

University at Albany, State University of New York

Scholars Archive

Educational Theory and Practice Faculty
Scholarship

Educational Theory and Practice

2013

Examining Studies of Inquiry-Based Learning in Three Fields of Education: Sparking Generative Conversation

Brett L. M. Levy

University at Albany, State University of New York, bllevy@albany.edu

Ebony Elizabeth Thomas

University of Pennsylvania

Kathryn Drago

University Of Michigan

Lesely A. Rex

University of Michigan

Follow this and additional works at: https://scholarsarchive.library.albany.edu/etap_fac_scholar



Part of the [Secondary Education Commons](#)

Recommended Citation

Levy, Brett L. M.; Thomas, Ebony Elizabeth; Drago, Kathryn; and Rex, Lesely A., "Examining Studies of Inquiry-Based Learning in Three Fields of Education: Sparking Generative Conversation" (2013). *Educational Theory and Practice Faculty Scholarship*. 23.

https://scholarsarchive.library.albany.edu/etap_fac_scholar/23

This Article is brought to you for free and open access by the Educational Theory and Practice at Scholars Archive. It has been accepted for inclusion in Educational Theory and Practice Faculty Scholarship by an authorized administrator of Scholars Archive. For more information, please contact scholarsarchive@albany.edu.

**Examining Studies of Inquiry-Based Learning in Three Fields of Education:
Sparking Generative Conversation**

Brett L. M. Levy
University at Albany, State University of New York

Ebony Elizabeth Thomas
University of Pennsylvania

Kathryn Drago
University of Michigan

Lesley A. Rex
University of Michigan

Citation Information of Original Publication:

Levy, B. L. M., Thomas, E. E., Drago, K., & Rex, L. A. (2013). Examining studies of inquiry-based learning in three fields of education: Sparking generative conversation. *Journal of Teacher Education*, 64(5), 387-408.

Acknowledgments:

We would like to thank the institutions and individuals who supported this work. The School of Education at University of Michigan facilitated our efforts to develop, discuss, and present this research. In addition, Peter Smagorinsky, Alan Lockwood, Jennifer Moore, and Lauren Harris provided helpful feedback on drafts of this article. The science education study described herein was made possible by Joseph Krajcik and numerous curriculum designers and researchers at the University of Michigan, the Weizmann Institute, and American Association for the Advancement of Science (AAAS). The latter study was supported by National Science Foundation (NSF) Grants ESI-0439352 and ESI-0439494, and the research described in the English language arts (ELA) teacher education section was supported by a grant from the University of Michigan's Rackham Graduate School. Finally, the open participation of the students and teachers in this study was vital to the success of our work. We deeply appreciate the efforts of all who have helped make this article possible.

Abstract

Many educational researchers across the United States have found that inquiry-based learning (IBL) supports the development of deep, meaningful content knowledge. However, integrating inquiry-based learning into classroom practice has been challenging, in part because of contrasting conceptualizations and practices across educational fields. In this paper, we (1) describe differing conceptions of IBL, (2) summarize our own studies of IBL in three fields of education, (3) compare and contrast the processes and purposes of IBL in our studies and fields, and (4) suggest numerous opportunities for cross-disciplinary collaborations on IBL curriculum, teaching, and research that could bolster its inclusion in K-12 education. We ground our exploration in knowledge-generating conceptualizations and practices in these fields.

Keywords: professional development, teacher learning, curriculum, secondary teacher education, preservice education, inquiry

Over the past two decades, educational standards in the disciplines have increasingly emphasized the importance of inquiry-based learning. For example, the Framework for K-12 Science Education (National Research Council, 2011) states that students should engage in “the major practices that scientists employ as they investigate and build models and theories about the world” (p. 30), and the National Standards for History (National Center for History in the Schools, 1996) indicate that students should become proficient at detecting biases in historical interpretations. Meanwhile, the Standards for the English Language Arts assert that evaluating and interpreting the findings from various information sources “is one of the most vital skills that students can acquire” (International Reading Association & the National Council of Teachers of English, 1996, p. 28). Recently, the Common Core Standards emphasize the importance of numerous skills associated with inquiry-based learning, including analysis of multiple texts and data sources (National Governors Association Center for Best Practices and CCSSO, 2012). Although derived from different fields, each of these standards documents has a clear focus on inquiry.

These standards are based on a growing body of research indicating that providing learners with opportunities to inquire into authentic problems can substantially enhance their understanding (e.g., Krajcik, Blumenfeld, Marx, & Soloway, 2000; Wirkala & Kuhn, 2011). Thus, many people involved in educator development programs are considering how to best prepare educators so that they will engage their students in inquiry not only *within*, but also *across*, the disciplines.¹ In other words, today’s students not only need to know what counts as

¹ Teacher education and professional development programs have undertaken and examined efforts to prepare current and future teachers to skillfully employ inquiry-based learning practices in their work (e.g., Oliveira, 2010). Meanwhile, educational scholars in several fields of education have explored and promulgated the potential benefits of inquiry-based learning (e.g., Bain, 2000; Bruner, 1996; Jennings & Mills, 2009; Nelson, Slavitt, Perkins, & Hathorn, 2008; Schunk, Pintrich, & Meece, 2008; Wineburg, 2001).

knowledge of a particular field, and how to demonstrate understanding within disparate fields, but also about how to integrate and synthesize knowledge in an interdisciplinary fashion *among* several fields at once. Thus, it is curious that whenever the term “inquiry” is used in policy or program documents that are for a general educational research or educational practice audience (as opposed to specific to a particular field), there seems to be an implicit assumption that the reader knows exactly what “inquiry” is. However, even a cursory examination of these variable usages of inquiry will show that this is not the case (as detailed further below).

We began to think about how *inquiry* is defined in our disciplines much more critically during the 2008-2009 academic year. As teacher educators in different fields at the same large public university, we participated in numerous meetings about our education school’s new initiative for inquiry-based practitioner preparation. Simultaneously, AERA’s call for proposals in advance of the 2009 annual meeting requested submissions that foregrounded inquiry in educational research. Against this backdrop, we began to talk with one another about some of the challenges and opportunities that we had experienced as we worked with preservice teachers and inquiry-based teacher education in each of our fields.

During these exchanges, we were struck by the different conceptions of inquiry across our three disciplines. As teacher educators, we were having trouble understanding how our colleagues were conceptualizing inquiry during meetings, and we began to wonder if the preservice and inservice teachers we were working with were experiencing the same confusion – confusion that they might eventually pass on to students. Therefore we believed that cross-disciplinary exchanges about IBL were necessary to address this confusion and generate interdisciplinary understanding. This is increasingly important in an era when students and professionals are often expected to excel not only in a single field or discipline but also to

transfer their skills and knowledge to new fields. Furthermore, we thought that fostering cross-disciplinary conceptions of IBL might help to alleviate some of the struggles our students were having with IBL in our individual fields.

Soon we realized that understanding the similarities and differences in the ways we thought about inquiry could potentially expand our conceptions of inquiry-based learning, to the benefit of both our practice as teacher educators and our development as researchers. While leading a colloquium on the topic at the 2009 AERA conference (Rex, Thomas, Levy, & Drago, 2009), the distance among our fields became even more apparent. For example, Kathryn Drago helped the rest of us consider how inquiry in education could be conceived as the *means* or the *ends* of instructional goals – an idea common in science education but not similarly conceptualized in other areas. Brett Levy, on the other hand, emphasized the importance of learners grappling with their own biases and those embedded in historical documents and narratives. Ebony Elizabeth Thomas contributed to our understanding about what inquiry looks like in a field where it is most often used to describe practitioner research instead of classroom instruction. We found this conversation to be so generative that in an effort to keep learning from one another, we decided to continue our exchanges at our home institution. Eventually, we chose to consider how inquiry-based learning was conceived, defined, and taught in our own fields and across fields. The issues we addressed led to the questions that guide this paper:

1. What are important similarities and differences of inquiry-based learning in different fields of education?
2. What are the major challenges and opportunities for inquiry-based learning in these fields?

3. How could enhancing our understanding of inquiry-based learning across fields facilitate its inclusion in educator development programs and foster cross-field collaborations on curriculum, teaching, and research?

To address these questions, we decided to analyze perspectives and data from three of our own qualitative studies, each of which involved a different tradition of inquiry-based learning (IBL). We noted at first that IBL in all three studies shared some common characteristics, including learners' active investigation and analysis of data and pursuit of probing questions. However, our discussions also surfaced significant differences in our fields' perspectives. By articulating these similarities and differences, we hoped to preview the kinds of conversations that could occur among teacher educators, teachers across the disciplines, and educational researchers in order to increase interdisciplinary understanding.

For example, IBL in science involves carrying out investigations and collecting data to construct evidence-based explanations of phenomena in the natural world. However, IBL in history typically involves the analysis of documents and artifacts in order to construct accounts of past events. IBL in English language arts (ELA) teacher education, although less clearly defined than in science and history, often requires learners to take ownership of their own learning while closely examining communicative acts such as speech or writing. In our discussions, we agreed that exploring these issues was important for teacher education, especially given that some future educators will teach in several fields, participate in interdisciplinary educational efforts, and/or collaborate with colleagues in different disciplines. Furthermore, with the erosion of traditional teacher certification and the proliferation of teaching contexts where practitioners are asked to teach outside of their field of training (Ingersoll, 2001, 2002; Ingersoll & Perda, 2010), enabling teachers-in-development to have a cross-disciplinary

understanding of what inquiry approaches might look like outside of their field has immediate practical implications as well.

The studies we draw on for our exchange were designed, implemented, and analyzed independently from one another. Thus, we have studied very different populations and do not purport to explore a single or co-designed research study into conceptions of inquiry across teacher education. That is because we were primarily concerned with our findings being relevant to the specific question of what IBL looks like in today's teaching and learning contexts. Our aim was not to explicitly investigate how our participants defined inquiry in their fields; nonetheless, by drawing on vivid examples from our own work, we do illustrate how colleagues at one institution but working within disciplines of education that have different histories, trajectories, and salient contemporary issues might productively learn from each other's different conceptual frameworks. Furthermore, as we engaged in our cross-disciplinary conversations, we hoped to shed light on the sticky problem of definition in policy documents, white papers, and other publications that are often addressed to a general audience of stakeholders in education. In these documents, *whose* inquiry do we mean? Is it inquiry as defined by science educators? History educators? English educators? More than one of these? Given the ongoing attention to inquiry-based learning, it seems that discussions of this kind are both timely and relevant, with important implications for curriculum, teaching, and research across fields.

Conceptions of Inquiry-Based Learning

Through our exchanges, the three of us learned that one barrier to cross-disciplinary understanding has been differing perceptions of what constitutes inquiry-based learning (Rex et al., 2009; Levy, Aiyegbayot, & Little, 2009). As Grossman and McDonald (2008) have noted, educational research fields often lack common definitions of terms. For example, in an analysis

of the term “context” in the five top literacy research journals, the Santa Barbara Classroom Discourse Group found that hundreds of meanings were in circulation (Rex, Green, & Dixon, 1998). Even wider definitional variations exist between different disciplinary fields. There are important reasons for these disciplinary divides, most notably the differing nature of knowledge production in various fields, but these divisions create challenges for K-12 learners and educators negotiating more than one discipline simultaneously. Although it is likely impossible to eliminate these differences altogether, clarifying and discussing them may be helpful for individuals who inevitably confront them, such as educators.

Overall, educational scholars agree that inquiry-based learning provides students opportunities to answer questions through the exploration and analysis of data. As Harste (2001) explains, “Education as inquiry provides an opportunity for learners to explore collaboratively topics of personal and social interest using the perspectives offered by others as well as by various knowledge domains” (p. 1). Even within each subject, however, conceptions of inquiry-based learning can vary based on the amount of scaffolding provided (Levy et al., 2009), the extent of teacher support (Levy et al., 2009; Wang, Kinzie, McGuire, & Pan, 2010), and the degree of conceptual preparation that students experience (Marshall & Horton, 2011). Furthermore, recent scholarship distinguishes between inquiry focused on gaining existing knowledge and inquiry focused on building new knowledge (Levy et al., 2009). Indeed, whereas some scholars use the term *inquiry* to describe active information retrieval (e.g., Schmidt-Jones, 2012), others highlight the importance of designing inquiry activities that include critical analysis (Paul & Marfo, 2001; Sprocken-Smith, Walker, Batchelor, O’Steen, & Angelo, 2011). Given this range of conceptions, it is no surprise that scholars emphasize different potential benefits of inquiry-based learning. For example, some stress the social and experiential aspects

(e.g., Major & Palmer, 2001) while others prioritize students' understanding of discipline-specific knowledge-generation processes (e.g., Wyatt, 2005). Acknowledging the value of all the aforementioned conceptions of inquiry, the studies described below incorporate elements of all of these, and our exploration (elaborated in the discussion section) enables us to consider the extent to which different conceptions of inquiry vary by field.

Scholars have previously explored the potential of *interdisciplinary* teaching (Levin & Nevo, 2009; Nikitina, 2006) and inquiry-based curricula (e.g., Mintrop, 2004; Rico & Shulman, 2004; Shulman & Sherin, 2004), but few have examined inquiry-based learning *across* educational fields. Among the most powerful conceptions has been that of Cochran-Smith and Lytle (2009), who characterize inquiry as content, outcome, pedagogy, and stance. They contend that if “inquiry as content” involves the collaborative construction of knowledge, then “inquiry as outcome” is when teachers and students develop a questioning and critical perspective on educational problems and issues. They further explain that an inquiry-based pedagogy generates and investigates questions, and inquiry as stance is “a grounded theory of action that positions the role of practitioners and practitioner knowledge as central to the goal of transforming teaching, learning, leading, and schooling” (p. 119). Like other scholars, Cochran-Smith and Lytle provided numerous useful insights for educators interested in inquiry-based learning, and their research adds to this body of work by considering cross-disciplinary and interdisciplinary comparisons.

By describing and analyzing the process of teaching inquiry in science, history, and English teacher education, we aim to fuel productive exchanges among related yet often disparate domains of education and educational research. Our exploration begins with a study of secondary science education, then moves to historical inquiry, and finally progresses to ELA

teacher education. We begin with science education because inquiry-based learning in this field has a long history, and there has been a wide variety of research and theory in this area. Our analysis of IBL in science education provides a foundation for our investigation of the other areas of inquiry. Next, we present research on social studies student teachers' initial forays into teaching historical inquiry – a growing area of inquiry-based education that scholars have begun to explore over the past two decades. Our third study describes how English teachers in a professional development program inquire into their own pedagogy – a key practice that has become central to both teacher education (e.g., the edTPA) and professional development. We present this study last because it provides valuable insights that may be valuable to inquiry-oriented educators in the former two fields. Although our descriptions provide only short summaries of each study, we include analyses of the challenges and opportunities that surfaced in these experiences, and we conclude by exploring what we learned from each other and how continued cross-field exchanges may enhance the teaching of inquiry at various levels.

Supporting Inquiry-Based Learning in Science Education (by Kathryn Drago)

Inquiry in Science Education

Inquiry-based learning has been widely promoted in science education. Within science education literature, *inquiry* takes on at least 18 distinct meanings (Duschl & Grandy, 2008). This multiplicity of uses has led science education researchers to call for a “greater precision and consistency” of the definition of inquiry (Hofstein & Lunetta, 2004) or to completely abandon the word for a more rigorous term (Michaels, Shouse, & Schweingruber, 2007; National Research Council, 2011). For teachers, the variation in the definition of *inquiry* presents an enactment problem because national science education standards (e.g., American Association for the Advancement of Science, 1993; National Research Council, 1996) recommend teaching

scientific inquiry or its successor, scientific practices (NGSS Consortium of Lead States, 2013), in all grades. Although the confusion surrounding the meaning of *inquiry* creates challenges for education researchers and teachers alike, it also provides an opportunity for these groups to collaborate and refine their thinking about what inquiry is and how best to support inquiry-based instruction.

For this study, I define *inquiry* according to the definition in the National Standards for Science Education:

Inquiry is a multifaceted activity that involves making observations; posing questions; examining books and other sources of information to see what is already known; planning investigations; reviewing what is already known in light of experimental evidence; using tools to gather, analyze, and interpret data; proposing answers, explanations, and predictions; and communicating the results. Inquiry requires identification of assumptions, use of critical and logical thinking, and consideration of alternative explanations. (National Research Council, 1996, p. 23)

Additionally, I differentiate between inquiry as educational means and ends (Abd-El-Khalick et al., 2004). When using *inquiry as means*, science educators exploit inquiry as a pedagogical approach that helps students develop understandings of science cross-cutting concepts and core ideas. When science educators utilize *inquiry as ends*, students' learning focuses on the practices of science (e.g. carrying out investigations, interpreting data, engaging in argument from evidence, and using models). Because the Next Generation Science Standards provides learning goals that integrate science practices, cross-cutting concepts, and core ideas (NGSS Consortium of Lead States, 2013), inquiry as means and ends should be taught simultaneously in all classroom instruction.

An Illustration of the Opportunities and Challenges Afforded by Classroom Scientific Inquiry

I examined how education researchers and in-service middle school science teachers discussed enactment of curriculum materials designed by the researchers. Discourse between science teachers and researchers provides a rich medium for characterizing conceptions of inquiry. The purpose of this conversation was to collect feedback for improving the curriculum in question, but it also illuminated how curriculum-aligned teacher education experiences might support science educators in enacting inquiry-based instruction in their classrooms. Employing discourse analysis (Gee, 2005), I focused my analysis with the following question: *What insights can a collaborating group of science curriculum designers and in-service science teachers bring to inquiry in the science classroom?*

Data sources. The discourse analyzed in this paper is a component of a large-scale design experiment involving the curriculum entitled Investigating and Questioning the World through Science and Technology (IQWST). IQWST is a middle school curriculum composed of 12 project-based units in biology, earth science, chemistry, and physics. These materials were designed according to the seven principles of project-based units (Singer, Marx, Krajcik, & Clay Chambers, 2000). One of these principles was inquiry. As such, each lesson within the IQWST curriculum was designed to engage students in inquiry to facilitate understanding of how the processes of science lead to knowledge generation. Thus, instruction in IQWST intended to leverage inquiry as both ends and means. Additionally, the IQWST curriculum development process followed the learning goals-driven design model (Krajcik, McNeill, & Reiser, 2008). The three stages of this model were “(1) specifying learning goals, (2) developing materials, and (3) gathering feedback.” During the feedback step, the curriculum designers elicited constructive

criticism from a variety of science and science education experts. The data analyzed in this paper was collected during the feedback step.

The discourse segments on which I focus occurred during a three-hour group debriefing session held among three curriculum designer-researchers (one of which is the author) and three teachers after they had piloted the second version of the 8th grade chemistry IQWST unit. Two teachers, Ellen and Sam (all names are pseudonyms), taught at a private school in a Midwestern college town, while the third, Aaron, taught at a public school in a large Midwestern urban center. All teachers had experience teaching inquiry-based science curriculum. In the debriefing session, the curriculum designers asked the teachers to describe their challenges with the curriculum. Using this question as a frame for the informal discussion, the curriculum designers and teachers worked through the unit lesson by lesson, and the curriculum designers asked clarifying questions as appropriate. The conversation was audio-recorded and then transcribed.

Data analysis. In order to revise the curriculum, I needed to understand how to change the materials to better support inquiry. Therefore, my first step was to perform content analyses on transcripts of discussions between the teachers and curriculum designer-researchers, selecting from among hundreds of discourse segments those that related specifically to inquiry. I then categorized these selections as relating to inquiry as means or inquiry as ends. Next, I performed a thematic analysis of discourse about inquiry as means. (Inquiry as ends was discussed infrequently in this conversation, so I did not perform a thematic analysis of this category.) Themes included the need to better support inquiry as means through (1) giving students the cognitive and physical tools necessary to make inquiry successful and (2) structuring activities that allow students to make meaning from their observations.

Within the transcript's segments related to inquiry as means and ends, I found sections of the conversation in which there was tension between the speakers. In these sections, the teachers challenged the curriculum designers or each other to view inquiry according to different perspectives, and many of these sections provided valuable insights about inquiry-based learning experiences. Drawing on Gee's (2005) perspective on discourse analysis, making sense of this discourse required attending to more than the content of what was said. In addition, analyzing the structure of language use provided critical insights into how the teachers and curriculum designers made sense of inquiry in the context of this debriefing meeting. To focus on the structure of the language, I retranscribed selected discourse to capture and denote linguistic details, including pauses (.), emphasis (*), elongation of word segments (::), change in speed ([ac] accelerated or [dc] decelerated), and change in intonation ([hi] high and [lo] low). Finally, I analyzed these selected passages especially for the challenges and opportunities of inquiry-based learning implied by the speakers.

Challenges and opportunities in supporting classroom scientific inquiry as means.

The enacted science unit was designed for middle school students to carry out in-class investigations of scientific phenomena. Students' investigations were driven by the need to collect data to support claims addressing open-ended, meaningful, real-world science questions. Teachers guided their students in formulating these questions, planning investigations, and making sense of their data, and homework readings were designed to reinforce in-class learning. The unit's inquiry experiences provided students with ways to gain scientific knowledge, but supporting student sense-making was difficult in this inquiry-oriented learning environment. As teacher Ellen explained,

I think the kids were lost in the activities. And then they had to do the student reader and figure out what's going on. Rather than.. And you want them to explore the phenomena, right? But the, but, but...too, too many of the kids, not just the regulars, too many of the kids, um...didn't, didn't make sense of stuff until they read the student reader. So the activity itself wasn't *enough*.

Ellen's words and inflection surfaced specific challenges involved in the process of employing inquiry as means. Although her elongation of the word "explore" showed that she appreciated the value of inquiry's exploratory nature, her other comments suggest her frustration with students' struggles throughout the process.

For example, by pointing out students' confusion and elongating the word "lost," she drew attention to a serious problem within the curriculum. She emphasized the severity of this issue by suggesting that this was an unnecessarily frequent occurrence that affected students across ability levels ("not just the regulars"). In addition, in her comment that students "had to do the student reader and figure out what's going on," her choice of the words "had to" suggested that there should have been another activity fulfilling this sense-making role, and "figure out" connoted lack of guidance and possible frustration for the students. Beginning the next sentence with the elongated "rather than" also implied a belief that another activity might have been more fruitful for student learning. Most explicitly, she ended her comments with "the activity itself wasn't enough." Thus, although Ellen thought that exploration was important, she concluded that simply participating in an activity did not provide enough support to foster learning.

When one of the curriculum designers asked Ellen if she thought that the cause of her students' confusion was inadequate teacher materials, she answered:

[lo] Well... that, and maybe the activity itself. You know, you have to find the balance where you give the kids *enough* so the activity's meaningful, but not [hi] too much that they don't learn from the activity. You have to find that balance...And what *I* think was that balance *wasn't* found.. in the..that there was t::oo:: much of kids [dc] not quite knowing what they're doing, and then not getting.. *enough from it* because of that.

With this statement, Ellen clarified that she valued the inquiry activities as pedagogical tools but she saw the need to support them appropriately to achieve the best learning outcomes. Starting her comment with a low tone showed that she was considering the possibility that the curriculum activities themselves were at fault. By then emphasizing the inclusion of “enough” but “not too much” exploration, she stressed that the perfect “balance” leads to the optimal enactment of inquiry as means. Finally, taking ownership of the balance idea by emphasizing “I,” she concluded by highlighting her reasoning that students were lost because the balance for the in-class activity “wasn't found” and students did not get “enough from it.”

Through these statements, Ellen articulated a major challenge of classroom science inquiry as means: finding a balance between letting students explore phenomena yet skillfully guiding them toward building an understanding of cross-cutting concepts and core ideas in science. Although the curriculum designers-researchers were aware of this challenge, before students actually enacted the unit, the designers were unable to determine if their materials successfully struck that balance. The teachers' perspectives provided the curriculum designers with the opportunity to refine their vision of well-supported classroom science inquiry. Because of this conversation, the materials were revised with a special focus on supporting student sense-making through multiple means, helping students to better understand (1) the purpose of investigations in light of the questions that motivated them, (2) scientific claims based on data

analysis, and (3) connections and distinctions between science learning built across multiple investigation and prior knowledge. Skillfully balancing student exploration and knowledge-building through science inquiry is a challenge that must be overcome to exploit the rich learning opportunities inquiry as means provides.

Challenges and opportunities in supporting classroom scientific inquiry as ends.

Elsewhere in the data, a conversation about a lesson in which groups of students used instruments to collect data about their bodies during exercise sparked discourse about inquiry as ends. Inquiry as ends presented different challenges and opportunities for classroom science inquiry than inquiry as means. For example, all of the teachers agreed that there were technical difficulties with the instruments in this experiment. The instrument problems left some students without data or with inconsistent results that confounded their attempts at formulating claims from evidence. Teachers' suggestions ranged from letting the students have more time to "practice with the probes" to replacing some of the probes with more reliable, low-technology means of measurement.

Although most of the exchange focused on how to avoid these problems in the future, Aaron's comment provided an interesting contrast. When asked by the curriculum designer-researchers if he experienced any challenges with the equipment, his response highlighted an opportunity that inquiry as ends provided in helping students understand the nature of data collection in science. He said:

Yeah, there were:: challenges with the technology, but just...yeah, I think I used it as the time to talk about the challenges with the technologies, and to generate some discussions as...to why the numbers probably should have come out one way but... it didn't.

Here Aaron agrees with the other teachers that the technology did present some challenges, yet his words and expression suggest that he refrained from seeing them as negative. He begins with the passive construction “there were challenges,” removing himself somewhat from these problems, and starts his second phrase with “but,” moving quickly to describe the generative discussions about discrepant data. Thus, Aaron saw the opportunity in certain difficulties in science class and used them to positively drive learning about inquiry as ends.

Although the earlier discussion about inquiry as means focused on how the curriculum designers could better support learning science content through inquiry, this discussion of inquiry as ends signified that problems with inquiry investigations can be a valuable part of the curriculum. Although teachers, curriculum designer-researchers, and the science education reform movement valued inquiry as ends, it was poorly translated in the curriculum. Often during curriculum development processes, inquiry as means is central, whereas inquiry as ends is an afterthought. Aaron’s contribution challenged the curriculum designer-researchers to elevate and support the latter in the revised materials so that it could be better leveraged as an opportunity.

Implications for Science Teacher Education

The results from this study suggest several implications for improving pre-service teacher education such that novice educators are better prepared to enact inquiry-based lessons. When science students engage in inquiry as means in the classroom setting, they mirror the practice of professional scientists, but novices do not have the deep conceptual knowledge necessary to derive scientific principles from the complex milieu of the inquiry-based learning environment (Hatano & Inagaki, 1986). As this study shows, even a curriculum carefully crafted to support students’ knowledge construction through inquiry may fall short in this regard. The challenges

highlighted in the conversations in this study regarding inquiry as means included helping students (1) identify what they were doing, (2) explore in a structured environment, and (3) make sense of their explorations in class before completing their at-home reading.

These challenges present pre-service teacher education programs with the opportunity to support novice science teachers in enacting inquiry as means by emphasizing the balance that must be struck between guiding students and letting them explore scientific phenomena. To accomplish this task, these programs might engage pre-service science teachers in framing, carrying out, and making sense of inquiry activities tailored to the prior knowledge, skills, and attitudes of their learners. Specifically, pre-service science teacher programs might engage their novice teachers in (1) modifying lessons to provide students with a meaningful purpose for carrying out their inquiry activity, (2) selecting appropriate variations of scientific inquiry, from teacher- to student-centered, (National Research Council, 2000, p. 29) based on students' abilities, and (3) rehearsing sense-making discussions such that they can guide students in making claims based on data collected during inquiry.

This study also highlights that inquiry as ends can be challenging to enact if it is not well supported by the curriculum. Additionally, teachers may not leverage opportunities to discuss inquiry as ends provided by classroom activities, instead viewing unexpected experimental results as unfortunate complications that inhibit students' ability to make sense of data. Nonetheless, these two challenges can provide opportunities for science teacher education to improve the enactment of inquiry in the classroom. Specifically, these programs might engage pre-service teachers in conducting discussions with students about how the processes of science relate to knowledge generation. Using the example from the debriefing meeting in this study,

pre-service teachers could be better prepared to discuss the validity of the data that students collect if they had rehearsed such discussions in their education programs.

The findings from this study about both inquiry as means and ends highlight the unnatural identity (Ball and Forzani, 2009) assumed by classroom science teachers. They must act as guides who are investigating and discovering scientific principles along with their students even as they have already built the science understandings the class is working toward. Additionally science teachers, sometimes in conjunction with a curriculum, must create an artificial environment in the classroom that simulates the work of science professionals yet enables students to achieve authentic inquiry experiences. These are challenging practices in science teaching, and science education programs must help their pre-service teachers to develop the skills and dispositions necessary to carry them out. To that end, I echo Windschitl's (2003) suggestion that pre-service science teacher education programs should require novice teachers to engage in inquiry science learning and reflect on how these activities could support learners' understanding of inquiry as means and ends. Through these exercises, novice teachers would be prepared to skillfully enact inquiry activities that promote an accurate depiction of the nature of science while teaching core ideas, practices, and cross-cutting concepts.

However, because pre-service science teacher education simply provides the foundation for teachers' ability to assess students and adapt inquiry teaching practices accordingly, professional development during induction and beyond should support teachers in deepening their understanding of their specific student populations and their own science-specific pedagogical content knowledge (Magnusson, Krajcik, & Borko, 1999). Indeed, inquiry science teaching can be viewed as a continuum of teacher learning through various stages in their careers from pre-service, to induction, to continuing professional development (Feiman-Nemser, 2001),

and education for in-service science teachers may play an even more important role in the successful enactment of inquiry learning environments than pre-service education. Therefore, the implications of this study could be elaborated to a course of study for improving inquiry-based instruction spanning pre-service, induction, and experienced science teachers.

Other fields of education grapple with similar challenges. As the studies below indicate, inquiry-based learning in both history education and ELA teacher education involves learners struggling to interpret meaning from various sources of evidence – an unpredictable process that does not always neatly support educators’ objectives. However, whereas science education has a long tradition of inquiry-based teaching and numerous associated curricula, educators in history and ELA teacher education often must design their own inquiry-oriented instruction to meet their learners’ needs. Nonetheless, this lack of structure creates opportunities to develop innovative, generative inquiry-based learning experiences. The study described next examined how student teachers’ experiences teaching historical inquiry surfaced these and other challenges and opportunities.

Supporting Inquiry-Based Learning in History Education (by Brett Levy)

Although most scholars of history education agree that IBL is important, inquiry in history and other social studies disciplines is not widely understood among educators (Mintrop, 2004; Yeager & Davis, 1996, 1995; Vansledright, 2010; Wineburg, 2001). Furthermore, evidence suggests that even when teachers do have strong knowledge of historical inquiry methods, they are not likely to teach their students how to use these methods (Barton & Levstik, 2003). The study briefly described below examines this challenge and considers how it might be overcome.

Historical Inquiry in Education

For the past several decades, historians and history education scholars have called for teachers to place greater emphasis on the teaching of historical inquiry methods (e.g., Bain & Mirel, 2006; National Center for History in the Schools, 1994; Vansledright, 2010; Wineburg, 2001). Although scholars' precise definitions of *historical inquiry* vary, they generally agree that historical inquiry involves the exploration of historical questions through the examination of various sources of evidence, which can include documents, photographs, film, art, and other artifacts (Doolittle et al., 2004-5; Vansledright, 2009, 2010; Wineburg, 2001). Similar to researchers in science education, history education scholars conceive of inquiry as a vital means of learning about both key content and the nature of the discipline itself (i.e., both as means and as ends). Levstik (1996) contends that for students to learn this process, teachers must

shift from an emphasis on a 'story well told' . . . to an emphasis on 'sources well scrutinized'[Students should learn to] pose questions, collect and analyze sources, struggle with issues of significance, and ultimately build their own historical interpretations. (p. 394)

There are important differences, however, in the historical approach to inquiry. As historian and philosopher Collingwood (1948) argues, history should be a science concerned with answering questions through the interpretation of evidence for the purpose of developing human self-knowledge. Deep historical learning, Collingwood argues, requires the investigator to reflect on one's own biases and to extend one's perspective beyond what is directly observable. Like the scientist, the historical investigator must consider various approaches to a problem, but unlike the scientist, the historian cannot re-enact the topic under investigation. Like the reflective linguistic investigator, the historian explores the intended meaning behind words, but unlike the

linguist, the history researcher must look at a variety of sources before constructing an explanatory narrative. Thus, although historical inquiry shares some common attributes of inquiry in other disciplines, it is a distinct form of academic inquiry.

Since the 1980s, history education scholars have conducted empirical explorations of the challenges of preparing secondary school students to engage in reflective historical inquiry (e.g., Bain, 2000; Seixas, 1998; Voss & Wiley, 1997; Wilson & Wineburg, 1988, 1993; Wineburg, 1991). Meanwhile, the U.S. National History Standards (National Center for History in the Schools, 1994), various state standards (e.g., California State Board of Education, 2000; Michigan Department of Education, 2007), and the English Language Arts Common Core content area literacy standards (National Governors Association & CCSSO, 2010) specify that students learn such historical inquiry skills, including interrogating sources, corroborating evidence, and marshaling contextual knowledge. (It is worth noting that *classroom* history IBL is usually designed to mimic, rather than directly replicate, the practices of historians.) Despite progress in this field, studies have found that many teachers lack the requisite understanding to prepare secondary school students to conduct exercises in historical inquiry (Seixas, 1998; Yeager & Davis, 1996, 1995). Supporting the development of prospective teachers' conceptions of teaching historical inquiry is vital, and examining these conceptions can reveal various challenges and opportunities for the teaching of historical inquiry in classrooms.

An Illustration of the Opportunities and Challenges Afforded by Classroom Historical Inquiry

The study described below examined how prospective secondary social studies teachers' conceptions of teaching historical inquiry developed during their student teaching semester.

The main research question guiding the study was: *In what ways does social studies student teachers' understanding of historical inquiry and its relevant pedagogies develop during the student teaching semester?* Through my analyses of interviews with student teachers, I identified key challenges and opportunities for strengthening educator preparation programs that aim to prepare teachers to guide students in historical inquiry.

Context. This study involved four student teachers enrolled in a three-semester teacher education program at a large Midwestern public university during the fall 2008 semester. During their methods courses and their student teaching seminars, all of these prospective teachers had opportunities to learn about historical inquiry methods. In their one-semester social studies methods course and during their student teaching, they participated (as students) in historical inquiry lessons that required them to consult several primary sources to construct an argument that would enable them to answer an authentic historical question. Then, during their actual student teaching (which I supervised and which occurred at four different schools), they were required to teach at least one historical inquiry lesson during the semester; several of them went beyond this minimum.

Data sources. To assess the student teachers' understanding of historical inquiry and how best to teach it, I conducted one-on-one semi-structured interviews with four student teachers at the beginning and end of their student teaching semesters. The interview protocols at both points focused on the student teachers' conceptions of historical inquiry processes and their understanding of how best to teach them. For example, each student teacher was asked, "When you hear the term 'historical inquiry,' what is your conception of what that is?" After some probing and discussion of their initial answers, I asked them whether or not they thought teaching historical inquiry was important and the strategies they would use to plan and teach a

relevant lesson. At the end of the semester, I also asked student teachers about the historical inquiry lesson(s) that they taught during the semester and what they had learned from those experiences. I audio-recorded and transcribed each interview, and these data provided a rich source of information about how different student teachers' views of teaching historical inquiry developed in different student teaching contexts.

Data analysis. To develop an understanding of the student teachers' evolving conceptions of historical inquiry, I conducted content and thematic analyses of all eight interviews in several steps. First, in order to identify the major themes that the student teachers addressed, including those that went beyond the scope of my interview questions, I read carefully through all transcripts and categorized the *in vivo* themes they discussed. Next, I axially combined these twelve categories around a smaller set of four themes (conceptions of historical inquiry, attitudes towards teaching historical inquiry, experiences teaching historical inquiry, and their own students' experiences doing historical inquiry).

To identify commonalities among student teachers' discourses at similar time points as well as changes in student teachers' discourses during the course of the semester, I created a comparison matrix containing all of the student teachers' comments separated into each of the four themes. I then read across each student teacher's comments on each theme in order to determine areas of growth and stability. After that, to assess commonalities and differences in student teachers' discourses at different time points, I read all student teachers' comments related to each theme at the beginning and end of the semester. Finally, I read across all thematically categorized interview transcripts again, this time looking for relationships among themes.

Student teachers' improving conceptions of historical inquiry. My analyses indicated that student teachers' experiences observing, planning, and teaching historical inquiry lessons

strengthened their conceptions of historical inquiry, and this demonstrates an important opportunity for developers of educator preparation programs to encourage the teaching of historical inquiry. In my analysis of interview transcripts, I found that student teachers demonstrated positive growth in understanding (1) the benefits of historical inquiry and (2) how to teach historical inquiry lessons.

First, student teachers developed a stronger understanding of the benefits of students' engagement in historical inquiry. At the beginning of their student teaching, only Jeffrey (all names are pseudonyms), who already had a graduate degree in history, expressed an interest in teaching historical inquiry. After observing, planning, and teaching historical inquiry lessons, though, the other three student teachers came to agree with Jeffrey. For example, Ahmed was initially skeptical about historical inquiry lessons. He told me, "high schoolers concentrate on what's directly in front of them, do it for a grade, and then go to the next thing. They don't try to connect one and two if it's not necessary." In short, Ahmed had little faith that students could engage in critical analysis. After conducting a historical inquiry lesson with his high school students, however, he argued that historical inquiry lessons give students skills necessary for responsible citizenship:

They can do research and then talk about an issue and look into an issue like abortion and figure out why conservatives feel the way they do, why liberals feel the way they do, and then present their own argument . . . as long as they have solid facts backing up their point of view, that's what it's all about.

Student teachers Annette and Ron made similar adjustments after their initial skepticism. Meanwhile Jeffrey's understanding of the benefits of teaching historical inquiry became even stronger. At the end of his student teaching, he said, "Without doing historical inquiry and

comparing texts, looking at primary evidence and secondary evidence from different time periods in history . . . they're just regurgitating it, you know, rote learning.” His experiences teaching a variety of lessons that either included or excluded historical inquiry processes enabled him to observe differences in students' evident learning, and this range of experience had convinced him of the value of inquiry.

In addition to learning about the benefits of students' engagement in historical inquiry, student teachers made progress toward learning to teach historical inquiry lessons. Observing models of such lessons was central to their progress, and over the course of the semester, such modeling occurred in their student teaching seminar (which I led) and in their placement classrooms to varying degrees. Annette, who conducted her student teaching in an 8th-grade U.S. history class, said, “I really liked when you modeled the lessons for us . . . You know, you can read about it, how to do it step by step, but it's definitely helpful and actually simplifies it when you see it done for real.” Ahmed and Jeffrey agreed that the models helped them to clarify their pedagogical options for such lessons. “Those models were key,” said Jeffrey. Viewing and participating in “sample lessons” enabled student teachers to envision the arc of a historical inquiry lesson, which facilitated their own lesson designs.

Furthermore, because the specific methods of conducting historical inquiry lessons vary by topic, by students, and by available technology, speaking with classmates helped student teachers develop a firmer conception of how to conduct such lessons. As Annette explained at the end of the term,

It's definitely helpful to talk to everyone else because everyone has different ideas. I tend to get stuck in a little box. With other people contributing ideas, it's like “Oh, yeah, you can do it that way...” You can connect it to this angle.

Having the opportunity to learn from her peers enabled Annette to broaden her conception of teaching historical inquiry. Overall, through observing models, communicating with classmates, and enacting lessons, student teachers strengthened their understanding of teaching historical inquiry and its benefits. This finding illustrates important opportunities for teacher education.

Student teachers' challenges in teaching historical inquiry. At the same time, my analyses of student teachers' experiences planning and teaching historical inquiry lessons surfaced major challenges involved in this work. Prominent among these challenges were (1) gathering and organizing appropriate resources for historical inquiry lessons, and (2) preparing for and addressing secondary school students' difficulties with the material.

In their initial interviews, none of the student teachers mentioned lesson planning, but in their exit interviews both Ahmed and Ron talked extensively about the challenges of finding appropriate sources and then shaping an inquiry lesson around those sources. Thus, as they developed stronger conceptions of how to teach historical inquiry lessons, they also gained a greater awareness of the related challenges. As Ahmed noted, "you have to find something that applies to your topic and to your enduring understanding . . . and for newer teachers it's harder to find relevant sources like that." Ron agreed that identifying appropriate materials was one of his biggest struggles. For his unit on ancient European history, for example, he had difficulty finding the types of varied sources that the modeled lessons had employed. "I was looking at Thucydides and Herodotus. They're the only two that I know of that were primary sources from that time." Indeed finding appropriate primary sources from ancient eras is a common challenge even among experienced teachers, and Ron's early identification of this issue highlights its salience. These vignettes illustrate that even educators who understand how to design a historical inquiry lesson may have difficulty doing so.

In addition, student teachers quickly learned the challenges faced by secondary students when they engage in historical inquiry. Both Annette and Jeffrey began the semester believing that high school students were fully capable of conducting historical inquiry with minimal guidance, but by the end they were less optimistic. Jeffrey lamented the struggles he saw his high school students experiencing: “They just didn’t understand how to draw the connections to the argument that each were making.” He was frustrated by students’ difficulty extrapolating from primary sources the necessary information and inferences to address the lesson’s central question. Annette faced more fundamental challenges with her middle school students. In her inquiry lesson titled “Who fired the first shot on Lexington Green?”, she found that “vocabulary and language can really get in the way of deeper analysis. . . . Students got a little overwhelmed by vocabulary, you know, ‘old talk.’” Upon seeing how difficult it was for her students to analyze individual sources, Annette recognized that her students required substantial scaffolding to even begin to engage in disciplinary processes. Thus, through the experience of planning and teaching historical inquiry lessons, student teachers became more keenly aware of the challenges involved.

Implications for History Teacher Education

These challenges and opportunities for classroom historical inquiry have several implications for history teacher education. First, several student teachers mentioned that observing models of historical inquiry lessons enhanced their understanding of how to structure such lessons, so teacher educators interested in preparing others to lead such lessons may benefit from exposing their student teachers to such models. This comports with earlier research suggesting that observing models can enhance competence and self-efficacy (Bandura, 1997). Also, to support new educators’ capacity to independently develop such lessons, teacher

educators could ensure that student teachers learn how to locate and identify resources that can facilitate their planning, such as online hubs for primary sources and relevant lesson plans. Understanding the process of IBL history is necessary but not sufficient for using it in the classroom; awareness of where to find resources relevant to one's curriculum is vital.

In addition, several teachers in this study described the tremendous difficulty that their secondary students had analyzing historical texts and engaging in historical inquiry. It is therefore important that teacher educators foster their student teachers' skills in locating and developing appropriate scaffolds for analyzing documents and artifacts. To support educators' work in this domain, several offline and online tools have been developed. For example, History Assessments of Thinking (e.g., Wineburg, Smith, & Breakstone, 2012) enable educators to gauge the extent to which their students can contextualize and source various historical images and documents. Student teachers would benefit from using these tools.

Finally, it seems particularly important for new educators to have opportunities to practice and exchange ideas about teaching historical inquiry. As this study illustrates, student teachers can develop a greater appreciation for the educative potential of IBL in history after leading such a lesson, but at the same time, the challenges they face may discourage some of them using these methods in the future. Thus, it is vital for teacher educators and professional developers to clarify and demonstrate ways to address these challenges.

As prior research suggests, individuals can learn tremendous amounts through sharing experiences, challenges, and potential solutions with their peers (Wenger, 1998), and these sorts of peer-to-peer interactions would likely have been helpful for my student teachers, as well. Likewise, this study suggests that teacher education and professional development programs could play a helpful role in strengthening new history teachers' abilities to employ inquiry-based

pedagogies by adjusting their curricula to incorporate the following elements related to historical inquiry: (1) model lessons, (2) resource identification strategies, (3) techniques for developing scaffolds, and (4) opportunities for productive exchanges of ideas among teacher education students.

Just as teacher education students can learn from discussions with their peers, my own conversations about historical inquiry with teacher educators in other fields have expanded my conceptions of how to teach about historical inquiry. For example, as the science education study described above illustrates, approaching inquiry as means or as ends may generate quite different challenges and opportunities in classrooms. History educators could benefit from clearly articulating the extent to which means and ends comprise their learning goals and how they might pursue these goals. Furthermore, they could specify how and if their means-related goals should mimic what historians do or be authentic investigations (e.g., interviews with volunteers from the Civil Rights Movement). In addition, the ELA teacher education study described below illustrates strategies that may be helpful to history educators, such as inquiry into one's own pedagogy. Through Ebony Elizabeth Thomas's examination of ELA teachers inquiring into their own practice, we see how educators who disagree may benefit from this type inquiry-based learning.

Opportunities and Challenges of Foregrounding Discursive Inquiry in English Education

(by Ebony Elizabeth Thomas)

English Language Arts Inquiry in Education

Unlike in science or history education, *inquiry* is not robustly defined in the secondary English curriculum or in secondary English teacher education as a whole. Although Hillocks (1982; 1995; 2005) powerfully advocated for defining argumentative writing, critical thinking,

and the tasks associated with both as *inquiry* in composition courses, the meaning of the term has shifted in the field over time. For instance, in the current version of the Common Core Standards for the English Language Arts and Literacy in History/Social Studies, Science, and Technical Subjects (National Governors Association Center for Best Practices, Council of Chief State School Officers, 2010), the term “inquiry” only occurs four times— all related to research—in a 66-page document:

- “Because of the centrality of writing to most forms of inquiry, research standards are prominently included in this strand, though skills important to research are infused throughout the document” (p. 8).
- “Conduct short research projects to answer a question, drawing on several sources and refocusing the inquiry when appropriate” (p. 44).
- “Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation” (p. 46).
- “Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation” (p. 46).

Thus, it seems that the meaning of inquiry in English Language Arts has shifted over time from inquiry as writing and critical thinking to inquiry as research. When scholars and practitioners use the term *inquiry* in ELA, they are usually referring to facilitating pre-service and experienced English teachers’ professional self-study as they critique, select, apply, and

conduct research on their own practice, or guide their students through research-oriented lessons and activities (e.g., Cochran-Smith & Lytle, 2009; Fecho, 2000; Hillocks, 1987; Gere et al., 2007). There are many opportunities for such work in the field, including the National Writing Project, the Read-Write-Think archive provided by the National Council of Teachers of English (NCTE) and the International Reading Association, and teacher research groups at the local district, state, and national levels (e.g., Crockett, 2002). Therefore, the participants most involved in ELA inquiry are teachers, who then are to model similar inquiry-based practices for their students in classrooms.

Sustained inquiry into one's own teaching practice can be extremely beneficial, providing opportunities for educators to explore uncertainties (Snow-Gerono, 2005), manage complexities (Darling-Hammond, 2000; Reid & O'Donoghue, 2004), support organizational change (King, 2002), and create opportunities for collaboration (Yorks, 2005). The research described below examines ideological dilemmas embedded in such inquiry, positioning inquiry as a dialectic that is inextricably related to discourse and interaction. Through case studies of high school English teachers engaged in a discourse analysis study group, I examined how teachers in the group developed metalanguage useful for inquiring into their own practice, a process that surfaced many of the oft-submerged philosophies and principles that underpin English education, enabling them to be accessible for scrutiny and critique.

As Australian language and literacy educators Frances Christie and Mary Macken-Horarik (2007) argue, the reason why English can be so contested is that the main unstated goal for our students is the acquisition of an acceptable shared ethical position. Students not only demonstrate their proficiency in English studies through their knowledge of language, literature, and writing, but also through demonstrating that they share and have internalized prevailing

social and cultural norms (Christie & Macken-Horarik, 2007). These sociocultural norms are enacted in the classroom through teacher and student conversations about literature. However, much of the training provided to pre-service and in-service teachers in the English language arts does not provide sustained formal or informal opportunities to deeply consider language in the classroom, especially the teacher talk that they will use to instruct, assess, and build relationships. This study examines inquiry into that talk.

An Illustration of the Challenges and Opportunities of Teaching with Inquiry in English Language Arts Professional Development

In order to foster successful inquiry-based learning in ELA professional development, encouraging and supporting teachers as they inquire into their own practice is essential. The central research question that I sought to answer using discursive inquiry into the *teachers'* discursive inquiries was: *How do high school English teachers inquire into their own and their peers' practice in a discourse study group?* By addressing this question, I aimed to develop a stronger understanding of the challenges and opportunities involved in ELA teacher inquiry.

Context. The data for this study is derived from a larger research project on discourse conflicts, specifically how English teachers at a multicultural high school talked about conflict in a professional learning community. I first became interested in understanding discourse conflicts in English teaching as one of the few African American teachers at hyperdiverse Rainfield High School. Several years later, I returned to Rainfield as a researcher and consultant, convening a series of five professional development workshops for ninth and tenth grade English teachers (Thomas & Sassi, 2011). Seven participating teachers were invited to learn about discourse analysis while recording one of their classes over the course of a semester. Each teacher in the group then selected a conflict-laden moment from their audio or video data to analyze, and then

they reflected with me about what they learned. The resulting research report recounts the case studies of seven high school teachers as they learned how to analyze their own and their colleagues' classroom talk (Thomas, 2010).

Data collection, organization, and analysis. Data collected for the study included 42 videos, 15 audio files, 153 email messages, seven working transcripts and worksheets for teachers, and seven informal written project evaluations, along with accompanying field notes and workshop materials. These included videos of the five workshops, videos and audiofiles of focal classes that teachers wished to have recorded for analysis, audiofiles containing initial interviews with the teachers, and videos of teachers viewing their classroom interaction while reading a transcript of a researcher-selected “interesting moment” and engaging in some on-the-spot analysis of that moment. I took an emic approach to data collection and selection, co-selecting with teacher participants data segments that highlighted their self-reported dilemmas of practice that were remarked upon by the participants as being particularly significant.

Three kinds of discourse analysis were conducted on the data from the workshops: (1) analysis of text, (2) analysis of context, and (3) analysis of the dilemma or disconnect itself, theorized in postcolonial studies as *décalage* (B. Edwards, 2009). For contextual analysis, I embedded my analyses of this data within interactional ethnography (Castanheira, Crawford, Dixon, & Green, 2001). In order to begin the iterative questioning process of interactional ethnography, I conducted a content analysis of all data, reviewing and writing memos for each video and audiofile. Next, I created a theoretical comparison matrix, examining data across contexts. After multiple conversations with participants about the data, I theoretically sampled from among the data specific codes, themes, and events. After I selected these theoretically

significant incidents, I coded classroom interactions and discourse study group workshops, identifying key concepts presented and categorizing them.

For textual analysis, I turned to systemic functional linguistics (Martin, 1997, 1999, 2002, 2004; Martin & Rose, 2007; Martin & White, 2005). This theory of “language-in-use” features an elaborated grammar that educational researchers and practitioners have found useful for discourse analysis, curriculum design, and other linguistic applications. Disarticulation and disconnects that lead to conflict in classroom discussions among teachers and students have been observed by many others researching language in education (Cazden, 2001; A. D. Edwards & Westgate, 1987; D. Edwards & Mercer, 1989; Gutierrez, 1993; Nystrand, 1997; Nystrand & Gamoran, 1997; Sinclair & Coulthard, 1975). In order to theorize these moments further, I turned to Edwards’ concept of *décalage*. *Décalage* is “an irreconcilable disconnect between... groups that is the result of a gap, discrepancy, time lag or interval” (B. Edwards, 2003, p. 15). Edwards asserts that it is only through examining forms of *disarticulation* – that is, “points of misunderstanding, bad faith, (and) unhappy translation” – that we can properly understand a paradigm that has long been viewed as undifferentiated (B. Edwards, 2009).

Developing opportunities to engage in inquiry into English teaching practice. The English teachers at Rainfield built a community where there were safe opportunities to address issues and challenges as they engaged in talk and interaction around the curriculum. Practitioner inquiry during the study group workshops involved metaprocessing their teaching practices and instructional decisions through talk. The primary goal of the workshop series was to extend teacher knowledge of discourse conflicts through readings and discussion of what conflicts in the high school English classroom look like.

Prior to the session described below, the teachers had been provided with several readings, which I had asked them to be prepared to discuss. As we exchanged perspectives on what constitutes conflict in the English curriculum, one teacher raised the challenge of handling literature on the Holocaust with students who were hostile to the topic. During the following discussion, the Rainfield teachers talked through each other's approaches for handling difficult conversations in the classroom without coming to consensus:

Ella: My first reaction would be to just *squash* that idea. To just say, "Okay, well look. When we're discussing whatever it is we're going to be discussing... it's never going to be okay to advocate the wiping out of some ethnicity or race."

Erin: Well, that was funny for me when you said "squash." Because I [teach] German, too... and in Germany it's against the law to deny the Holocaust. It's against the law to draw swastikas... But... but a kid somehow to me has to be allowed to express their opinion. How are you going to ever educate it, change it, you know, modify it if a kid isn't allowed to bring in their *error*, whatever, condition?

Ella: Well, although... the idea that *Hitler* had the right idea... that was such an extreme, that to work with people who talk about controversy about the Holocaust, and what caused it, and what happened... yeah. That I think we can talk about. But...

Erin: Haven't you gotten it in journals? Kids writing that? That opinion?

Ella: That Hitler was right?

Erin: Yeah!

Ella: No.

James: I haven't either.

Natalie: Well, I have.

For Ella, a White late-career teacher, the classroom was “not a place to talk about something that’s *that far out of the mainstream*.” Here and throughout the workshop, the teachers acknowledged a tacit, socially understood norm that was appropriate for, as Erin noted later in this workshop, “middle-class, liberal settings such as Rainfield Township.” Erin, another White late-career teacher, also pointed out that Ella’s position of “squashing” conflict-laden discussions about forbidden topics is the law in postwar Germany, where it is illegal to discuss or depict certain ideas. Ella took exception to Erin’s position, and the subsequent exchange showed that different teachers in the group had different experiences when it came to students with racist and anti-Semitic views, or who were, as mid-career African-American teacher Anthony noted, “looking for a rush out of the teacher.” Thus, as they inquired into their practice through discourse analysis, the Rainfield teachers drew on their own knowledge bases, such as Erin’s understanding of German law.

Furthermore, the Rainfield teachers’ sustained practitioner inquiry led them to talk with each other about difficult classroom discussions about literature, in spite of their racial and ethnic differences. Erin, who is Jewish, told the group that before 9/11, her Palestinian students used to write in their journals that Hitler was right. In her opinion, it was “because they knew I was Jewish, and they wanted to... try it out on me, I think.” When Ella and James, who are both White and non-Jewish, assured Erin that they have never “gotten it in journals,” Natalie, a younger African-American teacher, said that she had. Before this conversation, Ella and James might not have been aware that some students were expressing anti-Semitic sentiment through their writing. Yet Erin and Natalie, both of whom were members of historically marginalized groups, had experienced this kind of behavior from students. This brief exchange illustrates the kinds of critical information secondary English practitioner inquiry might reveal. The teachers

learned through inquiry that variations in teachers' identities and social subjectivities seemed to lead to differences in interactions with students. By working together to inquire into their teaching, English educators may broaden their understanding of the ideological dilemmas faced by their colleagues, which could help to illuminate situations within their own classrooms.

Challenges of inquiry into English teaching practice. Although inquiry into English teaching practice has potential for surfacing ideological and philosophical dilemmas, there are significant challenges in doing this kind of work. For example, shared ethical positions around literature and writing can be difficult to reach when teacher colleagues engaged in inquiry together have different perceptions of social values, curriculum, pedagogy, or student ability and motivation. During a discussion of the challenges of teaching academic argument to minority students, one of the African-American teachers in the group clashed with Belinda, a guest consultant, about the ways he perceived that underserved students were being positioned in the conversation. In this excerpt, Anthony finally speaks after more than an hour of silent listening:

Ebony Elizabeth Thomas: Anthony? You had something to say, Anthony?

Anthony: I guess... it's like the *assumption* that these students couldn't... I guess... it doesn't surprise me at all. Because if you were to look at the complexity of their life, and what they had to deal with and go through, why couldn't they learn more than other students? It seems to me like they would be able to learn more easily than other kids, because they've already had to learn so much to survive... because of their street skills, they have to constantly adapt. I'm at a loss for words, but...

Belinda: That's the case, but some of them are more verbally articulate than others. So one young woman in the class had the whole [structure of her argumentative paper] in her head ahead of time. She just was just trying to convince everybody of things using

warrants and counterarguments. She was *way* beyond the others. Very sophisticated.

And this was a young woman who had been taking care of her family. She's sort of the child in the family that has to hold everything together. So it makes sense that she had acquired these skills. But it's how do you then get them to surface those skills? Get the students to demonstrate those skills? And then, to value them?

Anthony: First, I want to ask you, why do they want to do it? Why *should* they want to do it? You know, this is for a certain time. For a certain space in time, they learn more. Like you said before, if they can't take it and apply it to their life, it's a waste of time. And that's how a lot of these students see this. You got, you want them to learn something for a certain class, but once that class is over, it serves no purpose whatsoever. You have to make a connection. So I guess... I see your point.

In this conversation, Anthony offered an alternate point of view as he sought to defend students he believed were being attacked during the prior conversation about the challenges of teaching academic writing. Prior to Anthony's intervention, the group had been talking about ways of using the tools of discourse analysis to help students "surface those skills", per the consultant's response. Using very few words, he constructed a counterargument about the inherent academic ability of underserved students. He did so by positioning the academic writing skills that the group is discussing as being "for a certain time, for a certain space in time", and asserted that students needed to understand the relevance of these skills to their lives. Yet although his disagreement with the group during the consultant visit threatened his remaining in solidarity with the other teachers, in the end, he concedes ("I see your point") and is silent for the rest of the workshop.

However, after the workshop was over, Anthony asked to speak with me privately. His first comment was “They study *us* like *guinea pigs!*” Privately, Anthony expressed his interpretation of the study group workshop that day. He was upset that his White colleagues had a congenial conversation with an outsider about deficiencies in the spoken and written discourse of students of color. Feeling like an outsider, he was ready to leave the group. Only by listening to Anthony vent his frustrations, appealing to our shared identities as African-American critical pedagogues, and assuring him that his contribution was valued and essential did I secure his continued participation.

Often, teachers in the inquiry group who expressed a divergent point of view chose to remain silent. For instance, the early and mid-career teachers did not speak as often during the meetings as the veterans, who dominated conversations. Male teachers did not speak as often as the female teachers. African-American teachers did not speak as often as the White teachers. The interactive patterns in the study group privileged some participants and in effect “silenced” others. Furthermore, it was not always clear whether participant silence was indicative of group dynamics or the result of personal situations revealed in the ethnographic data (e.g., workshops were held at the end of the school day, teachers were tired, hungry, pregnant, preoccupied with other matters, etc.).

What was evident from analyzing discourse in the practitioner inquiry workshops were the particular ways this group of English teachers had developed to inquire into their own teacher talk. The Rainfield teachers’ discourses were drawn from their varied lived and intellectual experiences, but ideological clashes were always uncomfortable, especially those involving race and ethnicity. Rainfield was a multicultural high school where colorblindness was a virtue and colormuteness was a cultural norm (Pollock, 2004; Sassi & Thomas, 2008). Thus, maintaining

solidarity was central in the negotiation of these teachers' interpersonal relations during the course of the discursive inquiry workshops, just as it was in their English curricula. In the Rainfield English department, the challenge of arriving at shared ethical positions around literature and life was critical. However, the presence of these ethical positions was only surfaced through providing teachers with opportunities to engage in inquiry into teacher talk within this particular context.

Implications for ELA Teacher Education

Inquiry-based ELA teacher education and professional development has the power to surface the potential of secondary English language arts to be about more than learning how to read, write, and logically reason. Rather, it highlights how English education involves reading, writing, and reasoning in societally acceptable ways, and how some groups and individuals' experiences, perspectives, and opinions are differently valued in schooling and society. As this study suggests, in-service and pre-service English educators could benefit from inquiry experiences that raise questions that complicate their practice and illustrate how analysis of classroom discourse can generate productive discussions about shared ethical values. These inquiry experiences could foreground the ways that inquiry is being used in the field: as steps leading to argumentative writing and critical thinking, as a synonym for student and practitioner research, and as a stance assumed by practitioners and their students.

However, there is an implicit idealism in practitioner inquiry. The assumption being made in this and other similar professional development opportunities is that by encouraging practitioners to engage in inquiry, they will then provide students in their own classes with similar frames for literacy learning and opportunities to engage in inquiry based learning of their own. Yet, is this always the case? The findings of this study showed that while teachers reported

greater self-efficacy as a result of engaging in practitioner inquiry, they seemed less assured about its role in transforming their practice. Inquiry based literacy learning approaches, where students are able to select their own reading material and generate their own writing prompts are increasingly uncommon in ELA classrooms where test prep seems to be the order of the day. While making teachers feel more confident about their role in the classroom is a worthy goal, ultimately, we need to know more about how an inquiry-based practitioner stance influences classroom teaching and student learning. This also suggests perhaps another opportunity for cross-field collaboration – if English educators can shed light on the relationship between teachers taking up an inquiry stance after their experiences investigating their own practice, then English education can learn from history and science education how to more explicitly expand these inquiry approaches into student learning.

Perhaps exchanges about inquiry with educators and educational researchers in other fields can support stronger IBL practices in English education. Like other disciplines within schooling, one of the invisible functions of English teaching is to transmit the social and cultural norms of society. However, unlike in history, this function of secondary English teaching is implicit instead of explicitly stated in and through instructional content, and in the ways that teachers and students talk together about historical and contemporary fictional and biographical texts (Thomas, 2012). Scientific inquiry, on the surface, may seem to have little in common with acquiring advanced literacy skills, but thinking of inquiry as both *means* and *ends* has utility for English, where inquiry has largely been considered as means. Rethinking the place of inquiry in ELA teacher education, as well as how it is defined, thought about, and implemented, has the potential to improve secondary literacy teaching and learning during this era of conflict, social change, and redefinition.

Discussion

The above summaries of our studies illustrate differences in how IBL occurs in different educational fields as well as challenges and opportunities that inquiry-based learning presents in these areas. We do not claim that these particular studies or the ways in which we characterize inquiry are definitive representations of inquiry or of our individual subject areas. Rather, we have presented them as heuristics that enable us to consider commonalities that adhere within our fields as we attempt to fuel ongoing exchanges across disciplines about how to facilitate the integration of inquiry-based learning in teacher education. These exchanges are happening already at all levels of education; we have some terms in common, such as “inquiry,” but not necessarily common definitions. This is not to say that inquiry ought to always be defined in exactly the same way everywhere, only to question whether we really know what we are talking about when engaged in both inter- and intra-disciplinary dialogue.

In the next section we offer some cross-study analysis that has the potential to prime these discussions. By surfacing different ways of looking at inquiry, we aim to trigger further exchanges among scholars and teacher educators about the commonalities and differences of various types of inquiry and encourage broad cross-disciplinary collaborations in curriculum, teaching, and research related to IBL.

Inquiry-Based Learning across Fields of Education

Although our three investigations into inquiry-based learning pose distinct questions and operate quite separately, the purposes, data, and processes we employed involve noteworthy similarities. As Table 1 illustrates, our studies of inquiry-based learning in science, history, and ELA examine efforts to support learners’ understanding of how knowledge is produced through the exploration and analysis of data. Furthermore, we all supported learners’ development by

posing questions about what is known or unknown, challenging learners to explore these questions based on their data, and requiring detailed, structured explanations.

Nonetheless, there were major disciplinary differences among our inquiry-based studies in the three fields, and our discussions enabled us to specifically identify these differences. For example, whereas Brett Levy's history education study was concerned with learners' ability to analyze historical accounts to understand how they were produced, Kathryn Drago's science education study was more focused supporting students in carrying out investigations to build explanations of the natural world. Also, while inquiry-based learning in history, science, and ELA all involve data analysis and interpretation, for the most part the data emerge from very different sources. Science education employs data collected through observing, experimenting with, and modeling natural phenomena; history educators ask students to collect, examine and relate historical artifacts; and ELA teacher education relies on the critical consumption, production, and interpretation of written, visual and audio texts.

Inquiry in each of these areas can also be viewed as involving distinct educational processes. Educators focusing on scientific inquiry have developed a detailed, specific list of practices for students to engage in, including planning investigations, using models, and constructing claims supported by scientific evidence. History educators meanwhile are concerned with fostering students' abilities to address historical questions by analyzing, comparing, and corroborating sources in context. The processes involved in ELA teacher education, however, include establishing purposes for literate activities, fostering critical literacies, and questioning received discourses and meta-narratives (See Table 1). By orienting similarities among subject areas according to epistemology, our fields can concurrently be viewed as having much in common as well as much that distinguishes them.

Identifying these commonalities and differences of inquiry-based learning in studies in three fields has enabled us to think more deeply about how to support educators' understanding of inquiry-based learning. For example, it would be helpful for a social studies teacher education student to distinguish between the inquiry processes in which her students will engage and those in which she herself might participate as a preservice or inservice teacher inquiring into her own practice. (The latter might be similar to the inquiry in the ELA study described above.) However, it is also important for her to understand that both processes involve proposing questions, answers, and explanations. This understanding can prevent confusion and enable new and experienced educators to acknowledge the distinguishing features of different types of inquiry-based learning. Locating inquiry across teacher education disciplines as a matter of knowledge production provides students with a sensible common starting point before diverging down disciplinary paths.

Challenges and Opportunities of Inquiry-Based Learning across Fields of Education

The studies described in this paper illustrate several challenges and opportunities presented by orienting teachers toward inquiry. Several of these are common across all three fields. One of these challenges may result from pre- and in-service teachers' lack of engaging inquiry experiences in their own schooling. If preservice teachers are expected to acquire fundamental procedural knowledge about IBL without taking additional course work in their subject areas, then thoughtful, targeted instruction is required on the part of teacher educators to

Inquiry-Based Learning in Three Fields of Education

Table 1

Characteristics of Inquiry-Based Learning across Studies in Three Fields

	Discipline general	Science education-specific	History education-specific	ELA teacher education -specific
Purpose	Knowledge production	Understanding of the natural world and nature of knowledge production in science	Understanding of historical events, accounts, and processes	Understanding of ethical values of society and how those values are transmitted via communication modes (e.g., reading, writing, speaking, listening, viewing)
Data	Information gathered or pre-selected for interpretation	Collected from investigation of the natural world using science-specific technologies Organized into patterns, relationships, and trends	Historical artifacts, including documents, media (e.g., photographs, videos), art, architecture, archaeological finds, and other artifacts	Transcripts and videos from PD participants' classroom contexts Student artifacts
Processes	Examining what is already known Posing questions Reexamining what is known in light of new data Proposing answers, explanations, and/or predictions Communicating results	Planning investigations Science-specific technologies, statistics, notions of reliability/ validity Posing claims backed with evidence and supported by scientific reasoning Science-specific modes of communication like scientific explanation, lab reports	Comparing, corroborating, and sources and evidence Exploring the credibility and/or perspectives of sources Analyzing sources in the historical context in which they were created Examining one's own interpretive biases	Examining the "what" and the "why" of inquiry Defining inquiry in more robust ways Questioning received discourses and meta-narratives about ethics and values Developing critical literacies
Community of learners		Teacher as guide and K-12 students		Facilitator and in-service teaching professionals
Authenticity		Investigation of canonical knowledge of the discipline		New knowledge generation

scaffold what they need. By providing such scaffolds to, for example, support data analysis in their fields, curriculum developers and educational researchers may increase the likelihood that educators would undertake, rather than avoid, inquiry-based lessons. Several scholars and educators have begun to develop and share such scaffolds (e.g., Winchitl, Thompson, & Braaten, 2011; Wineburg, Smith, & Breakstone, 2012), but more research and development may be useful as well.

Another serious challenge is presented by disparate, disjointed or unsolidified views of inquiry education within fields. Though knowledge in a field is ever-evolving, subject to historical trends as well as to peer review, general agreement as to what constitutes a field's fundamental conceptualizations for achieving its purposes and producing its knowledge would well serve teacher education, particularly regarding inquiry. Current uncertainty presents an opportunity for educational leaders in each field to more clearly delineate the processes of knowledge production in their fields as they relate to inquiry-based learning. In fact, science education has already taken this step (National Research Council, 2011). For example, in the framework for k-12 science education, scholars delineated eight specific IBL practices appropriate for science and engineering.

The studies above also illustrated how inquiry-based learning opportunities and challenges specific to each field further complicate these more generalized issues. For example, history educators face the distinct challenge of locating appropriate sources for historical inquiry lessons that would be relevant to prescribed content standards (as opposed to process standards). In the study described in this paper, several student teachers mentioned that challenge, with one left searching the web diligently but despairingly for sufficient primary sources linked to his ancient history curriculum. On the other hand, ELA teacher developers, who organize educators

to inquire into their own practice, face the difficulty of building an authentic inquiry-oriented community of learners who do not share common goals, values, or questions. Science educators whose students engage in inquiry may find that their students' experimental results, due to the messiness of experimentation, do not always support scientific principles.

These challenges may be well known to teacher educators within these fields, but cross-field exchanges could help them to reframe these issues from the perspective of inquiry-based learning. Teacher educators may also appreciate the unique opportunities interdisciplinary inquiry-based learning affords. For example, science educators whose students gather data that conflicts with established scientific principles can discuss with their students how to assess the validity of data – a useful skill for both future experiments as well as for their understanding of science. If these science educators are also familiar with the knowledge production processes of other disciplines, they may find their students have followed a methodology more appropriate to another discipline and be able explain the error as a difference in what counts as data. An explanation that acknowledges differences in students' understanding rather than deficits is more likely to win students' continued engagement.

Sometimes interdisciplinary distinctions between expected procedures for producing knowledge are opportunistically similar. Within history, inquiry processes used to assess antiquated texts also may be useful in helping students to analyze contemporary issues by critiquing current representations of events and the arguments for their veracity. Such inquiry bears a strong resemblance to rhetorical analyses of texts studied in ELA (although most ELA practitioners generally do not label such analyses as “inquiry”), and history teachers could benefit from inquiry-based ELA curriculum for writing persuasive arguments that utilizes evidence gleaned from textual analyses.

Another cross-disciplinary opportunity that could become interdisciplinary curriculum is afforded by ELA teacher education's focus on uncovering ethical issues that arise in ELA curricula. Ethics is a central issue in scientific research and in historical representation, especially the role of the knowledge producer and protections for participants. Though only a beginning, these common and discipline-specific challenges and opportunities of inquiry-based learning point to a promising basis for cross-disciplinary dialogue and potential interdisciplinary teaching and learning (See Table 2).

Implications for Teacher Education Research and Practice

We believe that cross-disciplinary exchanges could generate greater clarity about the commonalities, differences, challenges, and opportunities of inquiry-based learning within and across fields of education. Ultimately, these exchanges could facilitate collaborations on curriculum, teaching, and research that could benefit education writ large.

Despite the self-referential manner in which education disciplines tend to work, we found that there are numerous similarities in the ways they approach inquiry-based learning. As demonstrated through our studies in science, history, and ELA teacher development, inquiry-based learning involves the posing of questions and analysis of relevant data. However, these three fields differ substantially in the issues they explore and the types of data they use (See Table 1). Likewise, whereas inquiry-based experiences in these areas face similar challenges and opportunities, several are unique to each (See Table 2). Despite the confusion that these differences often generate, we contend that there is tremendous potential for disparate fields to address challenges, maximize opportunities, and learn from each other through continued collaboration and research.

Table 2

Some General and Field-Specific Challenges and Opportunities of Inquiry-Based Learning

	General	Science education-specific	History education-specific	ELA teacher education -specific
Challenges	<p>Educators lack common understandings of inquiry-based learning within their disciplines.</p> <p>Learners who are using inquiry may have difficulty participating in inquiry-oriented processes without appropriate scaffolds.</p>	<p>Experimental results may not always support scientific principles because of the messiness of experimentation.</p>	<p>Gathering and organizing appropriate resources for historical inquiry lessons.</p>	<p>Stakeholders in an ELA inquiry group (teacher-teacher or teacher-student) may not come to consensus on ethical values.</p>
Opportunities	<p>Educators can work with others in their subject areas to solidify understanding of inquiry processes.</p> <p>Educators need to have opportunities to develop scaffolds that support learners in inquiry-oriented learning.</p>	<p>Teachers and students can discuss the validity of data collected when inquiry is used as ends.</p>	<p>Historical inquiry can strengthen students' abilities to analyze other social issues, such as current events.</p> <p>Student teachers' observation of historical inquiry lessons enhances their ability to conduct such lessons.</p>	<p>Discursive inquiry can surface the presence of shared and conflicting ethical positions transmitted through the ELA curriculum.</p>

K-12 educators would benefit from learning about and contributing to dialogues about inquiry. For pre-service elementary school teachers, who are responsible for teaching several subjects, understanding how inquiry-based learning varies across subjects could better enable them to show their future students which practices and purposes are most appropriate for each subject (Tuyay, Floriani, Yeager, Dixon, & Green, 1995; Yeager, 2003). In secondary schools, students who move in and out of inquiry-based learning in different subjects would benefit from secondary teachers who can clarify these differences and similarities for them. Providing k-12 students with inquiry experiences in various subjects could enable them to transfer and employ

such analytical thinking to their everyday lives (Bransford, Brown, & Cocking, 2000). If teachers make explicit the differences and similarities across the disciplines, students might develop an integrated conception of inquiry that could result in this strong foundation for students to continue applying inquiry to learning environments outside of the school setting. Given the possible frustration that may result from difficult experiences with inquiry-based learning, teachers who are prepared for these challenges may be better able to address them, turn them into opportunities, and add their voices to ongoing exchanges in this area.

There are several ways that teacher education and professional development programs could facilitate current and future educators' learning about these aspects of inquiry-based learning. First, practice-oriented educational psychology or foundations courses, which often advocate inquiry-based learning, could help educators gain an understanding of these issues, and field supervisors through observational feedback could support student teachers' practice of inquiry-based learning. Also, methods classes could further strengthen pre-service teachers' understandings of inquiry across the disciplines as they practice carrying out inquiry-based lessons and inquiring into their own practice through reflection. Third, field supervisors through observational feedback could support student teachers' understanding of the similarities and differences between their inquiry-based teaching and inquiry into their own practice. In addition, professional development workshops could help in-service teachers acquire and develop intra- and inter-disciplinary lenses through which to conceptualize inquiry.

Programmatic changes would be necessary to support this teacher learning about inquiry. Such programmatic changes could not succeed unless teacher educators who usually operate within the circle of their own subject areas take on a more expansive view of inquiry. Teacher educators from each discipline would have to understand the nature of IBL in multiple

disciplines as well as how it can be applied to pre-service teacher learning. Thus, methods instructors from different disciplines could develop and share resources and speak to each other's classes about the inquiry traditions in different fields. An expanded view would necessarily lead to curricula reframing and expansion and to assuming a more collaborative role as part of an interdisciplinary team.

Collaborations among k-12 researchers and educators could also facilitate the development and use of inquiry-based learning in classrooms through cross-disciplinary curriculum projects. Indeed, examining some issues *requires* understanding inquiry processes in more than one domain. For example, if teachers aimed for their students to deeply analyze environmental problems, such as water pollution, it would be helpful for them to inquire into both historical issues (e.g., development of environmental legislation and industry in an area) and scientific issues (e.g., how different types of pollution affect the organisms in the river and ultimately impact humans). In addition, educators leading such a unit might retrospectively inquire into their own practice, using transcripts or videos of their instruction to improve students' opportunities to learn in future enactments of the curriculum. As such, curricular interventions could benefit from integrating IBL from different disciplinary traditions.

Furthermore, the findings from this paper suggest numerous opportunities for collaboration among educational researchers and scholars. For example, many educators would benefit from having more clearly circumscribed definitions of inquiry-based learning, which academic and professional organizations could work to develop. Although singular definitions may be elusive, it seems possible for educational and academic leaders to agree about types of inquiry suitable for various educative purposes and curriculum designs. To clarify differences and similarities of inquiry-based learning across fields, educational researchers could collaborate

to design studies examining how it is enacted in diverse settings and subject areas, including educator preparation. In addition, researchers in different fields, such as educational psychology, learning sciences, and content area disciplines, could collaborate to examine how to address challenges in IBL that span different content areas. For example, k-12 students in various fields may regularly ask their instructors to give them the “right” answer to an inquiry-based experience (as teachers in non-inquiry-based educational settings often might), and it would be valuable to explore how educators in different fields help students change their conception of learning from the memorization of facts to knowledge-generating processes in which there may be no right answer (Yerrick, 2000). Also, researchers could examine inquiry-related issues that span disciplines, such as teacher education or civic scientific literacy (e.g., Miller, 1998). Having a team of researchers with different perspectives on IBL could enrich and enhance the quality and reach of such a project.

Likewise, educational scholars from different fields investigating IBL might benefit from the exchange of research conceptualizations and methodologies necessary for truly collaborative research efforts. Indeed, Kathryn Drago recorded the debriefing session with the sole intent of analyzing the content to guide the revision of the curriculum. Conceptualizing the analysis of the conversation using a grounded approach to investigate how classroom science teachers speak about IBL and its opportunities and challenges only came about through interactions with her colleagues in other disciplines. This type of research in science education is rare, as the roots of the field lay in much more positivistic scientific empiricism. However, this study, employing discourse analysis and leveraging an epistemic stance more common to English education researchers, highlighted nuances in the opportunities and challenges presented by IBL in the science classroom heretofore unrecognized because of Kathryn’s previous vision of educational

research. Collaborations between researchers in various disciplines around inquiry would likely lead to additional fruitful and reciprocal interchanges of theoretical frameworks, methodologies, and analytic techniques.

These collaborative efforts might not only enhance cross-disciplinary understandings but also enable scholars and educators to rethink inquiry in their own fields. By considering scientists' conceptions of inquiry as either *means* or *ends*, for example, historians and ELA teacher educators might consider which aspects of inquiry in their areas support each goal. While current educator preparation programs could teach educators to support and practice inquiry-based education, future research projects may provide robust insights about the characteristics and nature of such experiences. Given the attention to IBL processes in the ELA Common Core content area literacy standards (e.g., pages 61-66), the edTPA, which will soon assess new educators in two dozen states (as of this printing), and science practices in the NGSS, it is important for scholars and leaders in education to consider the practical value of such collaborations in preparing future educators for the demands they will face during their careers.

In summary, we have illustrated how exchanges among colleagues from different disciplines in one teacher education program broadened and deepened our conceptions of inquiry-based learning and how to employ it in teacher education. There are three reasons why this conversation is generative for teacher education curriculum, practice, and research. Encouraging preservice and inservice educators to engage in similar conversations about IBL has the potential to foster greater interdisciplinarity, thus broadening and deepening student understanding about the similarities and differences among fields. Ideally, teachers would then know how to collaborate on IBL lessons, units, and curricula, and researchers in teacher education could then examine how, why, and under which conditions teachers choose to take up

an inquiry approach in classrooms and schools. Given the challenging content and quick pace of teacher development programs, clarifying the processes and elements of inquiry-based learning in different fields may have tremendous benefits for educators. Thus, we hope that this paper sparks further explorations of cross-field conceptions and processes of inquiry-based learning. We think there is much to be gained from such work.

References

- AAAS. (1993, 2009). *Benchmarks for science literacy*. Retrieved online from http://www.project2061.org/publications/bsl/online/index.php?chapter=1#bm_1AE2
- Abd-El-Khalick, F., BouJaoude, S., Duschl, R., Lederman, N. G., Mamlok-Naaman, R., Hofstein, A., . . . Tuan, H. (2004). Inquiry in science education: International perspectives. *Science Education*, 88(3), 397-419.
- Bain, R. (2000). Into the breach: Using research and theory to shape history instruction. In Stearns, P. N., Seixas, P., & Wineburg, S. (Eds.), *Knowing, Teaching, & Learning History* (pp. 331-352). New York, NY: NYU Press.
- Bain, R. & Mirel, J. (2006) Setting up camp at the great divide. *Journal of Teacher Education*, 57(3), 212-219.
- Ball, D.L. & Forzani, F. (2009). The work of teaching and the challenge for teacher education. *Journal of Teacher Education*, 60(5), 497-511.
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York, NY: Freeman.
- Barton, K. & Levstik, L. (2003). Why don't more history teachers engage students in interpretation? *Social Education*, 67(6), 358-361.
- Bransford, J. D., Brown, A. L., & Cocking, R. R. (2000). *How people learn: Brain, mind, experience, and school*. Washington, DC: National Academies.
- Bruner, J. (1996). *The culture of education*. Cambridge, MA: Harvard UP.

- California State Board of Education (2000). History-Social Science Content Standards for California Public Schools, Kindergarten through Grade Twelve. Sacramento, CA: California Department of Education.
- Castanheira, M.L., Crawford, T., Dixon, C.N., & Green, J.L. (2001). Interactional ethnography: An approach to studying the social construction of literate practices. *Linguistics and Education, 11*(4), 353-400.
- Cazden, C. (2001). *Classroom discourse analysis: The language of teaching and learning*. Westport, CT: Heinemann.
- Christie, F., & Macken-Horarik, M. (2007). Building verticality in subject English. In F. Christie & J. R. Martin (Eds.), *Language, knowledge, and pedagogy: Functional linguistic and sociological perspectives* (pp. 156-183). London, UK: Continuum.
- Cochran-Smith, M., & Lytle, S. (2009). *Inquiry as stance: Practitioner research for the next generation*. New York, NY: Teachers College Press.
- Collingwood, R. G. (1948). *The idea of history*. Oxford, UK: Oxford.
- Crockett, M. D. (2002). Inquiry as professional development: creating dilemmas through teachers' work. *Teaching and Teacher Education, 18*, 609-624.
- Darling-Hammond, L. (2000). How teacher education matters. *Journal of Teacher Education, 51*(3), 166-173.
- Doolittle, P., Hicks, D., Ewing, T. (2004-5). Historical inquiry: Scaffolding wise practices in the history classroom. Retrieved online 7 March 2009, www.historicalinquiry.com.

- Duschl, R., & Grandy, R. (2008). Reconsidering the character and role of inquiry in school science: Framing the debate. In R. A. Duschl, & R. E. Grandy (Eds.), *Teaching scientific inquiry* (pp. 1-37). Rotterdam, The Netherlands: Sense Publishers.
- Edwards, A.D., & Westgate, D.P.G. (1987). *Investigating classroom talk*. London and Philadelphia: The Falmer Press.
- Edwards, B. (2003). The practice of diaspora: Literature, translation, and the rise of Black internationalism. Cambridge, MA: Harvard University Press.
- Edwards, B. (2009). The practice of diaspora. In J. A. Radway, K. K. Gaines, B. Shank & P. Von Eschen (Eds.), *American studies: An anthology* (p. 14). London, UK: Blackwell.
- Edwards, D., & Mercer, N. (1989). Common knowledge: The development of understanding in the classroom. London: Methuen.
- Fecho, B. (2000). Critical inquiries into language in an urban classroom. *Research in the Teaching of English*, 34(3), 368-395.
- Feiman-Nemser, S. (2001). From preparation to practice: Designing a continuum to strengthen and sustain teaching. *Teachers College Record*, 103(6), 1013-1055.
- Gee, J. P. (2005). *An introduction to discourse analysis: Theory and method*. New York, NY: Routledge.
- Gere, A. R., Aull, L., Dickinson, H., McBee-Orzulak, M., & Thomas, E. E. (2007). 21st century literacies: A policy brief produced by the National Council of Teachers of English. *NCTE Council Chronicle*, 17, 13-20.

- Grossman, P., & McDonald, M. (2008). Back to the future: Directions for research in teaching and teacher education. *American Educational Research Journal* 45(1), 184-205.
- Gutierrez, K.D. (1993). How talk, context, and script shape contexts for learning: A cross-case comparison of journal sharing. *Linguistics and Education*, 5(3-4), 335-365.
- Harste, J. E. (2001). *What education as inquiry is and isn't*. In S. Boran & B. Comber (Eds.), *Critiquing Whole Language and Classroom Inquiry* (pp. 1-17). Urbana, IL: National Council of Teachers of English.
- Hatano, G., & Inagaki, K. (1986). Two courses of expertise. In H. Stevenson, H. Azuma, & K. Hakuta (Eds.), *Child development and education in Japan* (pp. 262-272). New York: W.H. Freeman/Times Books/ Henry Holt & Co.
- Hillocks, G. (1982). Inquiry and the composing process: Theory and research. *College English*, 44, 659-73.
- Hillocks, G. (1987). Synthesis of research on teaching writing. *Educational Leadership*, 44(8), 71-80.
- Hillocks, G. (1995). *Teaching writing as reflective practice*. New York, NY: Teachers College Press.
- Hillocks, G. (2005). At last: The focus on form vs. content in teaching writing. *Research in the Teaching of English*, 40(2), 238-248.
- Hofstein, A., & Lunetta, V. N. (2004). The laboratory in science education: Foundations for the twenty-first century. *Science Education*, 88, 28-54.
- Ingersoll, R. M. (2001). The realities of out-of-field teaching. *Educational Leadership*, 58(8), 42-

45.

Ingersoll, R. M. (2002). Out-of-field teaching, educational inequality, and the organization of schools: An exploratory analysis. *Center for the Study of Teaching and Policy, University of Washington*.

Ingersoll, R. M., & Perda, D. (2010). Is the supply of mathematics and science teachers sufficient? *American Educational Research Journal*, 47(3), 563-594.

International Reading Association & National Council of Teachers of English (1996). *Standards for the English Language Arts*. Published by the authors in the USA. Retrieved from <http://www.ncte.org/standards/ncte-ira>

Jennings, L. B. & Mills, H. (2009). Constructing a discourse of inquiry: Findings from a five-year ethnography at one elementary school. *Teachers College Record*, 111(7), 1583-1618.

King, B. K. (2002). Professional development to promote schoolwide inquiry. *Teaching and Teacher Education*, 18, 243-257.

Krajcik, J., Blumenfeld, P. C., Marx, R. W., & Soloway, E. (2000). Instructional, curricular, and technological supports for inquiry in science classrooms. In J. Minstrell (Ed.), *Inquiring into inquiry learning and teaching in science* (pp. 283-315). Washington, DC: American Association for the Advancement of Science.

Krajcik, J., McNeill, K. L., & Reiser, B. J. (2008). Learning-goals-driven design model: Developing curriculum materials that align with national standards and incorporate project-based pedagogy. *Science Education*, 92, 1-32.

- Levin, T. & Nevo, Y. Exploring teachers' views on learning and teaching in the context of a trans-disciplinary curriculum. *Journal of Curriculum Studies*, 41(4), 439-465.
- Levstik, L. (1996). Negotiating the history landscape. [Review of the book *Lies my teacher told me: Everything your American history textbook got wrong*, by J. Loewen]. *Theory and Research in Social Education*, 24(4), 416-420.
- Levy, P., Aiyegbayot, O., & Little, S. (2009). Designing for inquiry-based learning with the Learning Activity Management System. *Journal of Computer Assisted Learning*, 25, 238-251.
- Magnusson, S., Krajcik, J., & Borko, H. (1999). Nature, sources, and development of pedagogical content knowledge for science teaching. In J. Gess-Newsome, & N. Lederman (Eds.), *Examining pedagogical content knowledge: The construct and its implications for science education* (pp. 95-132). The Netherlands: Kluwer Academic Publishers.
- Major, C. & Palmer, B. (2001). Assessing the effectiveness of problem-based learning in education. *Academic Exchange* 5(1) 4-9.
- Marshall, J. & Horton, R. (2011). The Relationship of teacher-facilitated, inquiry-based instruction to student higher-order thinking. *School Science and Mathematics* 111(3), 93-103.
- Martin, J.R. (1997). Analyzing genre: Functional parameters. In J. R. Martin & F. Christie (Eds.), *Genre and institutions: Social processes in the workplace and school* (pp. 3-39). London: Cassell.
- Martin, J.R. (1999). Grace: The logogenesis of freedom. *Discourse Studies*, 1(1), 29-56.

- Martin, J.R. (2002). Writing history: Construing time and value in discourses of the past. In M. J. Schleppegrell & C. Colombi (Eds.), *Developing advanced literacy in first and second languages* (pp. 87-118). Mahwah, NJ: Lawrence Erlbaum Associates.
- Martin, J.R. (2004). Mourning: How we get aligned. *Discourse and Society*, 15(2-3), 321-344.
- Martin, J.R., & Rose, D. (2007). *Working with discourse: Meaning beyond the clause* (2nd ed.). London: Continuum.
- Martin, J.R., & White, P.R.R. (2005). *The language of evaluation: Appraisal in English*. Houndsmills, Basingstoke, Hampshire and New York: Palgrave MacMillan.
- Michaels, S., Shouse, A., & Schweingruber, H. (2007). *Ready, set, science!: Putting research to work in K-8 Science Classrooms*. Washington, DC: National Academies Press.
- Michigan Department of Education. (2007). *Grade level content expectations for social studies*. Retrieved from Michigan Department of Education website:
http://michigan.gov/documents/mde/SSGLCE_218368_7.pdf
- Miller, J. D. (1998). The measurement of civic scientific literacy. *Public Understanding of Science*, 7, 203-223.
- Mintrop, H. (2004). Fostering constructivist communities of learners in the amalgamated multi-discipline of social studies. *Journal of Curriculum Studies*, 36(2), 141-58.
- National Center for History in the Schools (1994). *Historical Thinking Standards*. Retrieved from <http://www.nchs.ucla.edu/Standards/historical-thinking-standards-1>
- National Center for History in the Schools (1996). *National Standards for History*. Los Angeles, CA: National Center for History in the Schools.

National Governors Association Center for Best Practices, Council of Chief State School Officers (2010). *Common Core State Standards for the English Language Arts and Literacy in History/Social Studies, Science, and Technical Subjects*. National Governors Association Center for Best Practices, Council of Chief State School Officers, Washington D.C. Retrieved from <http://www.corestandards.org/ELA-Literacy>

National Governors Association Center for Best Practices and CCSSO (2012). *Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects*. Retrieved from <http://www.corestandards.org/the-standards/english-language-arts-standards>

National Research Council. (1996). *The national science education standards*. Washington, DC: National Academies Press.

National Research Council. (2000). *Inquiry and the national science education standards: A guide for teaching and learning*. Washington, DC: National Academies Press.

National Research Council. (2011). *A framework for K-12 science education: Practices, crosscutting concepts, and core ideas*. Washington, DC: National Academies Press. Retrieved from http://www.nap.edu/catalog.php?record_id=13165

Nelson, T. H., Slavitt, D., Perkins, M., & Hathorn, T. (2008). A Culture of collaborative inquiry: Learning to develop and support professional learning communities. *Teachers College Record*, 110 (6), 1269-1303.

NGSS Consortium of Lead States (2013). *Next Generation Science Standards: By States, For States*. National Academy Press.

- Nikitina, S. (2006). Three strategies for interdisciplinary teaching: Contextualizing, conceptualizing, and problem-centring, *Journal of Curriculum Studies*, 38(3), 251-71.
- Nystrand, M., Gamoran, A., Kachur, R., & Prendergast, C. (1997). *Opening dialogue: Understanding the dynamics of language and learning in the English classroom*. New York, NY: Teachers College Press
- Oliveira, A. W. (2010). Improving teacher questioning in science inquiry discussions through professional development. *Journal of Research in Science Teaching*, 47(4), 422-453.
doi:10.1002/tea.20345
- Paul, J. & Marfo, K. (2001). Preparation of educational researchers in philosophical foundations of inquiry. *Review of Educational Research* 71(4), 525-547.
- Pollock, M. (2004). *Colormute*. Princeton, NJ: Princeton University Press.
- Reid, A. & O'donoghue, M. (2004). Revisiting enquiry-based teacher education in neo-liberal times. *Teaching and Teacher Education*, 20, 559-570.
- Rex, L., Green, J., Dixon, C., & the Santa Barbara Classroom Discourse Group. (1998). Critical issues: What counts when context counts?: The uncommon "common" language of literacy research. *Journal of Literacy Research*, 30(3), 407-433.
- Rex, L. A., Thomas, E. E., Levy, B., & Drago, K. (April, 2009). *A disciplined conversation: The language of inquiry in science, social studies, and English education*. Paper presented at the Annual Meeting of the American Educational Research Association, San Diego, CA.
- Rico, S. A., & Shulman, S. H. (2004). Invertebrates and organ systems: Science instruction and 'Fostering a community of learners'. *Journal of Curriculum Studies*, 36(2), 159-81.

- Sassi, K. & Thomas, E.E. (2008). Walking the talk: Examining privilege and race in a ninth-grade classroom. *English Journal*, 97(6), 25-31.
- Seixas, P. (1998). Student teachers thinking historically. *Theory and research in social education*, 26(3), 310-341.
- Schmidt-Jones, C. A. (2012). An open educational resource supports a diversity of inquiry-based learning. *The International Review of Research in Open and Distance Learning* 13(1), 1-16.
- Schunk, D., Pintrich, P., & Meece, J. (2008). *Motivation in education: Theory, research, and applications*. Upper Saddle River, NJ: Prentice Hall.
- Sinclair, J.M., & Coulthard, M. (1975). *Towards an analysis of discourse: The English used by teachers and pupils*. London, UK: Oxford University Press.
- Singer, J., Marx, R. W., Krajcik, J., & Clay Chambers, J. (2000). Constructing extended inquiry projects: Curriculum materials for science education reform. *Educational Psychologist*, 35(4), 165-178.
- Snow-Gerono, J. L. (2005). Professional development in a culture of inquiry: PDS teachers identify the benefits of professional learning communities. *Teaching and Teacher Education*, 21, 241-256.
- Shulman, L. & Sherin, M. G. (2004). Fostering communities of teachers as learners: Disciplinary perspectives. *Journal of Curriculum Studies*, 36(2), 135-40.
- Sprocken-Smith, R., Walker, R., Batchelor, J., O'Steen, B., & Angelo, T. (2011). Enablers and

constraints to the use of inquiry-based learning in undergraduate education. *Teaching in Higher Education*, 16(1), 15-28.

Thomas, E. E. (2010). *We're saying the same thing: How English teachers negotiated solidarity, identity, and ethics through talk and interaction* (Doctoral dissertation). The University of Michigan.

Thomas, E.E. & Sassi, K. (2011). *An ethical dilemma: Talking about plagiarism and academic integrity in the digital age*. *English Journal*, 100(6), 47-53.

Thomas, E.E. (2012). The next chapter of our story: Rethinking African American metanarratives in schooling and society. In Thomas, E.E. & Brooks-Tatum, S.R.F. (Eds.), *Reading African American Experiences in the Obama Era: Theory, Advocacy, Activism* (pp. 29-50). New York, NY: Peter Lang.

Tuyay, S., Floriani, A., Yeager, B., Dixon, C. & Green, J. (1995). Constructing an integrated, inquiry-oriented approach in classrooms: A cross-case analysis of social, literate, and academic practice. *Journal of Classroom Interaction*, 30(2), pp. 1-15.

Vansledright, B. (2009). Thinking historically. *Journal of Curriculum Studies*, 41(3), 433-8.

Vansledright, B. (2010). *The Challenge of rethinking history education: On practices, theories, and policies*. New York, NY: Routledge.

Voss, J. F. & Wiley, J. (1997). Conceptual understanding in history. *European Journal of Psychology of Education* 12(2), 147-58.

Wang, F., Kinzie, M., McGuire, P., & Pan, E. (2010). Applying technology to inquiry-based learning in early childhood education. *Early Childhood Education Journal* 37, 381-9.

Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity*. Cambridge, UK:

Cambridge UP.

- Wilson, S. M., & Wineburg, S. (1988). Peering at history through different disciplinary lenses: The role of disciplinary perspectives in teaching history. *Teachers College Record*, 89, 525-539.
- Wilson, S. M., & Wineburg S. S. (1993). Wrinkles in time and place: Using performance assessments to understand the knowledge of history teachers. *American Educational Research Journal*, 30(4), 729-769.
- Windschitl, M. (2003). Inquiry projects in science teacher education: What can investigative experiences reveal about teacher thinking and eventual classroom practice? *Science Education*, 87(1), 112-143.
- Windschitl, M., Thompson, J. & Braaten, M. (2011). Ambitious pedagogy by novice teachers: Who benefits from tool-supported collaborative inquiry and why? *Teachers College Record*, 113(7), 1311-60.
- Wineburg, S. S. (1991). Historical problem solving: A study of the cognitive processes used in the evaluation of documentary and pictorial evidence. *Journal of Educational Psychology*, 83(1), 73-87.
- Wineburg, S. S. (2001). *Historical thinking and other unnatural acts*. Philadelphia, PA: Temple.
- Wineburg, S., Smith, M., & Breakstone, J. (2012). New directions in assessment: Using Library of Congress sources to assess historical understanding. *Social Education* 76(6), 290-293.

- Wirkala, C. & Kuhn, D. (2011). Problem-based learning in k-12 education: Is it effective and how does it achieve its effects? *American Educational Research Journal*, 48(5), 1157-1186.
- Wyatt, S. (2005). Extending inquiry-based learning to include original experimentation. *Journal of General Education* 54(2), 83-91.
- Yeager, E. (2003). "I am a historian": Examining the discursive construction of locally situated academic identities in linguistically diverse settings (Unpublished dissertation). University of California, Santa Barbara.
- Yeager, E. A. & Davis, O. L. (1996). Classroom teachers' thinking about historical texts: An exploratory study. *Theory and Research in Social Education*, 24(2), 146-166.
- Yeager, E. A. & Davis, O. L. (1995). Between campus and classroom: Secondary student teachers' thinking about historical. *Journal of Research and Development in Education*, 29(1), 1-8.
- Yerrick, R. (2000). Lower track science students' argumentation and open inquiry instruction. *Journal of Research in Science Teaching*, 37(8), 807-838.
- Yorks, L. (2005). Adult learning and the generation of new meaning: Creating liberating spaces for fostering adult learning through practitioner-based collaborative action inquiry. *Teachers College Record*, 106(7), 1217-44.