Brien et al., 1995). Therefore, teachers may not have developed their facilitation skills. Before presenting data that highlight the challenges presented by discussion, I first recap how teachers were oriented to discussion in the Summer Institute. Note that while discussion was introduced during professional development, this section explores teachers’ use of embedded curricular supports for discussion *after* this initial introduction. Teacher learning that occurred during the Summer Institute will be addressed later in this chapter, in the section on professional learning opportunities.

When the learning-from-text approach was introduced to teachers at the Summer Institute, discussion of text was portrayed as an important site for sense-making, for helping students understand what they had read, and for making connections between a text and the larger task or project. Discussion was also positioned to motivate students to read; to this end, the lesson plans emphasized how texts (whether read in-class or for homework) would be *used*. Such

application opportunities frequently incorporated discussion (pairs, small groups, or whole class) as a primary component in tasks that followed learning from text. Embedded curricular supports for in-class discussion included suggestions like these (examples from an EcoFootprint lesson on Energy Sources):

- Questions teachers might ask to focus a text-based discussion

- Facilitate DISCUSSION:
 - Have students recap different sources and what's important to know about these different sources for thinking about their EcoFootprint analysis – compare to the chart compiled before reading.

- Prompts to confirm understanding about important concepts or ideas in the text

- Press for understanding of the following using the ✓s in their texts)
 - fossil fuels,
 - renewable, non-renewable
 - developing vs. developed nations

- General, metacognitive discussion suggestions aligned with what students were asked to do during reading

- Ask students to identify places where they have placed ? sticky notes. Discuss and clarify questions.
- Guide students to examine the Tables & Figures by having them describe and interpret each one in their own words. Be sure they read the captions under each.

- Application tasks (frequently discussion-based)

- Direct students to header on p. 546 (“It takes energy to make energy”) and have them discuss its meaning and implications for their EcoFootprint Analysis.

Importantly, the discussion supports initially linked directly to the purpose for reading, but then aimed to go beyond the purpose in the suggested application tasks. For homework readings, the lesson plans included assignments and application suggestions for the following class. These were also available to teachers on PowerPoint slides; an example is presented in Figure 6.1:

LFT Homework Assignment	Homework Application
<ul style="list-style-type: none"> • PURPOSE: Read to understand the types of waste people and cities generate – and how various disposal methods are used to manage municipal waste. After you find out our city’s main management method for waste, consider why this information is important to consider for your EcoFootprint. • USE: For our next class, be prepared to discuss how our city’s waste system impacts your LCA research and your family’s footprint. Also, be ready to take a stand on the most effective waste management method. • PROCEDURE: <ol style="list-style-type: none"> 1. Research our city’s waste management plan. 2. Use sticky notes for ✓s in the assigned text (including graphics and captions) to read for the purpose. 3. Mark any questions /confusions with ?s 	<ol style="list-style-type: none"> 1. The three graphics on pp. 632-633 are closely related. With your partner, discuss the connections between them – and be ready to share how this information matters for your own EcoFootprint. 2. Decide with your partner whether you think a landfill or incinerator is a better municipal waste management method. Take a stand on the issue – make sure to support your answer with evidence from the text. 3. Based on what you found out about where our city waste goes... <ul style="list-style-type: none"> • What are the most likely disposal options for your LCA object? • What information from this chapter is important for your EcoFootprint? Discuss with your partner; be prepared to share. 4. What questions did you mark? Discuss and clarify.

Figure 6.1. Learning from Text Homework Assignment & Application

After an orientation to the role of discussion in text-based learning during the Summer Institute, teacher comments suggested there was apprehension about facilitating discussions. Some teachers worried that discussions took too much time and others questioned how to balance the right amount of questioning with content coverage pressures. Ms. Earle characterized the unknown depth of a discussion as a “wormhole” in which teachers could easily get stuck (APES_PD_14-08-05.1of2). However, in their respective interviews after the Summer Institute, most teachers agreed that discussion was “really important to the course” and despite concerns about time, student engagement, and previous challenges with discussion, they looked forward to

using discourse strategies they had learned in the Summer Institute to engage all students, particularly quiet ones, in text-based discussions (Ms. Carson; Summer Institute Interview: T552_14_8_7).

How then, did teachers utilize the embedded supports for discussion? Data analysis suggested all teachers used embedded supports to help guide discussions, but for most teachers the curricular support was insufficient. Discussion facilitation was highly dependent on the teacher's familiarity with the specific text at hand, but also on her understanding of how the text figured into the larger curricular scope. In addition, teachers needed to be able to facilitate a discussion, a skill requiring the ability to bring students into the conversation, ask productive questions, and help students make sense of the text without doing the thinking for them. Teachers who brought this conceptual clarity to text-based discussions were able to navigate student questions, graphics, and challenging vocabulary, all the while pressing on student understanding, asking for text-based evidence, and ultimately, supporting students to do the work of thinking. This kind of discussion was frequently evident in Ms. Carson's classroom and rare in the other three teachers' classrooms. Ms. Earle, Ms. Hunter, and Ms. Murie demonstrated a tendency to lead IRE¹⁸-style discussions regardless of the inquiry inherent in the embedded discussion prompts. These findings suggest that the curricular supports, while enacted in many discussions, were not sufficient for ensuring discussions supported student thinking about texts.

A continuum of discussion facilitation emerged across the four teachers. On one end of the continuum, there were discussions guided by curricular prompts that led primarily to student recall of material. On the other end of the continuum, discussions used the same curricular

¹⁸ IRE stands for teacher Initiated question, student Response, and teacher Evaluation of the response, which Cazden (2001) describes as being one "of the most common discourse patterns at all grade levels," making it a longtime hallmark of "traditional" instruction (p. 30). Cazden and other researchers describe alternative discourse patterns variously as nontraditional, inquiry, dialogic, ambitious, or evidence-based.

prompts to support student thinking and understanding of key concepts and ideas. To present the two far ends of this continuum, I use an example from a lesson in EcoFootprint, the second unit. This lesson focused on understanding sources of energy and was intended to relate to the students' audit of their home electricity use, in which they would look for ways to reduce their family's usage. The curriculum presented the following discussion supports:

After reading 2nd chunk pp. 546-549:

Facilitate DISCUSSION

- How is electricity is produced from coal and what are some possible advantages, problems, and issues related to sustainability?
- What questions/clarification do you have about this section?
- Based on what you just read, should we continue using coal to make electricity? Why or why not? Support your response with evidence from the text.
- Has “clean coal” become a reality? This might be interesting for you to research outside of class.

An example from Ms. Carson's classroom illustrated a representative dialogic, inquiry-based discussion in which students did the work of thinking. Although Ms. Carson's understanding of the text implicitly undergirded her movement through student contributions, she kept the students doing the thinking through requests for evidence and invitations to elaborate on important ideas. Prior to this discussion, Ms. Carson had assigned the text for homework; she used the first two suggested discussion prompts to guide students' reading at home. The following class, she used the third prompt as a quick-write: students were asked to argue whether coal should continue to be used to generate electricity and to use evidence from the reading to support their opinion. Ms. Carson adaptively transformed the question to function as both an individual (quick-write) and group (discussion) application task. A brief, representative segment of the six-minute discussion is presented here:

- Ms. Carson: I'd like to hear what you, or perhaps the person next to you, what they think. Let me restate the question: Should we continue using coal to make electricity? Who said yes?
- Maria: I thought we use too much coal right now to immediately stop. [...]. I don't remember what the number was, but our state was like 61%... Oh, 77% according to Sam. We should gradually cut down on the use of coal, but I don't think we can just stop using coal.
- Ms. Carson: OK. Nadia? For or against coal? What did you say?
- Nadia: I said no.
- Ms. Carson: No. Support that position with evidence.
- Nadia: Coal is a nonrenewable resource and once it's all used up, we'll have to use other sources. We should try to shift now.
- Ms. Carson: We should shift now, OK. Luis?
- Luis: I basically agreed with what they said. Use it less, but not get rid of it all together. [...] Coal's a resource. We should use it if we have it, not too much. But another point is that it's really bad for the environment.
- Ms. Carson: OK, I'm glad you said that: Coal is bad for the environment. Who can elaborate? What does "bad" mean?
- Emmett: The problem with burning coal is a lot of greenhouse gases. And also when you're mining for it you cause air pollution and water pollution.
- Ms. Carson: OK, sounds like a good argument. Avery, your hand was next...
- Avery: The impurities in coal, such as sulfur, are really, really bad for environment. It's very difficult to get those impurities out before burning it and releasing the toxins.
- Ms. Carson: Yes. Good evidence. Malia, did you want to add as well?
- [CO_E1_V_APES_T552_PD3_14-09-18_C5]

Ms. Hunter used the same lesson plan suggestions during an in-class reading, yet the nature of the discussion she facilitated was markedly different. While Ms. Hunter also structured student reading (in-class) with a focus on identifying advantages and problems of coal, her goal afterward was to elicit examples of those advantages and problems. She did not check to see if students understood key concepts, even when students produced answers that suggested they did not grasp major ideas. For example, when a student suggested “organic matter” was an advantage of coal, Ms. Hunter did not press for an explanation. Typically this indicates coal is a nonrenewable resource, which is a problem when considering sustainable energy sources, rather than an advantage. Likewise, Ms. Hunter did not explore why “pollution” or “techniques for extraction” might be considered problematic. The surface-level, IRE-nature of this interaction

with text suggests that Ms. Hunter's understanding of the text and its content may be insufficient for supporting student engagement with the ideas promoted by the guiding question. Or this could mean Ms. Hunter is not yet adept at leading discussions.

Ms. Hunter: Alright. Here we go. What are some advantages to coal?
 [Ms. Hunter writes on white board as students call out the following statements]
 Derrick: Organic matter
 Selena: There's a lot of it.
 Ms. Hunter: What else? What else? [silence] That's all we get out of coal?
 Maya: It powers everything. They use it for a lot of stuff.
 [Ms. Hunter records this as "It powers a lot of things"]
 Abdul: The U.S. has one quarter of all the world's... something like that
 Ms. Hunter: Like one quarter of all the world's coal?
 Abdul: All the production.
 Ms. Hunter: Is it supply or production?
 Selena: Supply
 Ms. Hunter: Alright... Disadvantages?
 [Ms. Hunter asks students to stop side conversations]
 Selena: Pollution
 [Ms. Hunter again asks students to listen]
 Selena: Techniques for extraction
 Ms. Hunter: Anything else? Nope, that's it?
 [silence]
 (CO_E1_V_APES_T543_PD2_14-09-16_C5)

This example portrays a focus on student-generated recall about text without conceptual teacher guidance or skill at pressing on student thinking. Evident in the exchange is a lack of engagement with the text itself; there are several missed opportunities for teachers and students to make sense of the text. For example, had Ms. Hunter asked what "organic matter" meant she would have likely brought up the important concept of nonrenewable resources. Yet Ms. Hunter did not ask students to consider the context of the information or otherwise examine its meaning when she recorded their responses on the whiteboard. Relegating text to the background was common in the majority of discussions in Ms. Hunter and Ms. Earle's classrooms, and many of Ms. Murie's, suggesting that curricular supports and professional development opportunities were not sufficient for promoting discussions that engaged with text.

Data analysis highlighted two other frequent teacher moves that also led to a sense of disconnection between text and discussion. One such move was a tendency for teacher “telling.” Teachers often spontaneously presented mini-lectures when they summarized key points for students, or when they initiated tangential topics and explanations. Teacher telling often unintentionally distracted students from the conceptual goal of the discussion, but it also prevented students from making sense of the text themselves. Another move teachers made that distanced discussion from text was to respond to student queries about text with their own interpretations, usually based on the teacher’s personal understanding, rather than using the opportunity to guide students to closely examine the text itself. When teachers offered their own anecdotes and perspectives, they missed opportunities to model how students might productively question the text. These moves frequently underscored the challenges of facilitating conceptually driven discussion.

Separately or in combination, these three moves (teacher facilitated recall, teacher telling, and teacher interpretation) characterized a majority of the discussions that took place in Ms. Earle, Ms. Hunter, and Ms. Murie’s classrooms. Ms. Carson’s discussions sometimes exhibited these moves, but generally kept students doing the thinking; her insistence on student use of evidence tended to engage texts more directly. I present a representative example of how the three moves were visible in one of Ms. Murie’s discussions after reading.

In the following example from the second project, EcoFootprint, Ms. Murie reminded the class to keep their own energy use in mind while they read a textbook section on energy sources. She clearly set a purpose for the in-class reading and reminded them to use checkmarks and question marks:

Read to find out sources of energy and what is important to know about them as you think about your own Ecofootprint Analysis¹⁹. This is the question I want you to continue to ask yourself as you are reading this. So if you should happen to read something that will help you answer this [pointing to the projected question], put a little checkmark next to it. (CO_E1_V_APES_T532_PD5_14-09-11_C5)

After students read and discussed with a partner, Ms. Murie asked students to contribute something they checked or put a sticky next to. A student, Marco, shared an important text-related question he had noted. Ms. Murie displayed the relevant text on the document camera and initially turned the question back to the students. After a brief student response, however, Ms. Murie shared her personal interpretation. This move distanced the conversation from the text itself, but also missed an opportunity to connect the text to other elements of the course, such as the recently completed EcoFootprint Analysis, which had intentionally highlighted the resource-intensive lifestyle of North Americans.

Marco: I didn't put a sticky next to it, but I found it on the map: I noticed how North America uses some of the most energy, more than most of the world, even more than the big European Union powers. Tons more, like twice as much. They're just as developed as us, if not more... so it's interesting how we're less precautious [sic] about this kind of stuff.

Ms. Murie: OK, let's talk about this. [T projects world consumption map from textbook.] I know sometimes this map, or this information, can make some people really mad. Why do you think it would upset people?

Steven: Because we use so much energy, more than all of Europe?

Ms. Murie: Is this true?

Cecilia: Is it?

Steven: Probably.

Ms. Murie: Are you guys like: "We're always getting picked on... the U.S. sucks." No, we don't suck, just because the rest of the world is doing something different. Alright? They need to recalculate the numbers because I don't think that's true. Some other places use just as many fossil fuels as we do, consumption wise. There are some places... basically all of Europe is like, wow... they don't consume as much energy as we do. Why do you think this is though?

¹⁹ Students had previously completed online EcoFootprint calculators that demonstrated the resources required for their lifestyle would require 4-6 planet Earths if everyone were to adopt the student's lifestyle.

Cecilia: I was going to say it's also from 2007, so... it's not necessarily completely accurate.

Ms. Murie: Yes. Excellent point. Did anybody see that? This data is from 2007... so this data is seven years old. So maybe seven years ago when they weren't touting green energy as much—and by green energy I'm talking about energy that's renewable, alright? Have you guys seen those wind turbines? Seven years ago there were a lot less wind turbines here; seven years ago there weren't as many solar panels here... Seven years ago a lot of green energy products were a lot more expensive than they are now... so please do not ignore the dates of these.

(CO_E1_V_APES_T532_PD5_14-09-11_C5)

All three students' contributions raised questions based on details in the text. Ms. Murie's responses, however, moved away from the text, demonstrating how teacher interpretation (her personal perspective on the validity of the data) and teacher telling (her explanation of how the 2007 citation influenced its current legitimacy) curtailed opportunities to model productive engagement with text. Her moves also short-circuited opportunities for students to interpret text they had found interesting.

Given that these moves characterized a majority of discussions in Ms. Murie's classes, it highlighted a discrepancy between her discussions in practice with her belief about the important role of discussions in PBL-APES. In interviews, Ms. Murie reflected on the discussion in her classroom and noted that she perceived her facilitation of discussions had improved in comparison to previous years. As a sign of increased engagement in text-based discussions, Ms. Murie pointed to student use of evidence from the textbook, and she reflected on how she actively tried to “channel” the discussion style that had been modeled at the Summer Institute as a way to “get the students to actually think and develop their answers” (Post-EF Interview: T532_14_11_5). She reported that she used “a lot of the prompts that are in the lesson plan itself” and felt many students regularly participated in the discussions, although she noted it was more difficult to engage some of her quieter students (Post-MCE Interview: T532_15_2_6). Ms.

Murie characterized her approach to discussion in all her classes, since her first day teaching, as modeled on her college experience, where she had valued getting to think for herself:

I really don't try to lead them down one path or another, at least I hope I don't do that, and if they say something, I don't tell them yes or no, that they're correct or incorrect, I actually present their question to the rest of the class, like "What do you think?" or I try to get the students to expand, "What do you mean by that answer?" or "Somebody jump in and help them out." (Post-MCE Interview: T532_15_2_6)

Ms. Murie laughed after saying this, stating she would have to review the KIA research videotape to see if this is what she actually did in class. It seemed Ms. Murie sensed there might be a difference between how she envisioned her practice and her actual enactment. Without an opportunity to examine her practice (no coach in the room, no video examination), Ms. Murie had to rely on how she thought discussions went, which was likely difficult to imagine. Given how consistently Ms. Murie described discussion as centrally important in every interview, it is clear that Ms. Murie had a vision of dialogic, student-driven discussions in mind that was based on PBL-APES professional development as well as her own experiences in college. It was also clear that Ms. Murie did not perceive how her enactment of discussion in the classroom differed from what she intended to enact.

Ms. Carson, who facilitated discussions on the more dialogic, text-based end of the continuum, viewed discussion as an integral component of her instruction rather than an activity in and of itself. For example, when explaining why one discussion-based application task worked well, Ms. Carson recounted that what made a particular "take a stand" activity successful was how it got students reasoning about new content:

There was a breadth of opinions represented, and they could justify why they were standing where they were, and it was good to see the different opinions. You know, there was some discussion. I can't remember specifics, but there was some discussion back and forth to try and convince people why one was maybe more important than the other. [...] It got them thinking about the different reasons why we might want to conserve or preserve an area. (CO_E1_V_APES_T552_PD3_14-9-12_C5)

For Ms. Carson, then, discussion supports worked because she brought to them a conceptual orientation to the text that permeated her enactment (Valencia et al., 2016). Her constant awareness of the broader conceptual goal was apparent in how she framed learning from text (“interrogate that article and find the evidence”), as was her skill of facilitating discussions that pressed on student understanding, and linking learning from text to application tasks (CO_E1_V_APES_T552_PD3_14-9-12_C5). Indeed, Ms. Carson had an interest in and a knack for discussion: After the Summer Institute, she described classroom discussion as “really rich and really important to the course,” and she considered herself, “Pretty good at probing questions. I try and not let [students] off the hook” (TI_A_APES_T552_14-08-07). Ms. Carson’s experience with the curriculum and the clarity of her conceptual goals for text-based learning were important dimensions that supported her use of the PBL-APES discussion supports. It is important to note that Ms. Carson’s emphasis on the use of evidence was a clear signal that students were expected to reason when discussing text. As she told her class in the first project of the year, “You’ll get sick of me saying *Where’s your evidence?*” (CO_E1_V_APES_T552_PD3_14-9-02_C5).

The teachers who were new to PBL-APES, Ms. Earle and Ms. Hunter, both approached discussion supports much like they approached framing (described in the previous section). That is, the teachers’ perceptions of discussion supports were linked to their knowledge of the content and their pre-PBL-APES beliefs. For example, Ms. Earle reported thinking that discussions in her class were not as “rich as my students would be able to have” had she known the content (Post-MCE Interview: T513_15_2_5). Ms. Earle also noted that discussion did not count as formative assessment in her standards-referenced grading; she preferred to know what every student thought, not just the ones who talked in discussion. In the same interview, Ms. Earle also

noted, “I don’t have great strategies with non-participants,” indicating that she recognized it was not just a content knowledge issue, but also a skill set uncommon in high school classes. Content and pedagogical limitations seem to have influenced Ms. Earle’s decision to generally avoid discussions; at the end of the third project, Ms. Earle had led very few discussions (and those she had led tended to be teacher-directed and IRE in nature). Her primary use of the embedded discussion prompts was for developing handouts to accompany selected readings.

Ms. Hunter perceived the discussion prompts as useful supports and reported using them adaptively: “I’ll use [discussion questions] as opening questions, but I can [also] just take those out and put them right in a quiz” (Post-EF Interview: T543_14-11-3). When reflecting on discussions in general, however, Ms. Hunter conveyed some uncertainty. On one hand, she reported that facilitating discussions in her small class was hard because students seemed hesitant to share in front of their peers, or were “just lazy” (Post-MCE Interview: T543_15_1_30). Ms. Hunter found that using quick-writes or group whiteboards before discussions, increased student motivation to share. Across both interviews, Ms. Hunter talked about the role of discussions in broad generalities; the one specific reflection she shared was how the students surprised her with how little prior knowledge they had on the topic of biodiversity in My Community Ecology. In response, Ms. Hunter shared her plan: “next year I’ll just front load that a little bit more, just to make sure the kids are all on the same page before we start a discussion” (Post-MCE Interview: T543_15_1_30). This seemed to reveal Ms. Hunter’s underlying expectation for discussion; she saw discussion as a forum for sharing known information more than an opportunity to make sense of text. This approach was illustrated in her discussion about the advantages and problems of coal (discussed earlier in this section).

However, the embedded curricular supports for discussion were not sufficient to acclimate Ms. Hunter to a more dialogic or inquiry-based interaction with text.

Looking across teachers in regard to discussion, there was wide variability in how teachers perceived the embedded curricular supports. Experience with the curriculum mattered, as did teachers' conceptual orientation to content learning, and the necessary facilitation skills. Whereas Ms. Murie demonstrated conceptual clarity in other elements of her PBL-APES enactment, an analysis of her text-based discussions highlighted the importance of conceptual clarity not only in the content itself, but also in a dispositional orientation to letting students interact with content, rather than having it be interpreted or summed up for them. Ms. Carson's conclusion at the end of a text-based discussion suggests she recognized how grappling with content *was* learning:

Didn't you all read the same article, and you had the exact same evidence presented to you, yet you've drawn very different conclusions based on the same evidence. How you have chosen to interpret the evidence that was presented to you, and what weight you personally place on different pieces of evidence is determined in the choice you make. That's really cool. (CO_E1_V_APES_T552_PD3_14-9-12_C5)

A related finding has been alluded to in this section, but not fully explored. Before continuing, I pause to emphasize that teachers who were challenged to discuss text were also often challenged to interpret the graphics in the textbook. Although graphics were frequently present in the course texts, and with particular frequency in the textbook, prompts in the curriculum for teachers to press on student understanding were not consistently taken up and when they were, the meaning of graphics were often not clarified or connected to what the text was saying. The example given previously with Ms. Murie and the world map of world resources is one occasion in which graphics were not explored for the purpose of making sense of a phenomenon; other documented instances occurred with Ms. Murie as well. While Ms. Hunter

less frequently engaged her students with graphics, the occasions on which she did were indicative of a similar surface understanding and interpretation.

For example, during one text-based lesson Ms. Hunter asked her students to “Explain some of these charts and graphs they put in the article for me.” In the discussion that followed, students engaged with several graphics in a short period of time. Ms. Hunter led them quickly through the section and the nature of her interaction tended to lead students away from the graphics rather than deeper into their meaning. When a student interpreting a table in the textbook used the word “reserve” as a verb (as in “save”), rather than the noun form used in the textbook (as in “source”), Ms. Hunter missed an opportunity to refine his understanding of nonrenewable resources by moving past the table data to comment on the local coal situation.

Derrick: Oil is the... world's... man, I don't know! I think oil is the most consumed.
[overlapping talk]

Andre: On Table 19.2, it lists the nonrenewable resources and says which country reserves more.

Ms. Hunter: And the U.S. has the most what?

Andre: We reserve more coal

Ms. Hunter: Yeah, we have a lot of coal. We have a lot of abandoned coal mines in [our city]. There are some you can take tours around. We don't have great coal in our area, which is why they're abandoned. That's why Pennsylvania and places like that have much better coal. What were some other things? Derrick, you were saying something about oil.
[CO_E1_V_APES_T543_PD2_14-09-12_C5]

One lesson in the first project focused on a graphics-based article that was intended to highlight the complexity of making “sustainable” consumer choices; the article compared paper and plastic grocery bags, providing graphics-based information on how they were produced, used, and recycled. For this particular lesson, teachers’ enactment varied widely. Ms. Carson encouraged students to interpret the graphics and draw conclusions based on the evidence. Ms. Hunter and Ms. Murie asked students to read the article independently, and then led a whole-class discussion of the article without close examination of any graphics. Taking another

approach, Ms. Earle encouraged students to find “discrepancies” between the graphics and the text and then walked students through a critical reading that highlighted unclear graphical comparisons (“We're missing any form of a scale... Is that 100% of the stuff? We don't know... they just used a graph for the heck of it.”), word use (“They're just throwing out science-y words to make it sound really convincing and smart.”), and the credibility of the newspaper’s sources. By the end of the lesson, the purpose for reading the article had been obscured by the focus on discrepancies, leading a student to ask, “So basically they're just trying to manipulate stupid people?” to which Ms. Earle responded, “Yep. Or people who don't read carefully” [CO_E1_V_APES_T513_PD4_14-09-12_C5].

This highlights how teachers approached graphics in varying ways. As with discussion, Ms. Murie, Ms. Hunter, and Ms. Earle tended to minimize opportunities for student interpretation. When teachers did engage with graphics, students’ misconceptions were not typically addressed and occasionally teacher elaborations provided misleading or inaccurate information. These three teachers often seemed unprepared to mediate student understanding of graphics; again, whether this was a result of insufficient preparation for the lesson specifically or teachers’ capacity for content interpretation more generally is not known. But as a result, curricular suggestions to interpret graphics were insufficient to support the intended kind of text-based interaction.

6.1.4 *Preparing to teach with texts: Teachers get ready*

So far this chapter has described how teachers used the curricular supports for enactment. This section focuses on how teachers *prepared* to teach texts. In this sense, the curriculum provided teachers with the same materials, but the teacher’s task was to prepare herself instructionally with both the text and task to guide students. Teachers’ dispositions and text-based goals

strongly influenced how teachers went about preparing to support text-based learning. In the rest of this section I contrast Ms. Carson and Ms. Earle in moments when they were transparent with students about how they personally approached learning from text.

Based on Ms. Carson and Ms. Earle's reflections in interviews as well as their interactions with students, it became clear that teachers who approached their own task of learning from text *as they expected students to do* found themselves deeply engaged in the process. It was not common for teachers to be transparent and reflective with their students about their own 'learning from text' processes. In 33 block periods across all four teachers, there were just two instances where a teacher (Ms. Carson) shared her personal learning from text with students; I contrast Ms. Carson's enactment with an example of Ms. Earle's practice.

Ms. Carson shared her learning from text with students twice. Notably both occasions occurred during the third project, My Community Ecology, which was the least familiar unit for Ms. Carson; she had taught a very different project the previous year. This likely meant that Ms. Carson had to prepare more carefully than for texts she had taught previously. In the first instance, Ms. Carson assigned students to read a pair of Pro and Con articles about the development site at the center of My Community Ecology. She cued her students to the fact that she had done the same work she assigned to them:

This is the first time you've seen articles one way or another and I asked you to make a T-chart. I did my T-chart yesterday afternoon because it was raining hard and there was nowhere else to be and I was like, by golly, I'll make a T-chart. And I did.
CO_E2_V_APES_T552_PD3_14-11-24_C5

Ms. Carson's enthusiasm and knowledge of the texts was apparent in her interactions with students throughout the following activities, in which students shared their T-charts and then participated in an application task. For example, Ms. Carson contributed to a small group discussion by sharing an issue that "resonated" with her; then, after the class had exhausted their

contributions, Ms. Carson added a big idea that had not been brought up. The tone of her comment suggested she found the reading genuinely informative and relevant:

There was another thing that surprised me; something I learned reading the article about the area and the history that I didn't know. [Brief inaudible student comment.] Yeah, there's a Native American burial ground and prehistoric village. So that's something we want to keep in mind. (CO_E2_V_APES_T552_PD3_14-11-24_C5)

That Ms. Carson waited until her students had contributed all they could before adding this detail speaks volumes about how she sees her role in discussions, which is first and foremost as a mediator of texts and content learning. Yet because she had closely read the article, this cultural consideration made it into the collective T-chart (in two other classrooms, this fact went unmentioned).

The second time Ms. Carson's own learning from text informed her teaching occurred after students had been assigned a 10-page section to read over a holiday break. As she had with the previous example, Ms. Carson incorporated the fact that she had done the reading into her framing, stating:

We're going to tear that reading apart now, and find out what we can actually use. [...] When I did the reading at home, I just sat with my textbook and my little notebook. And I took notes... just like I would have done in college: What do I think is the important stuff here? And I kind of put it into my own words. I took notes of definitions and things like that. So if you took some notes when you read—dig those out now. [...] Did anyone take notes at home? Somebody please say yes. Because I did. (CO_E2_V_APES_T552_PD3_14-12-01_C5)

When it became apparent that most students had not done the reading, Ms. Carson made a spontaneous decision to share her notes: “When I did this I wasn't necessarily thinking I was going to share them with you, but I will.” She then went on to explain her note-taking process, which incorporated abbreviations and strategic restating of the textbook. As she went over her notes, the resulting guided lecture was a blend of mediated textbook translation and interactive

discussion of key concepts. Since students needed the content for the next activity, there was a high level of attention and engagement.

Although students were supposed to have read the text independently, it seems they likely benefitted from seeing their teacher as an expert learner. Unlike her modeling at the beginning of the year, which was done with the intention of conveying class expectations and promoting “buy-in,” this was a glimpse of genuine learning, with their teacher and her personal notes caught unexpectedly in the act. It conveyed her commitment to the material she assigned: Ms. Carson did not just assign students work; she did it, too. This communicated to students that even content experts learned from text. Reflecting on the experience in an interview, Ms. Carson viewed her spontaneous modeling as providing different things for different students: a potentially rote activity for some and an engaging, metacognitive activity for others:

It worked in that, yes, they copied down things that I wrote, but that just shows that they're used to copying down things teachers write. Do they internalize why they're writing it? Do they understand that that is the most important stuff to write down? I think for some of them, yeah, they did, and they were engaged and contributing to help make the decision as to why it should be written down. (Post-MCE Interview: T552_15_1_27)

Ms. Carson's frank assessment of the differential student engagement afforded by her mini-lecture was likely true, yet Ms. Carson demonstrates in her comment that she was cognizant of the importance of imparting *why* the “important stuff” was important.

Ms. Earle also wrote handwritten notes from the textbook to share with her students, yet her goal was so different from Ms. Carson's in the examples above that her approach can be viewed as a counterexample. Ms. Earle intended to deliver textbook content directly to students without any expectation that they read. Ms. Earle reported that it was challenging for her to convey an expert's knowledge of the topic because despite her reading, note-taking, and additional Googling as needed, “a lot of times, I don't realize I don't know it until I'm talking

about it out loud” (Post-MCE Interview: T513_15_2_5). Ms. Earle described the discouraging feeling of trying to stay abreast of the content, only to have student questions reveal her knowledge gaps.

As a result, Ms. Earle’s aim was to cover content, not to impart strategic approaches to the textbook. As a vehicle for teaching content, however, Ms. Earle’s approach had some drawbacks—her interpretation of the content was superficial, at times inaccurate, and did not clearly impart key ideas to students; in short, it seemed challenging for students to understand the content as it was delivered. Students had to twice ask for clarification as they copied the notes; Ms. Earle apologized for her handwriting and clarity issues: “Like I said, I was really struggling writing these notes. My words weren’t good.” In addition, Ms. Earle’s in-class elaborations on the content frequently included inaccuracies along with her opinions, contrasting with her stated emphasis on test prep. Had students opened their textbooks, they might have noticed that Ms. Earle’s description of Theodore Roosevelt (“Teddy Roosevelt -- he’s the guy. He’s our nature man. You always see him in pictures riding a horse. He likes his nature.”) actually referred to a photograph of John Wesley Powell on horseback. Likewise her explanation of federally designated wilderness areas did not provide students with relevant background knowledge: “You can go hiking there but this isn’t like *Oh there’s a path... it’s lovely. You’re in the wilderness. This is like you go in the woods and hope you come back. Bigfoot. Beef jerky*” (CO_E3_V_APES_T513_PD4_15-01-06_C5).

Although each teacher had prepared notes from the textbook, Ms. Carson and Ms. Earle illustrate two teachers engaging very differently in learning from text. Guided by her understanding of the content *and* her conceptual orientation to the PBL-APES course, Ms. Carson’s learning process was portrayed as a productive interaction with the textbook, which

was open for reference and co-construction during her entire text-based discussion. Ms. Carson put herself on par with students in completing the same work she expected of them. Ms. Earle, on the other hand, presented notes *instead* of asking students to read or even examine the text; she did the work for students. While Ms. Earle leavened her lecture with humor, she generally portrayed the process of learning from text as a challenging and solitary process: students may have come away thinking it is difficult to paraphrase historical background into bullet points, but unless they were moved to open their textbook, they would not have know what information was open to other interpretations than Ms. Earle's translation of the text.

6.2 THE ROLE OF PROFESSIONAL LEARNING OPPORTUNITIES

Teachers were presented with two kinds of professional learning opportunities during this study: a four-day Summer Institute and monthly two-hour collaborative team meetings. Experienced teachers were familiar with both: they had attended a Summer Institute with the KIA team when they had on-boarded with PBL-APES in 2012. During Year #1 (2012-13) the PBL-APES teachers taught without any support from the KIA team. During Year #2, 2013-14, the KIA team began collaborating with the PBL-APES teachers via monthly collaborative team meetings in preparation for the Year #3 curriculum revision. Figure 3.1 presents the Study Timeline.

The KIA design principle of keeping scalability in mind meant that the level of support was intentionally kept feasibly low. This maintained a realistic model for the poverty-impacted, urban districts the KIA approach was designed to support. In the next section, I examine the ways in which the Summer Institute and the collaborative monthly meetings supported or constrained teacher learning.

6.2.1 *Professional Development: The Summer Institute*

A brief history of the 2014 Summer Institute is helpful for understanding its design. The Summer Institute was originally organized to collaborate with five returning (experienced) teachers to finalize the newly revised curriculum for the first two projects and work on the ongoing redesign of the third project. When two of the experienced teachers unexpectedly left at the end of Year #2, new teachers (Ms. Earle and Ms. Hunter) came on board. Although the summer plans were revised to accommodate both new and experienced teachers, there was still an emphasis on collaborative curricular design. Providing the new and experienced teachers with the same Summer Institute program was not an ideal situation; the KIA team knew the new teachers were likely to need more support for taking on project-based learning and the course content in addition to the revised learning-from-text approach. Although we built in an overview and encouraged the experienced teachers to share their previous experiences and perspectives during the work sessions, we knew we were walking a fine line between collaboration and support for the new teachers.

Therefore, it was not surprising that the new teachers reported feeling like overwhelmed “newbies” (APES_PD_ENHANCED_14-08-04.1.of2). Although they were physically present, the new teachers contributed approximately half as many suggestions and comments as the least talkative experienced teacher, likely because they were focused on comprehending the curricular scope of what they would soon be teaching²⁰. As a result, it is possible the new teachers were on

²⁰ When asked what advice she had for providing effective support for teachers, one of the experienced teachers, Ms. Carson, recalled the first immersive project-based learning experience she had with the KIA project:

I think the best thing I did was the first time we came out and we actually went through one project cycle, practically as if we were students. That really helped, it was a kind of a big-picture orientation of the mindset and, you know, how the whole thing works. (Post-MCE Interview: T552_15_1_27)

shakier ground with understanding the curriculum, and therefore they may have been less prepared to engage deeply with the learning-from-text approach. In general it is difficult to know exactly what new teachers took up. It certainly did not assuage their worries about learning content, which persisted throughout the study.

Two important elements of the Summer Institute focused on text-based learning: First, an orientation to the revised approach to learning from text; second, a half-day workshop focused on classroom discourse. In both, the KIA goal was to ensure teachers saw the underlying rationale for the importance of text-based learning in PBL-APES. The discourse workshop, led by a UW professor of secondary science education, was well received by teachers. Among other interactive activities, the workshop included analytic review of a video recorded teacher effectively leveraging academic talk to engage students with scientific concepts and the use of discourse tools, such as sentence frames for promoting academic talk (for agreeing/adding to ideas, respectfully disagreeing with ideas, or probing ideas for evidence or clarification) and moves that develop dialogic interaction, such as turn-and-talks and creating conceptual models. As teachers left the summer institute, they looked forward to using tools like the sentence frames to support student talk about ideas, but the sentence frames themselves proved to be short lived in all classrooms. Experienced teachers, Ms. Carson and Ms. Murie, continued to use some of the discourse language when they facilitated discussions (e.g., Can someone add on to that? Who has another idea?) but the sentence frames themselves did not sustain student-centered talk about big ideas.

The experienced teachers were primed to learn about text-based learning; they had arrived at the Summer Institute with pressing text-based problems they wanted help resolving

Because it remained salient to Ms. Carson more than two years after the fact, it is important to note that the 2014 Summer Institute was *not* presented as an immersive onboarding experience

and they had a vision of what PBL-APES enactment looked like in their minds. Ms. Murie hoped to strengthen her support of reading as well as increase accountability for homework reading; Ms. Carson found the earlier literacy approach to be a poor fit with her advanced students and she hoped to resolve that issue. Although both Ms. Murie and Ms. Carson contributed descriptions of their previous enactment of PBL-APES, Ms. Carson's engagement stood out for her emphasis on what she and her students needed from the revised curriculum. She specifically noted areas such as providing better opportunities for students to understand key terms (i.e., *the commons*) (APES_PD_14-08-05.2of2.rtf). Ms. Carson consistently considered the curriculum with a "big picture" view toward curricular insights and revisions. At one point she asked, "Could we zoom out a little bit?" and asked the group to help her support students in understanding "how all this"—meaning the readings and the lab work—"is part of answering this question" (APES_PD_14-08-06.1of3.rtf). For teachers who knew the curriculum, like Ms. Carson, the Summer Institute represented an opportunity to grapple with the curriculum and begin to understand how it was put together. Revising and clarifying the lessons represented a deep learning opportunity for experienced teachers; new teachers, as anticipated, were much less prepared to engage in that work.

Teachers were not always at the forefront of revision. Perhaps in response to observations that a discussion and text-centered approach is "not easy to orchestrate," teachers reflected that they thought the tools and moves would take time to develop and perhaps not fit smoothly into their existing instructional styles and routines; in other words they were cautious about embracing the new learning-from-text approach in entirety. At times, teachers were notably quiet when pressed to apply new talk- and text-based approaches to instructional revision; for example, when asked "Do you think if we used the term "Facilitate Discussion" that it would

trigger the ideas talked about [in the discourse workshop]? ... or should we use some sentence starters in here to be more specific?" teachers did not provide suggestions. Due to an absence of teacher reflection on this, I cannot be sure if teachers felt unsure how to apply new strategies or if they were hesitant for another reason. At other times, the research team's willingness to take the floor seemed to re-position teachers as observers rather than participants. But at other points, experienced teachers pressed on issues around text, such as how long a discussion of text would take in the first project when students were not yet used to talking about text. In short, there was a varying ebb and flow to the Summer Institute talk as it engaged with different aspects of revision and the perspectives of researchers and teachers on content, conceptual development, interactions with texts, pedagogy, and teaching philosophies.

Previous sections on teacher enactment and beliefs have already provided evidence that experienced teachers generally continued developing their conceptual understanding enactment of text-based learning while teachers new to PBL-APES tended to take up surface features. Deeply held teacher beliefs and dispositions evident in the Summer Institute, such as Ms. Carson's value for a "big picture" perspective and Ms. Earle's sense of tension between learning and content coverage, did not appear to shift over time (APES_PD_14-08-06.1of3.rtf).

Beyond these impressions and the first glimpse of enduring teacher beliefs, it is difficult to identify precisely what teachers came away with from the Summer Institute. For experienced teachers, it was likely that they had begun to integrate learning from text into their conception of teaching PBL-APES. Both new teachers left worrying about the curriculum and their concerns continued to be a pressing problem.

6.2.2 *Collaborative team meetings*

Monthly collaborative meetings provided a way for teachers to contribute to ongoing curricular design by providing feedback and looking ahead to as yet untaught, still developing projects. The meetings also allowed teachers important time to coordinate instruction, problem-solve issues, cooperatively plan field trips, and share teacher experiences. Although these meetings supported opportunities for teachers to clarify and share practices around text-based learning, including some rare moments of genuine impact that will be discussed, they primarily provided mostly procedural and logistical support. All teachers generally believed the monthly meetings were valuable. While the experienced teachers did not feel they benefitted as much as the new PBL-APES teachers, they recognized the importance of collaborating and participated fully in the meetings. Ms. Carson put it this way:

Collaboration with other teachers who are doing it, I think, is really helpful. For me, to share with somebody: "This is how I understand it; is that really what I'm supposed to be doing? Does this work well for you? Do your students grasp this? How did you really ... How did this go down? How long does this really take?" You know, that's a big variable. I just think it's really helpful to be able to share the experience with somebody else. And get someone else's insight into how it really works when you're in the classroom, doing it. (Post-MCE Interview: T552_15_1_27)

In these monthly meetings, teachers took on roles reflecting their experience level. Ms. Carson was dubbed the "sacrificial penguin" by Ms. Murie, indicating that she was proceeding through the curriculum faster than the other teachers with a duty to report back on her experiences. To this, Ms. Carson replied with a comment indicating how prior history and her previous experience validated the role for her: "I don't mind being a little bit ahead [...] and that's based on this being my third time doing this." It also validated the role of less experienced teachers. As Ms. Carson reassured Ms. Earle: "So it's OK for you to be a bit behind because then I'll try out the new stuff and I can tell you what's working, and if there's tweaks along the way."

‘Cause [Mr. Brower] did that for us last year’ (collaborative team 3_PD_V_APES_DMPS_14-11-05).

Possibly as a result of this kind of transparent social organization, the new teachers, Ms. Earle and Ms. Hunter, tended to be quite open about their needs, frequently noting that they were working “day by day” even through the fourth (December) meeting. They primarily requested and received procedural support (lab instructions, grading suggestions, instructional clarification); very little talk supported and encouraged their enactment with texts. The new teachers’ stated need for curricular and content knowledge support was primarily met with a broad overview of each new unit that did not fully support or address the use of texts. The experienced teachers, Ms. Carson and Ms. Murie, also raised some enactment questions about their own practice (e.g., whether a particular text could be assigned as homework in the Intro to Sustainability), demonstrating that all teachers need support regardless of experience level. They also occasionally provided insight into how learning from text played out in their classrooms; for example, Ms. Murie recounted how her class was “more into the discussions” and that she was enjoying class “much more than I did last year,” yet the lack of specificity about her practice was unlikely to inform enactment of less experienced teachers (CTM1_PD_V_APES_DMPS_14-09-03). Rarely were teacher practices examined in depth in ways that would inform other teachers.

The first two meetings may have helped establish some boundaries around discussing practice. In addition to some inquiring prompts by the KIA team, the district science coordinator, Mr. Brower, strongly encouraged teachers to orient students to learning from text early in the year²¹. In two separate Skype meetings, Mr. Brower emphasized the importance of establishing

²¹ It is important to briefly recall the history that informed Mr. Brower’s role in the Skype sessions because he taught PBL-APES the previous two years (2012-2013 and 2013-2014) and worked with Ms. Murie, Ms. Carson, and Mr. Leopold as colleagues in collaboration with the UW team for those two years. Although Mr. Brower left his teaching position (which was filled by Ms. Hunter) for his new role as the district’s science coordinator, he drew on

high expectations for text-based learning. Yet the approach did not resonate with Mr. Leopold²², Ms. Hunter, or Ms. Earle. Several interactions between the teachers at the Skype meetings suggested that these teachers understood orienting students to text-based learning as an opportunity to provide encouragement and accountability for reading. In response to Mr. Leopold's questioning of the PBL-APES reading expectations, Mr. Brower spoke forcefully in opposition to Mr. Leopold's stance that learning from text expectations were too high:

Putting the time in early with your kids, getting them to realize what you're assigning, what they're reading, is important because you're requiring it for classroom discussion. Hammering that home every time is going to pay dividends down the road when they're internalizing what you're saying. I don't think you guys would be doing yourself a service if you start backing away from the material, cutting it down to the point where kids can say "OK, I can do this with ease." [...] The best thing you can do is require information be used the next class period and put as many scaffolds in place that require checks for understanding along the way. I can't say enough: You can't back down on your expectations because that's not realistic. That's just my perspective.
(PD_V_APES_DMPS_14-11-05)

Both Ms. Murie and Ms. Carson could have related their enactment to Mr. Brower's description, but they remained quiet; to say something would have been to take sides in the debate. After Ms. Carson made a comment indicating her commitment to text-based learning even when it felt in tension with her other instructional goals, she did not talk about her belief in "going slow" again with her colleagues. Likewise, Ms. Murie remained silent on her perspective, even when the KIA team asked specifically about the approach. Observations of classroom enactment suggest Ms. Murie and Ms. Carson's learning from text approach was widely divergent from their colleagues; that they did not engage in the discussion suggests they may have realized it represented a philosophical shift too great to bridge. Ms. Murie's tendency to be particularly quiet led the KIA

both his personal teaching experience and his ongoing PBL-APES collaboration with the UW team when participating in the Skype teacher meetings.

²² As noted in the Methods chapter, Mr. Leopold was not included in this study's analysis due to data collection issues. However, he was an enthusiastic and vocal participant in the project and his interactions in professional learning contexts (such as the Skype meetings and Summer Institute) will be referenced when relevant to the findings under discussion.

team to privately encourage her after the third meeting to share more about her practice in order to benefit the group. On the fourth collaborative team meeting, a rare discussion about text-based enactment occurred that went beyond logistical or procedural information.

6.2.3 *Support for text-based learning*

During the fourth team meeting²³, the opening for a discussion came when Ms. Earle reported how she had taken “the chunked reading and turned it into a workable worksheet,” lamenting, “I guess [my students] just aren't very good at... Like they need a reason. A purpose statement is not enough of a reason to be reading it” (CTM4_PD_V_APES_DMPS_14-12-10). Ms. Murie recognized that Ms. Earle was describing a problem (needing a reason to read) that she had addressed with the Field Notebook. She responded to Ms. Earle with a classroom reflection that provided the kind of “reason” for reading that Ms. Earle had described lacking:

I did notice the Field Notebooks are helping – I had one girl who never speaks up who was like, "We're going to put this in our field notebooks, right?" And I was like, "Yes! So glad you referenced that... you're actually using it! (CTM4_PD_V_APES_DMPS_14-12-10)

Ms. Carson, who had been unsure about the procedural elements of the Field Notebook (e.g., how many pages to leave blank) clearly considered it a text-based task; this was evident in her enactment of the Field Notebook. She asked Ms. Murie to share more: “Tell me how you’re doing this.... because I think I confused people with it. How did you present it?” Ms. Murie described how she oriented students to the approach for the next ten minutes, a notably lengthy turn of talk for the collaborative meetings. Ms. Murie shared how she modeled setting up and using the notebook to bring together students’ site data and research: “every single time I referenced the Field Notebook, I was writing along with them, so they could see. I was kind of

²³ During this meeting, Mr. Leopold was absent.

modeling.” She walked her colleagues through a specific example with the textbook (p. 149, trophic levels). She also shared how she conveyed the Field Notebook’s usefulness for the long-term goal of the final project: “I told them they’d be referencing this a lot, coming back to this a lot” for the final project products. Ms. Hunter noted how she had “interpreted it something different,” and when she described her approach, Ms. Murie was able to identify the section she had skipped. In response, Ms. Carson and Ms. Hunter engaged in reflective thinking about their own enactment in light of Ms. Murie’s explanation. The very next day, Ms. Hunter revisited and fine-tuned her approach to the Field Notebook based on this conversation (CO_E2_V_APES_T543_PD2_14-12-11_C5). At this point, Ms. Carson was nearing the end of the unit so she did not make any changes to her instruction.

Ms. Earle’s comments during this discussion [“I don’t understand what this thing is, even in general.” “What are we impacting?”] suggested she was struggling to make sense of the Field Notebook and its role in the curriculum. However, a month later (after the winter break), Ms. Earle enacted a version of the Field Notebook. She modified the assignment to reduce the reading load: in class she modeled how to use the textbook index to identify and write entire definitions verbatim from the textbook in order to answer the Field Notebook’s questions (CO_E2_V_APES_T513_PD4_15-01-06_C5). Although her enactment looked quite a bit different from the other teachers and the curriculum, it seems the discussion of the Field Notebook during this meeting likely contributed to Ms. Earle’s understanding of how it fit into the curriculum and supported enactment of a tool that she had previously found confusing.

This episode suggests that when teachers have the opportunity to discuss and reflect on practice, it can provide significant support for teachers to refine their practice and thinking. It also demonstrates that one conversation does not easily translate conceptually to teachers who

have been taking a more procedural approach to PBL-APES for the previous four months. Nonetheless, it is important to recognize Ms. Hunter was very receptive to support for a text-based support she had enacted partially and then readdressed in an effort to fine-tune her enactment. Although it was challenging for both Ms. Hunter and Ms. Earle to grasp the conceptual underpinnings that Ms. Murie's approach was based on, that they both attempted enactment of the Field Notebook nonetheless suggests the external domain plays a powerful role in encouraging teacher experimentation with new approaches.

6.2.4 *Sharing resources*

The collaborative team meetings also offered an opportunity for the PBL-APES teachers to share resources and fill gaps in teachers' knowledge. Again, the fourth meeting was particularly productive in this way. For example, when Ms. Murie sent Ms. Earle her adapted lesson on a textbook reading, Ms. Earle implemented it the next day, marking a rare occasion for her to assign in-class reading. Ms. Murie's adaptation was revealing in its adaptive expertise. The section was notable for its lack of curricular support: the lesson had specified a lengthy section in the textbook and recommended teachers develop a lecture or develop it as a reading. Ms. Murie opted for the latter, and the consideration she brought to her development of the assignment clearly reflected the integrated nature of the learning-from-text approach:

The only thing I had to break up was the Population Ecology reading – cause it was too much for one sitting. So I ended up using what you suggested; I just broke it up into the 3 different chunks. That was the only thing I've changed so far, aside from assigning it to homework. Which then kind of helped me figure out... like I had to read it ahead of time and figure out what is the purpose for this? What do I want them to be able to answer from the reading? Just because that ecology section was... massive: Lots of vocab, a lot of long words, not a whole lot of pictures and a lot of words, so... If you want that, I can send it to you, it's not grandiose. [To Ms. Earle: That's the one I sent you].
(CTM4_PD_V_APES_DMPS_14-12-10)

Ms. Murie's adaptation reflected purpose setting, a strategic approach that included chunking and

attention to vocabulary and text density, and teacher initiative to closely read the text in advance in service of supporting student learning from text. Although Ms. Earle implemented it, she did not reflect any of the support for reading that Ms. Murie had imbued the assignment with; she may have been lacking conceptual understanding of the text and the text-based supports necessary to make that shift.

Another example of how the collaborative team meetings supported the teachers was seen when Ms. Earle asked for help understanding the curricular trajectory of the third project, My Community Ecology. Ms. Earle commented in an interview on the value of these kinds of interactions:

I find it really valuable hearing when Ms. Carson or Ms. Murie say, like *we started doing this, and I haven't changed this or I had to do this...* just being able to use that as resource time is really, really valuable... (Post-MCE Interview: T513_15_2_5)

Although Ms. Hunter reported that she found the procedural support of the meetings very helpful, she did not feel there was much support for learning for text. She may have forgotten about the fourth meeting in December where she was inspired to revisit her use of the Field Notebook because she did not recall much text-based support when interviewed at the end of January: "Honestly, I can't think of it. They might talk about "I discussed it in this manner," or I used whiteboards at this moment, that happens a little bit. A little bit, I guess" (Post-MCE Interview: T543_15_1_30). This reminds us that meetings are ephemeral and that teacher learning over time draws on resources that contribute at many levels, not all of which are made visible for tracing. Additionally, the new teachers' developing conception of what it meant to support learning from text may have meant they did not perceive discussions of the Field Notebook (or other curricular components) as related to text-based learning or their role in supporting such learning.

Conclusion

The teachers valued the PBL-APES community and they reported feeling supported by the monthly collaborative meetings. The rare occasion of Ms. Murie's Field Notebook, which directly influenced both Ms. Hunter and Ms. Earle's enactment, suggested that the opportunity to collaborate spurred teachers to try new things and to occasionally think more deeply about using texts. It is hard to know if additional meetings would have yielded more growth of this type. But evidence of Ms. Hunter and Ms. Earle's Field Notebook enactments indicated that new teachers tended to take up ideas procedurally, in line with their thinking and beliefs throughout the first three projects. In general, the new teachers struggled with their limited understanding of the curriculum and although they received some support from their colleagues, it did not appear to greatly reduce Ms. Earle or Ms. Hunter's burden of learning the curriculum one step ahead of the students. Overall, the structure of both the Summer Institute and the collaborative meetings did not fully address the needs of either new or experienced teachers.

Chapter 7. DISCUSSION

Overview

This study set out to examine how four teachers put text-based learning into practice and what they thought about it while teaching PBL-APES. In Chapter 4, I looked at the durability of teacher beliefs and practices and how these influenced teacher enactment. Chapter 5 explored shifts in teacher thinking and practices in relation to supporting learning from text. Finally, Chapter 6 looked closely at how teachers interacted with and were influenced by external supports and resources, such as the PBL-APES curriculum and formal and informal learning opportunities. The Interconnected Model continually informed these analyses as I illuminated teachers' beliefs and knowledge, goals and priorities, their adaptations, and their interactions with the KIA team and the curriculum.

This chapter returns to the purpose of my dissertation and the research questions that guided my analysis. First, I consider how the experiences of Ms. Carson, Ms. Earle, Ms. Hunter, and Ms. Murie contribute to our understanding of supporting teacher learning about text-based instruction. After addressing limitations of the study, I conclude with implications for further research.

7.1 WHAT CAN WE LEARN FROM TEACHERS' EXPERIENCES WITH LEARNING FROM TEXT?

The purpose of this study was to understand how a trio of resources (curriculum, initial and ongoing professional development) supported teacher learning about working with texts in PBL-APES. This work contributes to a research landscape defined by decades of static student reading scores (National Assessment of Educational Progress, 2015a), urgent calls for “scientifically

literate citizenry” capable of meeting the career and civic demands of the 21st century (Pearson et al., 2010), and recent studies suggesting texts are too often “missing in action” when it comes to subject-matter learning (Greenleaf & Valencia, in press; Moje et al., 2011).

Given this research and previous KIA finding, it was not altogether surprising that the four teachers in this study reported little use of texts in their other classes, in keeping with their respective school cultures’ tendency to work around text. However, it was striking that three of the four teachers (all but Ms. Carson) shared with their students in their PBL-APES classes how they had personally struggled with reading in college, where they recalled information-dense texts and a lack of strategies with frustration. Although this study did not explore teachers’ personal histories, and it is possible that teachers overemphasized their experiences to convince students to learn from text, this glimpse into the past suggests most teachers approached PBL-APES with little prior experience—personal or instructional—(Lortie, 1975) for working productively with texts. Taking up text-based teaching, then, represented not just a significant shift of teaching practice for teachers, but quite likely a reworking of their beliefs and goals as well.

I found great variability in teacher enactment and thinking; several themes of interest arose during my analysis. First, I explore the kinds of teacher learning that became visible through the mediating processes of enaction and reflection, as identified by Clarke and Hollingsworth (2002). I describe how learning was reflected in three change domains (the Domain of Practice, the Domain of Consequence, and the Personal Domain) and make sense of what we can learn from the patterns of teacher learning that emerged. Second, I examine two important influences on teacher learning: the role of teacher experience and the external domain. Finally, I discuss two problems of enactment (Kennedy, 1987) that emerged from the data.

7.2 AN ANALYTICAL FOCUS ON ENACTION & REFLECTION

The Interconnected Model located learning in the arrows of enaction and reflection and this is precisely where the model revealed patterns of similar and divergent teacher learning. It was analytically exciting to identify evidence of enaction in the very first classes taught by all four teachers. This demonstrated that the Summer Institute had prepared teachers to enact the new approach to learning from text (the External Domain). Yet this is where learning pathways diverged for new and experienced teachers. In order to theorize why experienced teachers were more successful in establishing durable learning than the new teachers, I address each group briefly in turn.

Enaction

Experienced teachers, Ms. Carson and Ms. Murie, demonstrated enaction of all components of the learning from text approach. Supported by their experience at the Summer Institute, the curriculum and their previous knowledge of the curriculum, Ms. Carson and Ms. Murie were able to enact new practices (e.g., orienting students to text-based learning, framing, setting purposes, application) with evidence of conceptual understanding. Reflection on their enactment led both teachers to make subsequent shifts in their thinking related to the efficacy and value of the new practices; this reinforced and refined their continued enactment of the practices. By the end of the third project, most text-based practices were still regularly in use and both teachers demonstrated an ability to be adaptive and innovative when it came to supporting learning from text.

Consider, for instance, how Ms. Murie and Ms. Carson enacted the new practice of orienting students to text-based tasks. Both teachers enacted strategies to orient students to text several times in the first project (Domain of Practice). Reflection on their enactment led Ms.

Murie and Ms. Carson to believe that orienting students had effectively prepared students to approach text strategically and with understanding; this developed a new belief for the practice (Personal Domain). After multiple opportunities to enact and reflect on orienting students to texts over the first two projects, both teachers adaptively incorporated orientation for new texts or tasks in the third project when they determined students would benefit. For Ms. Carson the new practice required a change in her salient outcomes (Domain of Consequence). Ms. Carson had initially prioritized preparing students to work independently with text (“going fast”), but as she saw the value of orienting students to new texts and tasks, she adjusted her salient outcomes. By the end of the third project, she realized orientation necessitated joint work with texts and tasks. She no longer viewed such work as in competition with expectations of AP rigor, but rather as supportive of her content learning goals. Ms. Murie, in contrast, did not need to resolve tensions with her goals; she initially viewed orienting tasks as supportive of student learning, which aligned with her existing salient outcomes. This illustration of durable learning explains how experienced teachers’ enactment of new practices led to empirically grounded “growth networks” (Clarke & Hollingsworth, 2002) that documented changes in their practice, beliefs, and goals.

Although this example illustrates how the experienced teachers’ learning pathway was similar, it is essential to point out that each practice was not enacted in isolation. To the contrary, Ms. Carson and Ms. Murie’s grasp of how the components for text-based learning worked *in concert* was important. Just as the project-based curriculum was comprised of interrelated experiences designed to build students’ understanding of key concepts over the duration of a project, the approach to texts worked in a similar cyclical way. Activities in the project-based curriculum could not be easily taught in a different order or in isolation from each other, and experienced teachers took the same approach to supporting texts. This perspective had been

developed during the Summer Institute: initially through the presentation of the approach but also as teachers worked to refine the curriculum. The latter may have been particularly supportive for teachers' conception of the text-based approach: close examination and revision of text-based portions of the curriculum would have communicated the underlying pedagogical design and reinforced the interrelated nature of the supports.

Enaction looked very different for the new teachers, Ms. Earle and Ms. Hunter. When the new teachers enacted text-based components of the curriculum, there was less evidence of durable learning. Ms. Earle's enaction often went no further than change sequences: after experimenting with a practice, Ms. Earle typically stopped using it. Ms. Hunter, on the other hand, tended to enact selected elements of practices (e.g., in-class reading, but not framing). Reflecting on this finding led me to consider what counted as enaction. For example, if a teacher presented a reading task, but not the purpose for reading, did that count as enactment? I considered how both teachers occasionally demonstrated that they were able to enact components of the text-based curriculum more fully. For instance, when Ms. Earle oriented students to a lengthy article or when Ms. Hunter shared the suggested framing and reading purpose with her students directly from the curriculum. In both cases, the teachers seemed to provide their students with increased instructional clarity by communicating more detail from the lesson plan, and this was met by evidence of more productive student engagement in the task. Was this more "enactive" than occasions when they assigned reading tasks without a purpose?

Although conveying more detail from the PBL-APES lessons did seem to have an effect on teacher clarity, in my analysis I decided not to discriminate between enaction that was partial or procedural versus enaction that was conveyed more completely or with more conceptual understanding. Initial enaction was at times "clunky" or non-proficient for all teachers, which

was to be expected during a learning process. To this end, I considered Ms. Hunter's persistent practice of assigning in-class reading (although without framing, purposes, or support) and her consistent, yet partial use of the *before-during-after* approach to text as representative of durable learning, even as it did not reflect the same level of conceptual understandings as the experienced teachers. However, I did not consider Ms. Earle's consistent practice of quizzing students on the AP test prep book as evidence of learning, although I do view it as evidence of teacher adaptation. The incomplete and fragmented bits of the learning from-text approach that new teachers took up seem representative of nascent learning, as described in different developmental stage theories relevant to novice teachers and experienced teachers taking on an innovation (Richardson & Placier, 2001). Had we looked at Ms. Murie and Ms. Carson in Year 1 or 2 of PBL-APES, we might have seen similar frustrations and partial enactments that prepared them more substantial change and deeper learning in Year 3.

Despite re-checking the data for disconfirming evidence, it was evident that new teachers made fewer changes in their thinking, practice, and goals than experienced teachers; changes that I considered durable were representative of partial enactment that persisted over time (e.g., Ms. Hunter's consistent in-class reading). This was a direct result of new teachers' selective and partial enaction, which indicated that they did not view text-based supports as interrelated. As a result, Ms. Earle and Ms. Hunter approached texts in a more traditional fashion. Although less learning seems reasonable for a new teacher embarking on a new curriculum, the new teachers appeared to be unproductively stressed by too much cognitive dissonance (Opfer & Pedder, 2011). As I discuss in more depth in the section below on teacher experience, one probable reason for this finding is that new teachers were tasked with learning both the curriculum and the content; this seems to have limited their ability to fully enact unfamiliar curricular components.

Another possible impediment to new teacher learning, however, may lie in the related mediating process of reflection. I turn now to examine the nature of reflection.

Reflection

When collecting data, I had anticipated the collaborative team meetings would offer opportunities for reflection. Although the meetings offered an important space for colleagues to discuss shared topics of interest, they did not tend to foster reflective talk as much as explanatory or procedural talk. Interviews, on the other hand, supported much more focused reflection. For this reason, I draw primarily on interview data for this section; a fact that does not go unnoticed in the section on implications.

As with enaction, there was disparity in the nature of reflection for experienced and new teachers. For experienced teachers, reflection seemed to function as “a meaning-making process that moves a learner from one experience into the next with deeper understanding of its relationships with and connections to other experiences and ideas” (Rodgers, 2002, p.845). This was evident in the way Ms. Murie and Ms. Carson, the experienced teachers, reflected on how their practices supported students. Analysis of their learning was based on multiple enaction-reflection links between domains that fostered teachers’ learning about new practices. Ms. Carson was particularly thoughtful about considering what indicated student learning; I believe this is what led her to value application tasks (where she could see student reasoning in action) so highly. Ms. Murie was sometimes more circumspect, reflecting that while she thought her practices supported learning she acknowledged a lack of evidence as to *how* some practices, like the Field Notebook, influenced her students’ learning. Overall, however, the experienced teachers generally reflected in detail about how new practices or beliefs had been useful or valuable; such reflection informed their beliefs, goals, and practice. This kind of “meaning-

making” demonstrated Ms. Murie and Ms. Carson’s interest in understanding the relationship between their instruction and their students’ learning.

Yet the lack of opportunities for Ms. Murie and Ms. Carson to really talk to each other about their practice raises a question about the role of reflection as it is conceptualized in the Interconnected Model. Ms. Murie and Ms. Carson’s teaching philosophies and enactments were similar in some ways, but the teachers differed in terms of instructional style, content knowledge, and student demographics. Although they emailed occasionally about procedural issues, there were few opportunities for the teachers to discuss their practice. Given reflection’s role as an integral component of the learning process, it makes me wonder what the influence of more reflective opportunities would have had on Ms. Carson and Ms. Murie’s learning.

The new teachers, in contrast, reflected at length about challenges they faced while teaching, but they drew fewer connections between their instruction and how or why it supported students. Ms. Hunter reflected on how the Field Notebook supported her students by providing a reason for reading and a way to organize their notes. But there are few other examples of Ms. Hunter reflecting on the relationship of her instruction to students’ learning. Ms. Earle explained her belief that lecturing content increased student participation, which reflected her salient outcomes (participation; coverage) but not what she thought students had learned from the process. Similarly, Ms. Earle’s consistent grappling with her decision to “spoon-feed” content to students over two interviews provided reflective evidence that she was questioning her instructional approach (or, alternatively, expressing awareness that it conflicted with the PBL-APES approach) but it did not indicate what she thought about the quality or effectiveness of her teaching. As new teachers to PBL-APES (and still relatively new to the profession) Ms. Hunter

and Ms. Earle may have been less able to focus on students as they were taking on new pedagogies and content.

The limited reflection from new teachers sent me to look more closely at instances where the new teachers had more fully enacted text-based instruction. However, there was no corresponding evidence of teacher reflection on instruction that had appeared to foster (in my analysis, based on observations of the classroom video) positive changes in student behavior. For example, when Ms. Hunter relayed clear purposes for reading, her students approached the task more purposefully. Yet Ms. Hunter did not appear to perceive a difference in student engagement or she did not relate it to her instruction. Again, this was suggestive of the novice teachers' necessary focus on their own development; they may have had insufficient perspective to step back and evaluate the effectiveness of their experimentation with new teaching practices.

As noted earlier, interviews were particularly productive sites for teachers to think about their practices and beliefs; this begs the question of how teachers would be supported without researchers who wanted to interview them after each project. Reflection, although it certainly happens individually and constantly, is conceived of in the Interconnected Model as ideally occurring "in community, in interaction with others" (Rodgers, 2002, p. 845). A teacher community can be particularly supportive of teachers' practice. As described in Chapter 6, only one significant, in-depth discussion about text-based instruction occurred during the fourth meeting, which occurred in December. Although this discussion influenced both new teachers' enactment, they were challenged to enact it with conceptual understanding.

One study on teacher communities suggests teachers are more capable of engaging productively in problems of practice when they are at similar stages in common curriculum that reflects their goals and beliefs, among other factors (Horn & Little, 2010). It seems likely that

both new and experienced teachers would benefit from more structured opportunities to reflect on their practice in a setting supportive of their particular perspective. However, as Ms. Earle noted, opportunities to learn from the reflections of experienced teachers felt useful; more interactions might have supported new teachers with useful perspectives from which to consider their own teaching.

Finally, productive reflection requires teachers to be genuinely curious, intellectually available, and interested in their own professional growth. The cumulative evidence of Ms. Earle and Ms. Hunter's instructional distress over their limited knowledge of the curriculum and environmental science content makes me consider the possibility that they have limited capacity to productively reflect on their teaching until they have survived their first year of PBL-APES. I address the issue of teacher experience in the next section more fully.

7.3 KEY INFLUENCING FACTORS

What supported the relative ease of learning for experienced teachers? Comparing the experienced and new teachers' learning pathways suggests some important contextual factors played a role.

Familiarity with the PBL-APES Curriculum

There was a striking divide between the teachers based on their level of experience with the PBL-APES curriculum. Analysis of the four teachers in this study indicated that curricular experience was one of the most influential contextual factors for teacher learning about working with texts. Although it was not the only influential factor for the teachers (for instance, Ms. Carson had a strong background in environmental science; she also taught two sections of PBL-APES which may have encouraged refinement of her practice), prior curricular knowledge supported Ms. Carson and Ms. Murie's learning in every change domain. Previous experience

gave teachers the underlying curricular knowledge necessary to experiment with new text-based practices, such as setting purposes, framing, and application tasks. Understanding how these practices fit into the curriculum imparted a sense of scope and confidence to experienced teachers. Importantly, once teachers experienced enactment of a new practice, their knowledge of the curricular arc allowed them to reflect on how well it had served students (Domain of Practice).

Repeatedly in interviews, the experienced teachers reflected on their familiarity with the course as a key influence on their ability to understand the underlying rationale for the project-based curriculum and the role that text played in that learning (Personal Domain). The positive influence of previous experience confirms what other research has found on the impact of cumulative professional development over two to three years (Butler et al., 2004; Corcoran et al., 2003; Desimone et al., 2002; Schneider, 2013). Importantly, the teachers were also able to convey their knowledge of the curricular trajectory to their students; this enabled them to articulate how text-based expectations (i.e., using evidence) and text-based concepts (i.e. sustainability) would support student learning throughout the course. Finally, curricular knowledge informed teachers' understanding of how they would know what students learned and they were able project their learning goals to students (Domain of Consequence). Taken together, it seems Ms. Carson and Ms. Murie's conceptually-oriented view of the curriculum was foundational to their ability to facilitate productive learning from text.

The new teachers lacked this deep curricular knowledge; in its absence, Ms. Earle and Ms. Hunter reported consistently in interviews and at nearly every collaborative teacher meeting on the arduous and discouraging experience of trying to learn the curriculum one step ahead of their students. In addition, both teachers spoke regularly about the compounding challenge

presented by their lack of subject-matter knowledge. At the same time, the teachers were acutely aware of the social dynamics in their classrooms and this undoubtedly influenced their instructional priorities in more ways than my analysis could identify. A more difficult position from which to approach a complex, high-stakes course is hard to imagine.

Ms. Earle and Ms. Hunter's ongoing struggle to understand and enact the PBL-APES curriculum suggested they did not feel there was sufficient "just-in-time, job-embedded assistance" to meet their needs (Guskey & Yoon, 2009). The situation appeared to leave both teachers with little bandwidth for enacting or committing to unfamiliar practices and/or materials. In other words, their lack of curricular and content knowledge impacted their decisions and the amount of change that was possible in the change domains. For example, in the Domain of Practice, both teachers tended to utilize the curriculum primarily for surface support. This helps explain why the teachers drew procedurally from the curriculum in different ways: Ms. Earle modified the curriculum into procedural worksheets while Ms. Hunter enacted most curricular activities, including in-class reading and discussion, at a partial and procedural level. This related to the Domain of Consequence: both teachers took what they could from the curriculum to accomplish their goals of student participation and content coverage while minimizing the need for their knowledge of the content. In the Personal Domain, surface use of the curricular supports developed a superficial understanding of what it meant to learn from text.

As a consequence, Ms. Earle and Ms. Hunter appear to have relied strongly on their pre-existing beliefs to help them navigate the course. What teachers believed about student learning influenced their enactment; I believe this is why Ms. Earle and Ms. Hunter tended to link their instructional decisions to compliance with tasks and content coverage rather than to student learning. To this end, Ms. Earle prepared fill-in-the-blank worksheets, and Ms. Hunter asked

students to transfer what they learned from texts into their Field Notebook without support. One hypothesis is that the teachers' tendency to rely on their previous beliefs and experiences meant they may have been "filtering" (Nolen et al., 2009) the PBL-APES approach to fit their existing conceptions of teaching and learning. This would further explain why the new teachers enacted only parts of the curriculum in a procedural way. Had the teachers felt confident in their environmental science knowledge—or in the curriculum, I conjecture they would have been able to engage with PBL-APES more effectively and would have been more capable of enacting text-based learning.

Influences from the External Domain: Professional Development & the Curriculum

Teachers had three PBL-APES resources to draw on for support: What they had learned and/or experienced at the Summer Institute; their colleagues and the KIA team during collaborative team meetings; and the curriculum. I discuss each in turn, highlighting areas of influence.

The influence of the Summer Institute was difficult to trace in day-to-day practice, however there was evidence that experienced teachers developed a conceptual grasp of the KIA approach to learning from text. I hypothesize they were able to deeply absorb what was presented during the Summer Institute because they did not have to exert cognitive energy trying to understand the curriculum or its project-based structure. The new teachers, on the other hand, demonstrated partial understanding of the purposes behind texts that had been modeled, suggesting that the Summer Institute approach had provided an insufficient introduction to the curriculum. Unlike the experienced teachers, they were putting together too many pieces to understand any elements deeply. As noted earlier, this was an anticipated but unfortunate consequence of providing a single Summer Institute to new and experienced teachers.

The collaborative team meetings provided procedural, logistic, and social support to both new and experienced teachers, demonstrating that even experienced teachers needed on-line supports when instructional components were new. On the other hand, new teachers' needs surpassed the capacity of the meetings to fully support them. Although text-based issues came up occasionally during the monthly meetings, the meetings were not conducive to exploring these types of problems of practice. Notably, experienced teachers did not engage with Ms. Earle about how the lecture approach she promoted worked against the PBL-APES intent to engage with text. This was precisely the opportunity for collegial support and some reflective exploration of learning-from-text practices. Instead, the other teachers remained silent. Perhaps this was due to the virtual support team on Skype or the time it takes to develop a productive teacher community. It could also have resulted from the large disparity between the needs and beliefs of the new and experienced teachers. My sense is that it was a combination of all three factors. Although teachers valued the monthly meetings, they did not adequately meet the needs of either the new or the experienced teachers and they rarely supported teachers in talking about text-based practice.

The curriculum proved to be a good match for experienced teachers; it conveyed pedagogical rationale and enabled teacher adaptation; in this sense it was educative (Davis & Krajcik, 2005). The consistency of the supports was described by Ms. Murie and Ms. Carson as particularly supportive and likely led to their development of durable change. It seems likely that Ms. Carson's personal disposition toward a "big-picture" view could lead her to work more independently of the curriculum, but she reported finding the materials useful and accessible, as did Ms. Murie. One feature of educative curriculum is the transparency of developers' pedagogical judgments (Ball & Cohen, 1996): Curriculum materials should "speak to" teachers

about the ideas underlying the tasks rather than merely guiding their actions (Remillard, 2005). In this way, the curriculum promotes teacher autonomy and adaptive expertise. Analysis suggests that the learning-from-text supports in the PBL-APES curriculum functioned in this way for experienced teachers.

As for the new teachers, the curriculum was too much to manage. It did not appear to “speak to” Ms. Earle or Ms. Hunter; nor did it convey conceptual understanding or support their need for content knowledge. Resources and contextual factors bring to mind the Goldilocks Principle (Opfer & Pedder, 2011) which emphasizes that either too much or too little support is counterproductive for learning. It appears the new teachers experienced too little support for content knowledge and too much information when it came to a complex curricular approach. For the experienced teachers, however, it seemed to be just about right. Provided with sufficient curricular knowledge, content knowledge, interest, and commitment, the experienced teachers found they could adaptively leverage the curriculum in ways that supported their instructional goals.

7.4 TWO PROBLEMS OF ENACTMENT

Facilitating Discussion

Given the experience and disposition Ms. Murie brought to PBL-APES, I was continually struck by the discrepancy between her instructional intentions and her enactment of discussion. Why was there so little change in Ms. Murie’s facilitation of discussion? It seemed to be a “problem of enactment” (Kennedy, 1987), where Ms. Murie *knew* what she wanted to do, but did not yet know *how* to put it into practice. Whereas in interviews she consistently envisioned her classroom discussions as dialogic and inquiry-based, she routinely facilitated discussions that were teacher-directed and followed an IRE pattern. Discussion was an area of practice Ms. Murie

cared about. She had been receptive to learning opportunities about classroom discourse during the Summer Institute and during the November interview she described trying to “channel” the inquiry-based questioning approach that had engaged her so thoughtfully during the Summer Institute.

This was not entirely surprising; the challenges of facilitating discussions in high school classrooms, and science classrooms in particular, are well documented (Alozie et al., 2010; Alvermann et al., 1990; Alvermann et al., 1996; Applebee et al., 2003; Cavagnetto, 2010; Moje et al., 2001; Nystrand, 2006). This suggests that for discussion to serve in its capacity for supporting thinking and comprehension, teachers may need significantly more support. That Ms. Murie struggled to facilitate discussion despite her curricular knowledge and philosophical belief in student-centered learning suggests teachers need opportunities to take up the facilitation skills necessary for leading text-based discussions. In addition, the practice inevitably draws on a teacher’s knowledge of the content and her pedagogical content knowledge for science teaching (Schneider & Plasman, 2011; Shulman, 1986). Although Ms. Murie’s discussions incorporated some discourse moves (such as asking students to add on to ideas) and reflected adaptive transfer of curricular supports, such as discussion structure and prompts, her facilitation typically did not reflect deep understanding of the ideas and issues presented in the texts, as demonstrated in the representative example with the world-wide map of energy consumption. It is impossible to know Ms. Murie’s actual level of conceptual understanding, but in the instructional context of talking about texts with her students, she did not leverage such knowledge in order to support student learning. This was likely a contributing factor to her difficulty enacting the kind of inquiry-based discussion she had in mind.

The other interesting component to Ms. Murie's problem of enactment was how it differed from other instances of enactment in terms of growth. For example, when Ms. Murie experimented with framing texts for different tasks, she had multiple opportunities to practice across the three projects until there was evidence of developing adaptive expertise (i.e., her extended framing). Yet repeated enactment of discussion did not follow a similar growth trajectory; that is, repeated opportunities to facilitate discussion did not lead to more effective discussions. I suspect this is related to the constantly shifting context of subject matter, text structure, and tasks that are part of the curriculum, which meant every discussion drew on different content in a different way. In addition, as Ms. Murie pointed out, there was little feedback on the effectiveness on her facilitation of classroom talk, whereas it was likely easier for her to interpret changes in student engagement with note-taking tools. Despite the emphasis on discourse in the Summer Institute, Ms. Murie appeared to need significantly more support (External Domain) in order to make changes to her practice with discussion. Interestingly, classroom discourse was rarely a topic of discussion in the collaborative teacher meetings, except as it related to participation. Like learning from text, this suggests discussion is another "hard-to-learn" component of instruction that teachers need support for engaging with (Billet, 2006). It also indicates that research on learning from text should attend to supporting this important aspect of text-based learning.

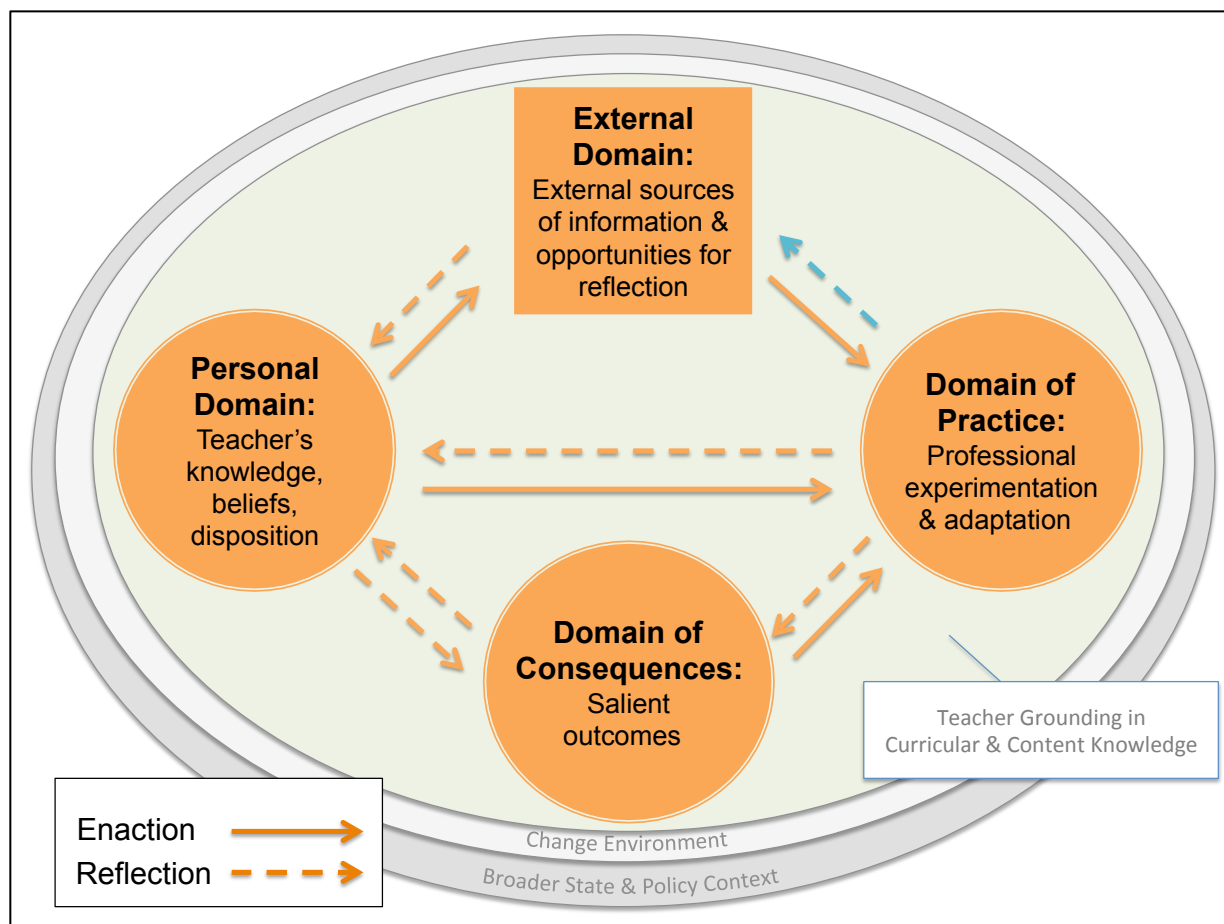
Interpretation of Text

Another problem of enactment was revealed with text itself. Across teachers, there was evidence that in the moment of interacting with text in front of students, three of the four teachers in this study were challenged to effectively interpret texts and related text-based graphics. Classroom observation evidence suggested teachers had not always read the text or studied the graphics

before they approached it with students. We cannot know from these data whether teachers, with time, could have understood and facilitated student learning, or whether they needed support in how to interpret the textbook and its features. Considering most teachers' reportedly negative experiences with college reading and their history of avoiding the textbook, it seems likely that teachers may need guidance or practice for engaging productively with texts and particularly the textbook before they facilitate student learning from its pages (Moje & Speyer, 2008).

The emphasis on evidence-based reasoning and critical reading in Next Generation Science Standards is driven in part by troubling assessment data demonstrating that many adults are challenged by text-based demands in science. The NGSS standards cite an example from the 2003 National Assessment of Adult Literacy, which found that “Fewer than one in three college graduates can perform tasks such as interpreting a data table about blood pressure and physical activity” (NGSS, 2013). Just as the standards assume teachers are using texts, our approach to text-based learning may have presumed teachers are proficient readers of textbooks. Just as this study addresses questions of how texts might be used in classrooms, it also highlights that we know little about how teachers make sense of the texts they assign.

7.5 RETHINKING THE INTERCONNECTED MODEL OF PROFESSIONAL GROWTH



In this revised model of the Interconnected Model, I emphasize the important contextual factor of familiarity with the PBL-APES curricular approach and its related content. As this analysis has shown, every element of the framework contributed in different ways to durable and momentary teacher change. Yet the findings of this study suggest a major influential factor for teachers was whether they were grounded in the curricular approach to PBL-APES and the underlying content of the course. At the Summer Institute, all teachers in this study were receptive to supporting text-based learning; expecting students to learn content from text aligned with every teacher's goal to teach students about environmental science. Whether teachers were grounded in the curriculum and the content made the difference in whether teachers could take

up and commit to an approach that used texts in ways not typical in most secondary classrooms, including their own classes beyond PBL-APES. Teachers who were “primed” with this grounded understanding had the capacity to consider and ultimately try out the learning from text supports. As they engaged with the curriculum, the embedded rationales in the text-based portions of lessons reinforced the integrated nature of the learning-from-text approach. The supports were thus able to “speak to” teachers because they were on the same page as the approach embedded in the curriculum (Remillard, 2005). This support enabled teachers to experiment with new pedagogical tools long enough to realize students did not push back (as they had worried) and to see how the approach worked in concert with content. Without this critical access point to the learning-from-text approach, teachers seemed unable to engage with learning from text when it most mattered, at the very beginning of the course.

Given the disparity between new and experienced teachers’ experiences and their perceptions of success with the learning-from-text approach, I argue professional development must consider teachers’ initial understandings in regard to their curricular and content knowledge if all teachers are to have access to a new way of supporting students with texts. Just as we expect varying student abilities to require a differentiated approach, so too must an approach that upends everything teachers know about learning from text. Although the KIA decision to work with new and experienced teachers at the same time undoubtedly explains some of the new teachers’ heightened learning curve, the Summer Institute was not so far from typical professional development that it can bear the full burden of responsibility.

7.6 LIMITATIONS & CONSIDERATIONS

The timing of this study is both an advantage and a limitation. On one hand, considerable evidence suggests teachers need at least two years to integrate new learning (Guskey & Yoon,

2009). That means experienced teachers (Ms. Carson and Ms. Murie) were past the implementation learning curve, and changes in instruction were more likely to be a result of the new curriculum and the revised approach to learning from text. Although I held the possibility open that teachers in their third year of implementation might not feel the need to look closely at a revised curriculum, this did not prove to be the case. In fact, despite the risk that the curriculum – now embedded with substantially clearer scaffolds for learning from text – would be considered extraneous, Ms. Murie and Ms. Carson were notably committed to the project. They were actively involved in developing the revised curriculum and articulated their interest in trying new approaches. Their contributions to the curricular design meant they were not typical teachers with only prior implementation experience. It is possible that their ease in adapting to the new text-based approach was supported by the curriculum development process in subtle ways that escaped my data analysis.

The dichotomy between the experienced and new teachers was unexpectedly stark. Although the KIA team had decided with trepidation to incorporate the new teachers into the collaborative design process rather than provide a typical on-boarding experience, the impact on the new teachers appeared to be more challenging than expected. Ms. Hunter and Ms. Earle's inexperience with the KIA approach appeared to be compounded by their inexperience with the environmental science content. This led to some distinct analytical patterns. Yet there were still important differences between all four teachers; in my analysis, I intentionally looked across the teachers to identify areas in which the new/experienced bifurcation did not apply or was more complicated than at first glance.

Another limitation is the selection of the first three projects, which represents approximately half the school year. It is impossible to say what might have happened in the next

collaborative team meeting, or for that matter, in the next project. Perhaps the teachers were just on the verge of beginning to examine problems of practice. In this study, I cannot account for the durability of teacher learning or the practices that were enacted after the conclusion of the third project. Likewise, I did not focus on student data, which limited my ability to describe how students perceived teacher enactment. Given the video-recording quality, I was generally able to hear whole-class discussions and at times I used representative student comments as limited evidence of student interactions, engagement, and perceptions when it seemed relevant to the data at hand. It is important to note that I may have missed opposing student perceptions, but when student data was used, I checked the representative nature of the data by reviewing the video and focusing on the students and the classroom dynamics.

My role as a researcher is also important to consider. Although the teachers seemed to speak honestly about their perceptions and experiences, I had spent some time filming in their classrooms and therefore represented the research team; it is possible teachers tuned their answers to what they thought I wanted to hear. Based on their candor and willingness to talk at length, I feel we established a good rapport. Still, my efforts to triangulate attempted to account for this dynamic. The teachers were all white women, like myself, which minimized issues of power. However, I still brought my own lenses and assumptions and may have inadvertently guided interviews in ways that overlooked or diminished relevant factors. I feel this was somewhat countered by the fact that the first interview of the year was conducted by other researchers (with the exception of Ms. Earle, who I interviewed all three times.)

Due to the highly reflective nature of the interview and the relative lack of reflective talk about text-based instruction in the collaborative teacher meetings, the interviews took on the nature of an intervention. This was unintentional, but it raises questions about how teachers

enacting the PBL-APES curriculum outside of a research context would compare to the experience of the teachers in this study.

Finally, qualitative studies are situated in specific contexts; thus my findings do not generalize to other teachers or cases (Silverman, 2001). Rather, I aim to generalize to theories of teacher learning in regards to learning from text in high schools.

7.7 SUGGESTIONS FOR FUTURE RESEARCH

Teachers at poverty-impacted schools of the kind that PBL-APES was re-designed to support are often asked to teach outside their area of expertise (Ingersoll, 2004). Yet limited content knowledge is not conducive to high quality instruction. Ms. Earle's background in Physical Sciences and Ms. Hunter background in Biology demonstrated how science domains might as well be different subject areas. Since the ability of teachers to support text-based learning hinges to a large degree on understanding how texts serve specific subject-matter goals (Moje & Speyer, 2008), it seems imperative for researchers to explore what kinds of professional development would support urban teachers who find themselves at the helm of PBL-APES without sufficient content knowledge of environmental science.

This study consisted of two highly contrasting pairs of teachers. Since there will always be variability in teachers, including levels of background knowledge and familiarity with the curriculum (Opfer & Pedder, 2011), an important question for research is whether there is an ideal point at which to introduce learning from text. Consideration of teachers' developmental needs would perhaps better support new and experienced teachers with the same resources. A more responsive approach, where teachers are provided portions or layers of the curriculum over time instead of all at once, might be worth investigating.

As Ms. Murie suggested, reviewing her enactment on video would have helped her identify and begin to unpack the discrepancy between her intended and actual facilitation of discussion. Thus, one approach to addressing problems of enactment around working with texts may be the use of video-based discussions about practice as a way to foster “analytic thinking and productive conversations” (Borko, Koellner, Jacobs, & Seago, 2011, p. 176). Supporting reflection around the challenging practices of discussions and interpretations of text and graphics would likely support learning for teachers who are ready to examine their own practice. Such an approach might be too much for a teacher just beginning to teach PBL-APES.

Finally, this dissertation focused on teachers, despite all the students in the classrooms who read texts with varying levels of support for their learning. I hope to be able to examine student data from the KIA study to understand how teacher enactment impacted students’ learning and their perceptions about learning from text. Coming into this study, I wondered how the ability level of students would influence teachers and their enactment, but although teachers were aware of different ability levels, they did not discuss adapting instruction for different students or how they interpreted different levels of student learning. Since this study did not examine student data, it is impossible to tell whether, say, increased opportunities to read had any impact on student learning. As Greenleaf et al. (2011) point out, there is little research (beyond their study) that looks empirically at both teachers and students. Future studies that link teacher learning to student learning would contribute valuable knowledge to the field and help both researchers and educators better understand the complex change environment surrounding learning from text.

Conclusion

How texts are—or could be—used in science classes was an area that Moje and colleagues (2011) identified as a critical area to research. This study's examination of how four teachers enacted learning from text in the context of a more supportive curriculum and more aligned professional learning opportunities contributes directly to this gap in the research. Promisingly, findings presented here suggest that when teachers are supported with curricular knowledge, consistent supports for text-based learning, and opportunities to reflect on their practice, teachers are able to support learning from text in science classes. Yet this dissertation also suggests that teachers will require sufficient time and support to fully engage with the complex task of bringing texts back into action.

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APPENDIX A: BEGINNING OF YEAR TEACHER INTERVIEW PROTOCOL FOR RETURNING TEACHERS

University of Washington Knowledge in Action Project

Beginning of the Year Interview Protocol 2014 *RETURNING TEACHERS*

Thank you for agreeing to participate in this interview. We are interested in hearing your thoughts about teaching and this course. Everything you share with us is confidential. This interview will be audio-recorded. You may ask me to stop recording at any time or to stop the interview at any time if you ever feel uncomfortable.

1. Compare the approach we've been working on this week and the end of last year with how you taught the course can you share how you think it may be different or the same?
 - a. Do you think it may require you to change your instructional approach at all? How?
2. Have your teaching philosophy & practices in science courses changed over the last couple of years? If so, how?.
3. Given what you've learned about the course this week, tell me about your goals and expectation for this course this year – any differences from last year?
4. What struggles and challenges do you anticipate you will face in teaching this course?
 - a. How do you think you will approach these challenges?
5. What struggles and challenges do you anticipate students will face in this course?
 - a. What do you think you would suggest or do to deal with these challenges?
6. Given the work on learning from text and homework this week, how do you think the students will respond? What strategies might you use to address issues that arise?
7. Can you talk about the level of student productive disciplinary engagement you expect for this course? (Using the concepts and practices of an environmental scientist, thinking in their role)
 - a. What ideas do you have about ways to support productive disciplinary engagement this year that may be changes from last year?
 - b. What kinds of things will get in the way of productive disciplinary engagement? Why?
8. Did you find the summer institute useful? How? What could we have done differently to make it more useful for you?

9. Tell me about your grading practices.

Prompt for:

- stuff that would go in a syllabus or grading policy (how do you assign grades on progress reports or report cards?)
- How do you decide which things get counted in the final grade,
- how do you assign weights to different things (project papers, LCA posters, tests, etc.)
- Is that similar or different to your other (non PBL) classes?

10. Is there anything else that you would like to add?

APPENDIX B: BEGINNING OF YEAR TEACHER INTERVIEW PROTOCOL FOR NEW TEACHERS

University of Washington Knowledge in Action Project

*Beginning of the Year Interview Protocol (New Teachers)
2014*

Thank you for agreeing to participate in this interview. We are interested in hearing your thoughts about teaching and this course. Everything you share with us is confidential. This interview will be audio-recorded. You may ask me to stop recording at any time or to stop the interview at any time if you ever feel uncomfortable.

1. Have you taught AP Environmental Science before? Comparing the approach of how you taught the course previously to this PBL course, can you share how you think it may be different or the same?
 - a. Do you think it may require you to change your instructional approach at all? How?
 - b. Can you describe for me the AP culture in your district?
 - c. Can you describe the student population that you expect to have in your class?
2. Given all the information you have received this week, tell me your thoughts on Project-Based Learning.
 - a. What does Project-Based Learning mean to you?
 - b. What are your expectations for teaching PBL this year?
3. Tell me a little bit about your teaching philosophy in science courses.
 - a. Describe for me your understanding of how science works/is done.
 - b. What should students learn from a science course?
 - c. How do you think a science class should be taught?
4. Given what you've learned about the course this week, tell me about your goals and expectation for this course.
5. What struggles and challenges do you anticipate you will face in teaching this course?
 - a. How do you think you will approach these challenges?
6. What struggles and challenges do you anticipate students will face in this course?
 - a. What do you think you would suggest or do to deal with these challenges?
7. Talk about the depth of learning you think students will achieve by taking this course.
 - a. How well do you think the course will prepare students for the AP Exam?
 - b. How well do you think the course will prepare student to be able to apply knowledge from the course to other situations in life?

8. Given the work on learning from text and homework this week, how do you think the students will respond? What strategies might you use to address issues that arise?
9. Can you talk about the level of student productive disciplinary engagement you expect for this course? (Using the concepts and practices of an environmental scientist, thinking in their role)
 - a. What ideas do you have about ways to support productive disciplinary engagement this year that may be changes from last year?
 - b. What kinds of things will get in the way of productive disciplinary engagement? Why?
10. Tell me about your grading practices.

Prompt for:

- stuff that would go in a syllabus or grading policy (how do you assign grades on progress reports or report cards?)
 - How do you decide which things get counted in the final grade,
 - how do you assign weights to different things (project papers, LCA posters, tests, etc.)
 - Is that similar or different to your other (non PBL) classes? If this is the first time to teach using PBL, will that affect your grading practices?
11. Is there anything else that you would like to add?

APPENDIX C: POST-ECOFOOTPRINT TEACHER INTERVIEW PROTOCOL

Post-EcoFootprint Interview: All Teachers

Thank you for meeting with me. I'm interested in talking with you about how reading and learning from text went for you and your students. Everything you share is confidential. This interview will be audio-recorded so I can remember what you say. You may ask me to stop recording at any time or to stop the interview at any time if you ever feel uncomfortable.

1. Talk to me a little about what has been most useful to you so far with the reading aspects of teaching APES this year – think broadly: not just the lesson plans, but also our work this summer in Seattle, our collaborative team meetings, the work you've done yourself and with your colleagues, etc. – consider all those aspects that have been part of the APES course this year. What has been most useful and what have you not found particularly helpful for teaching APES?
 - a. Why has that been useful? Can you give me an example?
 - b. If something has not been useful: What would have been more helpful?
2. So when you think about everything you've done up to this point, what kinds of changes have you made so far this year? Again, think broadly... changes to any of the lessons, the teaching strategies, things you've developed yourself. What changes have you made so far?
 - a. Any changes in your teaching approach/style?
 - b. Any changes in your expectations for students or grading?
 - c. What changes would you suggest?
3. Overall, tell me what you think so far about providing this kind of literacy scaffolding support.
4. Now that you've been at this for two months... Talk to me about how this year's class looks the same or different from last year (or when we started this project). What looks or feels different to you from your other classes? What looks and feels the same?
 - a. How are your students responding?
5. Think back over the last week or two – tell me about a lesson that included text (it could be reading, online research, writing up their notes or proposal)... Pick a lesson that comes to mind – would you describe for me how it went?
 - a. That's really interesting; tell me your thinking about that.
 - b. What led you to make that an in-class/HW reading?
 - c. How do you think it worked?
 - d. If you had to teach the lesson over, would you do it the same way or do you have different thoughts now?

6. One of the tools you and other Des Moines teachers worked on this summer was adding in a notebook tool for students to use during and after reading. Tell me what that looked like in your classroom this fall.
 - a. Why did you decide to do it that way?
 - b. How do you think it worked? – for content? – for preparing for the proposal?
 - c. What would you do differently for MCE?

7. Any other comments or thoughts about working with text or tools that I didn't ask about?

APPENDIX D: POST-MY COMMUNITY ECOLOGY TEACHER INTERVIEW PROTOCOL

Post-MCE Interview: All Teachers

Thank you for meeting with me. I'm interested in talking with you about how reading and learning from text went for you and your students. Everything you share is confidential. This interview will be audio-recorded so I can remember what you say. You may ask me to stop recording at any time or to stop the interview at any time if you ever feel uncomfortable.

1. Last time we talked you mentioned that XXX [From REVIEW of EF INTERVIEW: 1-2 things; for example: students weren't doing the reading].
So -- tell me how XXX worked for you and your students in MCE.
 - a. What aspects of this project -- or your teaching -- or your kids -- do you think might have contributed to that?
 - b. Difficulty level? Why challenging?
 - c. Tell me some of the ways you supported XXX (i.e. students' reading) in class?
 - d. How about out of class?

2. Tell me about the MCE notebook tool that went with the readings... Did you use the tool in MCE? What did you and the students do with it? How did you use it?
 - a. Describe for me what it looked like and how it worked.
 - b. FOCUS: prompt talk about how they used it. That's interesting -- why did you decide to do that? What happened when the kids came back with it? What did you do then?
 - c. Why did you decide to do it that way?
 - d. Do you think the tool helps your students get where you want them to go in terms of content learning? [Impact report] How do you know? OR What do you look for?
 - e. What might you do differently?
 - f. If it didn't get used or didn't go well: Tell me about your decision... What would you need for it work?

3. We've already talked about XXX and the MCE notebook tool... Is there anything else that sticks out for you about how reading and discussion of text-based information worked in MCE? Either positively or negatively, as you think back to MCE and the reading students did... What do you think would be helpful for me to know about?
 - a. Any teaching strategies you used that worked/didn't work? Homework Application?
 - b. Any readings that worked well or not?
 - c. Any changes or adaptations that you made that worked well -- or didn't work well?
 - d. Tell me about it: if it didn't go well, what happened? How do you know? What did you see students doing?

- e. We know you have this curriculum, is there anything else that influences your teaching or your practices around reading? Other classes, other PD, other teachers?
4. You've been an important part of designing this course collaboratively – and the reading and discussion has to make sense for teachers like you in your own practice with your particular kids. So in this question, I'd like you to help me understand how what we've put on paper translates to your classroom.

We know and expect that teachers will make things their own – they will make choices based on their own expertise, their students, timing, their particular goals – we want to understand what you do to make this your own.

First I'll ask generally how you use the curricular material and then we'll look together at a specific lesson.

- A. So in general, how do you use the curricular material (lesson plans, PPTs, handouts, texts) when you prep and then teach? Take me through your process – think aloud.
 - Why do you do that/use it in that way?
 - If you changed xyz, why did you change it?
 - When and why do you drop/skip some things?
- B. Now let's look at a particular lesson plan [email or have teacher pull up lesson plan for YYY]. Talk to me a little about what parts of the lesson you would have used for planning – what parts of the lessons do you tend to focus on for your planning? What parts aren't helpful for you? Again, walk me through your process.
 - Framing
 - Before-During-After
 - Discussion
 - HW Application

Probes for these features:

- What does [framing] do for you?
 - What do you think it does for students? How do you know?
5. Now that you've been through MCE... Talk to me about how you handled the readings (in class AND homework) and discussions *in comparison to* EcoFootprint.
- What did you do that was similar?
 - Why did you decide to do that? How did it work out?
 - How did your students respond? Why?
 - What did you do that was different? What changes did you make?
 - Can you explain that to me a little more – why did you decide to make that/those changes?

- What did you think about when you made those adjustments? How did it work out?
 - How did your students respond? Why?
- Now think ahead to Foods and beyond.
- What will you continue to do w/ respect to readings and text-based discussions?
 - What do you think you might change?
6. Overall, tell me what you think at this point about providing this kind of reading support for your students.
7. As you know, the Lucas Foundation is working on their model for scaling this curriculum and they're thinking about the amount and kind of professional development they provide for teachers. One structure you all have in place is the monthly meetings. How do they work for you? What do you take away?
- a. Do you feel that talking with your colleagues helps you think about supporting reading?
 - b. Say more about that...
 - c. What advice would have for GLEF for supporting teachers?
8. Any other comments or thoughts about working with text or tools that I didn't ask about?

APPENDIX E: DATA ANALYSIS CODES

Summer Institute Codes

- T asks any question
- T asks question (LFT-related)
- T connects with practice / experience
- T critiques / notes issue with PBL-APES
- T engages in curricular/instructional discussion
- T goals / salient outcomes
- T offers suggestion for revision / process
- T reflects on OTL / PD
- T understanding / belief
- T understanding / belief (LFT)

Codes for classroom observations, teacher interviews, teacher meetings

- LFT(s): Adaptive expertise
- LFT(s): LFT accountability
- LFT(s): Researcher talk concludes T-reflection
- LFT(s): T-T support for enactment
- LFT(s): T concern /question / revision re: enactment
- LFT(s): Teacher curric influence
- LFT(s): Teacher goals / salient outcomes
- LFT(s): Teacher PK/experience (or lack) influences enactment
- LFT(s): Teacher reflection on changes (instr, beliefs, etc.)
- LFT(s): Teacher reflection on LFT enactment
- LFT: Application / Use
- LFT: Building/activating background KN
- LFT: Citing source of info
- LFT: Compliance
- LFT: Conceptual orientation / Framing (Teacher)
- LFT: Context / culture
- LFT: Discussion - small group
- LFT: Discussion - whole class
- LFT: During reading: Strategies and activities
- LFT: During reading: Student active reading behaviors
- LFT: During reading: Teacher interactions
- LFT: During reading: Student-Student interactions
- LFT: Explicit instruction / explanation / demonstration for engaging with text
- LFT: Homework
- LFT: Materials: other texts
- LFT: Materials: Textbook
- LFT: Materials: Tools
- LFT: Personal connections

- LFT: Purpose for reading
- LFT: Student initiated talk about text
- LFT: Student perceptions
- LFT: Teacher beliefs / perceptions
- LFT: Teacher challenges
- LFT: Teacher OTL
- LFT: Vocabulary/concept
- LFT: Writing

APPENDIX F: TEACHER PSEUDONYMS

Rachel Louise Carson (May 27, 1907 – April 14, 1964) was an American marine biologist and conservationist whose book *Silent Spring* and other writings are credited with advancing the global environmental movement. Carson began her career as an aquatic biologist in the U.S. Bureau of Fisheries, and became a full-time nature writer in the 1950s.

Sylvia Alice Earle (born August 30, 1935 in Gibbstown, New Jersey) is an American marine biologist, explorer, author, and lecturer. Since 1998 she has been a National Geographic explorer-in-residence. Earle was the first female chief scientist of the U.S. National Oceanic and Atmospheric Administration, and was named by *Time Magazine* as its first Hero for the Planet in 1998.

Celia Hunter (January 13, 1919 – December 1, 2001) was an American environmentalist and conservationist. She was conferred the highest award by the Sierra Club, The John Muir Award, in 1991. The Wilderness Society presented her with the highest award, The Robert Marshall Award, in 1998.

Margaret Thomas "Mardy" Murie (August 18, 1902 – October 19, 2003) was a naturalist, author, adventurer, and conservationist. Dubbed the "Grandmother of the Conservation Movement" by both the Sierra Club and the Wilderness Society, she helped in the passage of the Wilderness Act, and was instrumental in creating the Arctic National Wildlife Refuge. She was the recipient of the Audubon Medal, the John Muir Award, and the Presidential Medal of Freedom—the highest civilian honor awarded by the United States.