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Integrating Disciplinary Literacy into Middle-School and Pre-Service Teacher Education

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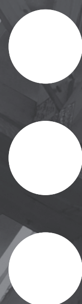

Integrating Disciplinary Literacy into Middle-school and Pre-service Teacher Education

Jamie Colwell & David Reinking

SLO • Netherlands institute for curriculum development

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23. Integrating disciplinary literacy into middle-school and pre-service teacher education

Jamie Colwell & David Reinking

Abstract

This case describes a summary of a formative experiment, a framework specific to educational design research, simultaneously conducted in a middle-school history classroom and a university social studies methods course. The purpose of the study was to refine an intervention to promote disciplinary literacy in history. The intervention provided middle-school students and pre-service teachers with explicit strategies to promote disciplinary literacy, while participating in a collaborative blog project engaging them in disciplinary literacy. Conclusions suggest practical consideration for implementation of disciplinary literacy into history. The case outlines the five phases of the formative experiment and briefly overviews modifications made during the intervention. Further, it offers suggestions and considerations for employing this approach to research.

1. Introduction to the problem

Becoming literate entails much more than learning to decode the alphabetic code of written texts, which is typically the main focus of initial reading instruction. For example, educators have a responsibility to help students meet the demands of reading, interpreting, and evaluating academic texts in the context of the increasingly specialized courses and content that students encounter as they progress through their years in school. But, where exactly does the responsibility fall for developing the skills, strategies, and dispositions needed for successful reading of academic texts in middle and secondary grades, particularly developing a critically evaluative stance? Should English Language Arts teachers teach students generic strategies that apply generally to all subject areas such as mathematics, history, and science? Or, because the texts and their function in each subject area are unique, should teachers of specific subjects be charged with helping students become literate in the domain of their respective subject area? How can teachers in middle schools and secondary schools integrate literacy in their subject area in a way that reinforces, or is at least is not distracting to, the content they are most interested in teaching students? And, how can effective strategies for doing so be communicated to and practiced by pre-service service teachers preparing to become teachers in a particular subject area?

Literacy researchers and educators have long struggled with these questions (e.g., O'Brien & Stewart, 1990; O'Brien, Stewart, & Moje, 1995; Ratekin, Simpson, Alvermann, & Dishner, 1985; Stewart & O'Brien, 1989). Beginning in the late 1990s, a new focus on adolescent literacy emerged in the field (Alvermann, 2002; Jetton & Dole, 2002; Moore, Bean, Birdyshaw, & Rycik, 1999) and along with it a new perspective referred to as *disciplinary literacy*, which influenced a response to these questions (Juel, Hebard, Haubner, & Moran, 2010; Moje, 2008; 2010/2011; Shanahan & Shanahan, 2008; Wilson, 2011). In a nutshell, disciplinary literacy is the concept that literacy skills in each content area are specific to the unique learning objectives of a discipline. For example, in social studies, particularly the area of history, disciplinary literacy implies instruction grounded in investigating, comparing, and contextualizing texts about

historical events. Such a stance leads readers to draw conclusions and interpret those events, which may contribute to developing a democratic perspective and informed citizenship, both of which are goals of social studies education (Mosborg, 2002).

Yet, despite considerable theoretical speculation about disciplinary literacy, there have been few attempts to investigate the viability of applying that perspective in classrooms and how it might be feasibly incorporated into the preparation of pre-service teachers. We believe design-based research, specifically what has been called a formative experiment (Reinking & Bradley, 2008; Reinking & Watkins, 2000), an example of which we report here, addresses that limitation, because it is well suited to determining whether such theoretical perspectives hold up in authentic classroom practice and how they can be workably implemented. A formative experiment falls under the general umbrella of design-based and educational design research (Reinking & Bradley, 2008), and aims to develop usable interventions that may be implemented in authentic classroom contexts. Thus, our goal was to implement and to refine, as needed, an intervention designed to instantiate the concept of disciplinary literacy in a middle-school social studies classroom and simultaneously in a social studies methods course in a university program for pre-service teachers. The central feature of the intervention enabled middle-school students and pre-service teachers to discuss history texts by posting and responding to an online blog. We aimed to refine instructional methods and a type of online writing activity that may be continued in the middle-school classroom following the conclusion of the study. We justified using a formative experiment because this approach is especially appropriate for investigating how promising interventions might be implemented to accomplish valued, and often difficult-to-achieve pedagogical goals that imply transformations of instructional orientations and practices. Further, formative experiments are conducted to align theory, research, and practice by designing interventions in authentic contexts (Reinking & Bradley, 2008).

In the remainder of this chapter we summarize briefly a recently completed study. Soon, we intend to submit a more detailed report of our findings for publication. We overview our methodological framework, describe the intervention and its theoretical basis, summarize a few preliminary findings and conclusions, and reflect on what we learned about disciplinary literacy and about our methodological approach.

2. The study

A formative experiment focuses on implementing workable interventions in classrooms, on testing, developing, and refining theory, and on generating design principles for a particular intervention. This approach has been used frequently to investigate instructional interventions pertaining to literacy. For example, formative experiments have been published regularly in *Reading Research Quarterly,* the field's leading, most rigorously reviewed journal (e.g., Ivey & Broadus 2005; Jimenez, 1997; Neuman, 1999; Reinking & Watkins, 2000). In this section we overview the framework we employed using this approach; we identify the two complementary pedagogical goals guiding the study; we specify the five distinct phases of the study; and we describe the intervention.

Framework

The framework of our study followed Reinking and Bradley's (2008) six guiding questions for a formative experiment:

1. What is the pedagogical goal to be investigated and why is that goal important?
2. What is an intervention that has potential to achieve the pedagogical goal and what is the theoretical and empirical support for that potential?

3. What factors, based on data collection and iterative analysis, enhance or inhibit the intervention's effectiveness, efficiency, and appeal?
4. How can the intervention be modified in light of these factors?
5. What unanticipated positive or negative outcomes does the intervention produce?
6. Has the instructional environment changed or been transformed as a result of the intervention?

Phases

We conducted this study in five phases: (a) recruitment of participants, (b) characterization of the instructional environment, (c) collection of baseline data, (d) iterative collection and analyses of data during the intervention, and (e) retrospective analysis. These phases are described with our findings in a subsequent section.

Goal

Unlike a typical formative experiment, our investigation had two complementary goals for two distinct but related populations, rather than a single goal for one population:

***Goal 1*:** Improve eighth-grade social studies students' use of disciplinary literacy in history, specifically improving their abilities to make connections with text, question the author/text, and draw conclusions based on evidence, through discipline-specific strategy instruction and collaborative blog discussions about history texts.
***Goal 2*:** Improve pre-service teachers' use and understanding of instructional techniques beneficial to improving middle-school students' disciplinary literacy skills, specifically using strategies that improve students' abilities to make connections with text, question the author/text, and draw conclusions based on evidence, through collaborative blog discussions with students about history texts.

The intervention

The object of a formative experiment is to investigate an intervention that can be justified as having potential to address the pedagogical goal. An intervention is defined by its essential elements, which we believe should be explicitly identified. Essential elements remain even when the manner, timing, and conditions for implementing them vary in response to data suggesting useful or needed modifications. These elements are selected while designing the intervention based on a review of literature and theory. Similar to the components of Van den Akker's (2003) curricular spiderweb, essential elements are fundamental to the rationale for the intervention's previous or potential success in accomplishing the pedagogical goal and provide a consistency and coherence to the design of the intervention, even when modifications are made. Interventions and their essential elements are analogous to building a bridge. To design a bridge, an engineer will take into consideration a particular site, anticipated purposes of the bridge, available materials, budget restrictions, and so forth. In light of those considerations a designer will first choose a basic structural approach, or a combination of several approaches, such as arch, cantilever, truss, suspension, and so forth. Each of these approaches has invariant defining elements that must be present to be true to the basic design, although they each may be developed and applied in countless variations. In the present investigation the essential elements defining the intervention and selected to achieve the goals were as follows: (a) middle-school students in a social studies class posting reactions to their reading of historical texts on a personal blog, (b) pre-service teachers in a social studies methods course reading and responding directly to middle-students about their blog postings, (c) integrating

strategies consistent with disciplinary literacy into middle-school students' and pre-service teachers' instruction.

More specifically, eighth-grade students wrote blog posts reacting to primary and secondary texts they were assigned to read on topics in their regular social studies class. The class focused on the history of South Carolina, and the texts followed events in South Carolina history as specified by the state curriculum. Pre-service teachers in a social studies methods course at a local university were paired with the middle-school students and responded to the blog postings by posting reactions, questions, and prompts that would encourage further thought about the topic. The researchers and a middle-school social studies teacher collaborated to develop and integrate accompanying disciplinary-literacy strategies into the teacher's existing curriculum. These strategies included activities focusing on making connections between texts and prior knowledge, using Questioning the Author (QtA), a reading strategy for analyzing text, (Beck, McKeown, Sandora, Kucan, & Worth, 1996), and drawing conclusions based on evidence (DECIDE, a critical thinking strategy that Beyer, 2008 developed for use in social studies instruction). These strategies were also presented, practiced, and discussed with the pre-service teachers in their social studies methods course during their regular class periods. Anchored by the blogging activity, these strategies were introduced as examples of integrating disciplinary literacy into social studies instruction.

New readings in conjunction with the social studies topics were introduced and assigned every other week, with a blog posting required in the first week and a response to the posting from the university student in the subsequent week. University students read the texts along with the students. Each reading was purposefully short (5-7 paragraphs) to increase the likelihood that students would focus on reading critically and not be distracted by a lengthy reading assignment. A new reading was introduced every other week with the middle-school students reading the assigned texts and writing a reaction on their blog during the first week, and the university students responding during the second week. Each bi-weekly topic became an iterative cycle for making modifications to the intervention based on data collection and analysis during the previous cycle.

3. Theoretical and empirical base for the intervention

The justification for the intervention and its essential components is drawn from the literature related to disciplinary literacy in middle-school history and to pre-service social studies teacher education. That literature is briefly reviewed in this section.

Disciplinary literacy in middle-school history

The first pedagogical goal targeting the middle-school setting in the intervention investigated in this study was to improve students' use of disciplinary literacy through strategy instruction and blogging. The rationale for that goal is that most adolescent students are lacking in strategies that evaluate information across textual sources to form overall interpretations (Afflerbach & VanSledright, 2001; Barton & Levstik, 2004; Hynd, Holschuh, & Hubbard, 2004; Stahl & Shanahan, 2004) and that blogging may extend critical thinking beyond the walls of the classroom (Black, 2005; McDuffie & Slavit, 2003), supporting critical reflection and construction of new knowledge. Further, disciplinary literacy, as a theoretical perspective, suggests that different purposes for reading in different content areas require different literacy skills, strategies, and dispositions (Moje, 2008; Shanahan & Shanahan, 2008). A formative experiment offered the opportunity to work with a social studies teacher and her students to understand how disciplinary literacy might be integrated into an authentic classroom. Further, the present formative experiment sought to expand the literature regarding how disciplinary literacy may be realistically incorporated into a middle-school classroom.

Disciplinary literacy in pre-service social studies teacher education

The second goal of the intervention targeted improving pre-service social studies teachers' use and understanding of disciplinary-literacy instructional techniques. This goal was guided by research suggesting a resistance to literacy instruction among middle school and secondary teachers (Moje, 2008; O'Brien & Stewart, 1990; O'Brien, Stewart, & Moje, 1995; Ratekin, Simpson, Alvermann, & Dishner, 1985). Even when researchers and educators provide useful instructional strategies in teacher education and professional development, many teachers are not willing to devote time to implement content literacy strategies into their curricula (Greenleaf, Schoenbach, Cziko, & Mueller, 2001; Hall, 2005; O'Brien et al., 1995), suggesting that further action is necessary to prepare pre-service teachers and teachers to integrate literacy into instruction. A logical step in this preparation may be working with pre-service teachers and their instructor to integrate disciplinary literacy instruction that is appealing to the pre-service teachers and complementary to the goals of a social studies methods course (Nokes, 2010).

A formative experiment, which provides flexibility to adapt the intervention to complement the course objectives, provided an opportunity to study how disciplinary literacy may be integrated into the methods course and add to local theory concerning disciplinary literacy and pre-service social studies teacher education.

4. Summary of methods and findings

In this section we summarize our methods and report a few preliminary findings. We organize our summary to correspond with the five phases of our investigation: recruitment of participants, characterization of the instructional environment, collection of baseline data, iterative collection and analyses of data during the intervention, and retrospective analysis.

Phases 1 and 2: Recruiting participants and characterizing the instructional environment

Reinking and Bradley (2008) suggested that in most instances an initial formative experiment to investigate a promising intervention should avoid being conducted in an environment where success or failure is almost assured. Thus, for the purposes of the present investigation, we selected a middle-school class with average student achievement in social studies. Likewise, we sought a teacher and a university instructor who were supportive of our goals, but who were not already systematically implementing instruction to achieve them. We used these criteria in purposive sampling (Patton, 2002) to consider contexts and participants as candidates for participation.

After pursuing several possibilities during the spring preceding the study, we recruited the participation of a middle-school eighth-grade state history class located in a rural school district in South Carolina. The class had 25 students and a teacher who had 13 years' experience in teaching middle-school social studies. We held two meetings with the teacher, Ms. Wells (all names are pseudonyms) in the summer to discuss and plan implementation of the intervention into her class instruction. Although supportive of increasing her students' critical reading of relevant documents and texts pertaining to state history, she was not explicitly integrating that perspective into her teaching before the study. Ms. Wells held a bachelor's degree in social studies education and master's degree in administration. The class consisted of 13 girls and 12 boys. Seven students were African American, 13 students were Caucasian, and five students were Hispanic. No student was classified as learning disabled or received special education services.

In the summer preceding the study, we recruited a professor and 28 undergraduate pre-service teachers in a social studies education program, which prepared them to be social studies teachers. The professor, Dr. Nelson, held a Ph.D. in social studies education and was an adjunct professor, and we also met with Dr. Nelson during the summer to plan instruction. The

class consisted of 14 females and 14 males of which 25 were classified as Caucasian and three as African American. All pre-service teachers were in good academic standing, but none were enrolled in the honors college.

To better understand these contexts prior to implementing the intervention qualitative data including structured field notes, video/audio recordings, semi-structured interviews, and participant interviews were collected during the two weeks immediately preceding the start of the intervention. These data were analyzed to build rich, elaborated descriptions of each setting (Merriam, 1998) to characterize the context of the settings, which enabled us to better understand if and how the settings were transformed during the intervention.

Phase 3: Establishing a baseline

The qualitative data collected in Phase 2, and used to characterize the instructional environments, also contributed to establishing a baseline to compare and determine transformations in the instructional environments. Analysis of these data suggested that Ms. Wells' instructional style prior to the intervention was teacher-centered with most activities involving lecture and students searching for specific answers to end-of-chapter and workbook questions in their textbooks. Data also suggested that, prior to the intervention, Dr. Nelson primarily utilized lecture and small group activities during instruction, and instruction focused on inquiry-based teaching methods.

However, in Phase 3, we also gathered data to establish participants' status in relation to the specific components of disciplinary literacy addressed in the pedagogical goals. That data would be a baseline against which we could assess progress formatively during and at the end of the subsequent intervention phase.

One week prior to implementing the intervention, qualitative data were collected using a Strategic Content Literacy Assessment (SCLA) to determine middle-school students' disciplinary literacy skills and pre-service teachers' use of disciplinary-literacy instructional techniques (Alvermann, Gillis, & Phelps, 2012). An SCLA is an informal reading assessment adapted from Brownlie, Feniak, and Schnellert's (2006) Strategic Reading Assessment, which focuses on generic reading practices. The SCLA is a type of assessment with clearly articulated curriculum targets to provide feedback on what and how students learn. Teachers can customize it to assess literacy strategies and skills specific to any content area. An SCLA specific to history was developed independently for each group. The middle-school version assessed the targeted disciplinary-literacy components addressed in the first pedagogical goal of the intervention: (a) making connections between personal and prior knowledge with texts, (b) questioning authors or texts, and (c) drawing conclusions based on evidence. The version for the pre-service teachers provided data about how they viewed and approached disciplinary literacy instruction in areas relevant to the intervention, such as (a) helping students to make connections between personal and prior knowledge and text, (b) helping students to question the author and text, and (c) helping students to draw conclusions based on evidence.

Results from the SCLA indicated the middle-school classroom presented a range of the skills, strategies, and dispositions relative to the pedagogical goal, although overall students' responses indicated an opportunity for improvement. For example, most of the middle-school students in this study could form connections between texts or prior knowledge. However, fewer students could appropriately question the author and validity of the text, and almost none of the students were able to draw a conclusion based on evidence. Baseline pre-service teacher SCLA evaluations indicated that pre-service teachers were able to describe general instructional techniques to encourage disciplinary literacy, but most were unable to indicate specific examples of those techniques or how those techniques might be implemented instructionally. These data reinforced our decision to implement explicit strategy instruction in

the intervention with focus on structuring middle-school students' consideration of the validity of the author/text and drawing conclusions based on evidence. We hypothesized that these strategies would also provide pre-service teachers with concrete methods to provide disciplinary-literacy instruction.

Phase 4: Implementing the intervention and making modifications

The intervention was integrated into instruction for 11 weeks, as described in a previous section, and was organized around five topics, each requiring approximately two weeks (see Table 1). During the intervention phase we collected data aimed mainly at answering questions three and four in the framework for our study, as described in a previous section. However, in this phase we also noted observations that addressed question five concerning unanticipated outcomes and question six concerning any evidence of general transformations in the instructional environment.

To structure data collection, we used an embedded, single-case study (Yin, 2009). The intervention was considered a single-case and the iterative cycles that paralleled the sequential two-week discussion topics focused on the readings were considered embedded units of analysis (Yin, 2009). Consistent with standards of rigor for qualitative research (Creswell, 2007; Yin, 2009), multiple sources of data were collected and analyzed during this phase including: (a) semi-structured interviews with participants, (b) audio/video recordings, (c) structured field notes, (d) informal interviews with participants, (e) pre-, mid-, and post-study SCLAs in both settings, (f) participant observations, and (g) blog postings. These data were collected to understand how the intervention functioned in each of the two settings, reactions to the intervention that might affect its failure or success, and changes in the instructional environments over the course of the intervention. Data were analyzed using constant comparison (Glaser & Strauss, 1967) to determine themes and to thus specifically to suggest enhancing and inhibiting features of the intervention. Three examples of those themes and the modifications they informed follow.

Table 1: Intervention Topic Schedule

Weeks	**Topical Units**
1 & 2	Blog Introductions and English Explorers in the Carolinas
3 & 4	Colonial Women in the Carolinas
5 & 6	Slavery in the South Carolina
7 & 8	Plantation Life in South Carolina
9 & 10	American Revolution in South Carolina
11	Final blog posts to conclude the blog project

Modification 1: Changes in the parameters of blogging. This modification illustrates how some of the modifications are likely to be basic logistical issues of implementation associated with the local context, but that may nonetheless have implications for other similar contexts. The initial version of the intervention specified that middle-school students write their blogs responding to the history texts outside of their scheduled class. However, during the first iterative cycle, we

discovered that the blog site students were permitted to access at school was blocked on their home computers as well as at the county library. The technical personnel at the district office were unable to reset filters to accommodate access outside of school. Consequently, we modified the blogging component of the intervention so that middle-school students could visit the computer lab and media center computers during class in small groups. That modification required the teacher to accommodate access during the class period including providing supervision in a nearby computer lab. Initially, this modification produced enhancing affects. For example, students were still required to read and take notes on the history texts outside of class, and Ms. Wells made going to the computer lab, which students enjoyed, contingent on showing the notes taken. These contingencies insured that all students had read and responded to the assigned readings by the assigned time.

This modification produced another positive outcome. It enabled Ms. Wells to see students' enthusiasm for blogging in the computer lab, which, in turn, seemed to encourage her to integrate more digital technology into her classroom and reinforced the potential of the intervention to motivate her students and get them involved with a more in-depth analysis of their reading about historical events. We also noted that Ms. Wells seemed to make a more concentrated effort to connect the ideas students expressed in their blogs to topics they studied as a class. In other words, our attempts to address an initially bothersome technological constraint gave us a new, an potentially useful pedagogical understanding: Creating conditions under which teachers can observe first-hand the motivating effects of blogging may motivate teachers to invest in using technology to promote disciplinary literacy.

Modification 2: Strategy instruction. Despite her increased motivation, data analysis during the second iterative cycle indicated Ms. Wells was reluctant to integrate the disciplinary-literacy strategies we planned into her teaching. For example, she would inform us of an upcoming lesson she had planned using a strategy, but on the day one of us visited she would not use the strategy. Based on observational and video data, we determined that Ms. Wells did not use the explicit strategy instruction in her lessons on several occasions as planned during the intervention. We hypothesized that she may be uncomfortable with this type of instruction, which could be an inhibiting factor, which was indirectly supported in our observational notes and interviews. Thus, we scheduled a planning meeting to discuss a different method of integrating the strategy into her instruction. Instead of generally integrating explicit strategies into her instruction as we had originally discussed, we proposed that she provide students with a guide requiring them to locate components of disciplinary literacy in model blog posts that responded to history text with which the students were already familiar.

Ms. Wells enthusiastically agreed with this modification, and almost immediately implemented the revised approach into her instruction. This modification had two complementary positive outcomes. The middle-school students were provided with modeling of disciplinary literacy strategies with which they eagerly engaged and seemed to need. Likewise, their eagerness to engage in more thoughtful reflection on the texts seemed to again boost Ms. Wells' confidence in her students' engagement with disciplinary literacy. Further, the pre-service teachers who were alerted to this modification seemed to benefit from observing this model of reflective reading by becoming more attuned to disciplinary literacy and how it might be integrated into classroom instruction. Thus, for future use of the intervention, we learned that providing a more explicit model of how to reflect on a history text may not only enhance the blogging activity for students' benefit, it may also reinforce their teachers' integration of disciplinary literacy. We also learned that this modification may benefit future teachers' understanding of disciplinary literacy and how they might implement it with their students. Finally, we learned that the concept of disciplinary literacy may need to be more explicitly represented to teachers and through multiple

types of instructional methods if it is to overcome their potential discomfort with integrating it into their instruction.

Modification 3: Reflective blog writing. A third modification to the intervention occurred during the third iterative cycle. Data analysis during this and the previous cycle suggested that middle-school students struggled to write reactions to text. Most students only summarized the history readings and used the minimum number of sentences Ms. Wells required for their blog posts. Data revealed students had little previous experience in this class expressing their opinions about texts in history through written reflection. Their difficulty in writing reflective responses made it difficult for the pre-service teachers to respond in ways that might stimulate deeper discussions, although it did reveal to them that they could not necessarily expect their future students to engage easily in reflective writing.

To aid students in writing a more reflective blog posts, we worked with Ms. Wells to develop a guide to writing a reflective blog. The guide consisted of eight questions students should ask themselves as they read and to reflect on after they finished reading. The guide focused on the disciplinary literacy common to historians, which were the focus by the intervention. Students could use these questions and prompts to write their reflections and consider their opinions about the assigned readings. The writing guide improved students' responses and, in turn, improved discussion between middle-school students and pre-service teachers.

We learned that enacting the intervention successfully is likely to entail more explicit prompts for middle-grade students to engage in reflective responses to historical texts. Interestingly, an unanticipated positive finding suggesting a transformation of the instructional environment was that Ms. Wells used this new knowledge about her students to incorporate other reflective writing activities into her teaching. Further, we learned that pre-service teachers might gain insights about middle-school students' capabilities related to disciplinary literacy by corresponding with students who have not been given that support. By extension, we also learned that disciplinary literacy, at least in social studies, may not occur without considerable support for and practice of the skills, strategies, and dispositions that define literacy in a particular discipline, although that conclusion is subject to further research with other interventions in other disciplines with other students.

Phase Five: post-intervention retrospective analysis

After the intervention was concluded, we conducted a retrospective analysis (Gravemeijer & Cobb, 2006) utilizing all the data we had collected and analyzed formatively during the investigation. The intent was to integrate our findings, drawing conclusions about pedagogical theory and generating pedagogical principles and recommendations that might guide practitioners and future researchers. We focused particularly on the final two questions that comprised the framework for this study: What unanticipated positive or negative outcomes does the intervention produce? Has the instructional environment changed or been transformed as a result of the intervention? The following are some examples of findings from this phase:

Unanticipated outcomes. Several notable unanticipated outcomes related to writing emerged from the retrospective analysis. For example, middle-school students' writing spontaneously shifted from an informal style of blog writing at the beginning of the intervention to a formal style by the end of the intervention. Blog writing typically does not follow the formal mechanics of writing (McGrail & Davis, 2011; Utecht, 2007). And, Ms. Wells told students that they had the freedom to use an informal style in their blog posts. However, most pre-service teachers elected to use a formal writing style when blogging, possibly because they perceived their role as that of a teacher who should model formal writing. We found that the middle-school students were

conscious about how they represented themselves in writing to the university students, which seemed to encourage them to gradually mimic the more formal style of the pre-service teachers. Thus, this intervention may promote a heightened awareness of formal writing among middle-school students and contribute to their development of a more academic identity (Hall, 2007).

Transformations of the instructional environments. Data indicated that transformations occurred in both instructional environments during the intervention. For example, pre-service teachers' discussion about using digital technology in social studies instruction increased in their course. Before the intervention, they indicated hesitancy to use technology in planning history instruction, viewing technology as an add-on or a possible hindrance to instruction. However, by the conclusion of the intervention, pre-service teachers' experience with blogging and witnessing middle-school students' enthusiasm about blogging in history seemed to sway their perceptions of digital technology use in history instruction. For example, many began to comment on the usefulness and importance of using technology to enhance instruction and how to make it more appealing and applicable to their future students.
In the middle-school classroom, multiple transformations were noted. Beyond those transformations already noted in the previous section, Ms. Wells began to consider more activities involving collaborative learning, discussion, and digital technology. We also saw evidence that she integrated more small-group discussion and disciplinary literacy in activities not directly related to the intervention. She explained that participating in the intervention helped her to understand and experience how disciplinary literacy could become a seamless part of history instruction, and she found multiple opportunities to incorporate disciplinary literacy into her lessons, whereas at the beginning of the intervention Ms. Wells instruction seemed more grounded in a transmission model of teaching history.

5. Conclusions

Using a formative experiment allowed us to learn much about this particular intervention, specifically how it might be implemented effectively, efficiently, and appealingly to accomplish the specified pedagogical goals. For example, in gathering data and making modifications in response to that data, we learned that more explicit support than we had anticipated may be needed for students to write reflective blogs. More generally, we learned about the viability of disciplinary literacy as a concept through our attempts to integrate it into authentic instructional environments. For example, we discovered what resistance might be encountered from teachers, what difficulties students might have, and how these obstacles might be addressed. At the end of the study, we concluded that the intervention, given the modifications we made, is a reasonable and potentially useful one for promoting disciplinary literacy in social studies among middle-school students and among pre-service social studies teachers. The unanticipated outcomes of the intervention and its role in transforming the instructional environments were positive. However, undoubtedly other modifications are likely to emerge through further replication in similar and alternative contexts.

6. Some lessons learned

Finally, we solidified and increased our understanding of formative experiments as a methodological approach to education research. In this section we highlight three lessons learned, or reinforced from our previous work, in this study.

The benefits and limitations of collaboration

Collaboration between researchers and educators, which is a key element of conducting formative experiments (Reinking & Bradley, 2008) was clearly evident in this study and proved

to be an ongoing challenge, particularly because we had no established professional relationship with the teachers or schools in which we worked. On the other hand, collaborating for the first time with teachers in a new context can be an advantage, because we made no assumptions from prior experience about these teachers and students. Nonetheless, maintaining a strong professional relationship with the teachers and students, built on trust, is a constant challenge, especially when teachers' beliefs or instructional practices and decisions conflict with the underlying rationale for the intervention. Or, as was the case in the present study, a teacher may passively neglect to implement agreed upon elements of the intervention. We were able to circumvent these issues in part, we believe, because of the groundwork we laid in recruiting appropriate participants and carefully selecting contexts. We also view such obstacles as useful data and opportunities to creative in adapting the intervention to conform to educators' needs, beliefs, and motivations.

This study reinforced our concerns about the extent to which researchers become part of the intervention or warp the authenticity of its implementation and consequently our findings. For example, we discovered during the study that the school principal, who had recently completed her dissertation research, had explicitly encouraged the teacher to cooperate in our study, thus potentially limiting the validity of some of our data and interpretations. Thus, an important consideration for design-based research, particularly formative experiments, is the negotiation of a researcher's role in an education environments under study and the effect that role may have on a study. How do we, as researchers, maintain a close relationship with teachers and instructors while distancing ourselves enough to ensure valid results and conclusions? Although it may seem contradictory, developing a close relationship with educators and drawing them into the research process may be one way to achieve this balance. Although Ms. Wells and Dr. Nelson did not participate directly in collecting or analyzing data, both were consulted on a bi-weekly basis to review iterative data analysis results and confirm or disconfirm data patterns observed in their respective classrooms.

Simultaneous, complimentary coals

In our previous work, we have placed a single, carefully articulated pedagogical goal at the center of a formative experiment. In this instance we set two complementary goals for two related populations. That approach seemed logical, because disciplinary literacy and the intervention aimed at developing it applied to both populations of participants. Although that dual focus was enlightening, it was difficult to engage in rigorous data collection and analysis and to make modifications to the intervention that accommodated both groups. Consequently, we focused primarily on how the intervention affected the middle-school students and more incidentally on the pre-service teachers. Based on our experience, we suggest that other researchers carefully consider expectations, limitations, and available resources before they tackle investigating multiple goals, especially with more than one population.

More nuanced and pedagogically useful insights

This study reinforced our belief that conducting formative experiments is a liberatingly expansive approach to research aimed at identifying promising instructional interventions. Unlike conventional experimental approaches, obstacles, even outright failures to achieve desirable results, are viewed as data and inspire creative thinking about how to design workable solutions to often difficult or problematic aspects of instruction. Gone is the subtle pressure to either achieve success or have nothing publishable to report. Further, conventional experimental approaches gloss over potentially critical nuances, which are often assumed to be random variation unrelated to the narrow range of variables under study. In contrast, every aspect of an instructional environment is potentially relevant and important in a formative experiment and

sustains efforts to confront less than satisfactory results toward improvement and accomplishing a goal.
Further, formative experiments are more likely to provide nuanced understanding of success, often revealing the most fundamentally important components of an intervention that lead to desirable outcomes, which may be overlooked when research is reduced to comparing statistical averages or simply describing passively what has been observed. Unlike conventional experimental approaches aimed at determining what works on average across diverse instructional environments, formative experiments are aimed at determining what it takes to make an intervention work in authentic contexts (see Ivey & Broaddus, 2007; Jiménez, 1997; Reinking & Watkins, 2000). Formative experiments also address more than just effectiveness in terms of measureable achievement, but the efficiency and appeal of an instructional intervention, as well as its unanticipated collateral effects. Consequently, we believe that the results of such research will be more directly relevant to practitioners and will help close the long-lamented divide between research and practice. Adding this study to our previous work, we remain increasingly enthusiastic about and committed to the advantages of this approach when compared to conventional experimental and naturalistic approaches. We hope that our brief summary of this study and our reflection about it will be helpful to others who share our enthusiasm and commitment.

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