Disciplinary Literacy: Successes and Challenges of Professional Development

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Abstract: Literacy research has investigated disciplinary literacy for over a decade. The focus on disciplines as cultures of distinct literacy practice has been integrated into national standards and classroom implementation. Yet, research exploring the professional development in-service teachers receive specific to delivering disciplinary literacy instruction remains limited. This systematic literature review addresses this gap by analyzing 58 articles using the search terms *professional development*, *disciplinary literacy*, and *content area literacy*. The researchers discuss four focused themes that have emerged in disciplinary literacy research in relation to professional development (PD): disciplinary literacy as strategy instruction, differentiation and disciplinary literacy, measures of disciplinary literacy, and a PD model. The authors conclude discussing theoretical codes demonstrating both successes and challenges for PD in disciplinary literacy with implications for future PD.

Keywords: disciplinary literacy, content area literacy, professional development

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Introduction[1]

Scholarship in disciplinary literacy emerged from the belief that adolescents needed discipline-specific literacy practices to help them make sense of increasingly complex texts and content information (Moje, 2007, 2008; Shanahan & Shanahan, 2008; Zygouris-Coe, 2012). Disciplinary literacy has evolved from a theoretical idea into the mainstream discourse of education. The Common Core State Standards (National Governors Association Center [NGAC] and Council of Chief State School Officers [CCSSO], 2010), for example, respond to the importance of disciplinary literacy in both educational standards and classroom implementation (Zygouris-Coe, 2012). Despite these changes in the educational milieu, there is a paucity of research investigating the professional development (PD) in-service teachers have received related to disciplinary literacy best practices. Thus, teachers risk missing training on discipline-specific strategies their students need in order to practice more advanced literacy. This systematic literature review offers a comprehensive analysis over the last decade of data to determine what PD is being provided to in-service teachers relevant to disciplinary literacy. The following research questions guided the analysis: (a) What are the prominent themes in PD focused upon disciplinary literacy? and (b) From these themes, what are the

implications for the future needs of teachers regarding PD and disciplinary literacy?

Perspectives on Disciplinary Literacy

Content area literacy arose from the desire to address adolescents' literacy needs across disciplines and has a long history dating back to the 1900s (Dunkerly-Bean & Bean, 2016). Content area reading is typically distinguished as literacy specialists developing literacy strategies that could be implemented by content area teachers. However, content area teachers often integrated this literacy with varying levels of resistance due to misconceptions, failure to connect the relevancy of literacy to their subject-area content and culture that may begin in their pre-service education, or a view that literacy experts lacked needed content knowledge (Hinchman & O'Brien, 2019; O'Brien & Stewart, 1990). Shanahan and Shanahan (2008, p. 56) argued content area literacy or "highly generalizable skills and abilities, such as decoding, fluency, and basic comprehension strategies that can be applied to most texts and reading circumstances across content areas" is needed, especially in the elementary years.

However, disciplinary literacy skills specialized to individual disciplines are needed in secondary grades and beyond, but are often not taught. Even though disciplinary literacy builds upon the skills of content area literacy, success with the latter does

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[1] All pronouns for individuals in this article correspond to the pronouns they use to refer to themselves.

not guarantee the former. Shanahan and Shanahan (2008) were concerned that content area literacy did not meet the advanced literacy needs within disciplines, the type of specialized reading practices and language used, for example, by engineers or chemists. More recently, scholars emphasized that disciplinary literacy skills also have a place in the upper elementary years (Cervetti et al., 2012). Dunkerly-Bean and Bean (2016) disagreed with Shanahan and Shanahan and argued their privileging of disciplinary over content area literacy treated adolescents who struggled with academic content and the literacies it entailed from a deficit perspective and did not adequately acknowledge the connections between content area and disciplinary literacy. Other authors have suggested a "radical center" in disciplinary literacy, meaning the dichotomy between content area literacy and disciplinary literacy was false and that perhaps more research was needed in both fields as well as the ability to balance perspectives (Brozo et al., 2013, p.353). Recently, Hinchman and O'Brien (2019) described disciplinary literacy at a crossroads, where literacy and content professionals and students need to come together to pursue disciplinary inquiries or reach what they termed a point of *hybridity*. This point of hybridity combines learning discourses and practices fluidly across contexts: literacy, disciplinary, school, community, and cultural. Yet, to reach this point, research and synthesis is needed across fields.

In our consideration of disciplinary literacy, we find Moje's (2015) framework of disciplinary literacy useful as it considers the literacy needs of adolescents and how disciplinary literacy might address those needs rather than how closely disciplinary literacy parallels or differentiates content area literacy. Moje's 4E framework, composed of *engage, elicit/engineer, examine*, and *evaluate*, suggests that disciplinary literacy is more than just the "accumulation of skills" (p. 255). Instead, disciplinary literacy is a culture that involves the practices of the discipline (*engage*), depends on providing students the literacy strategies used within that discipline (*elicit/engineer*), *examines* the language of the discipline, and *evaluates* why those practices are valued. This disciplinary work is complex for both teachers and students and requires "a spiraling, developmental, apprenticeship" (Moje, 2015, p. 272). Thus, more information is needed regarding how to provide such apprenticeship to teachers via PD that helps teachers integrate disciplinary literacy as a culture applicable to each of the 4Es, not just as the acquisition of skills. Regardless of disagreement on the degrees of separation between disciplinary and content area literacy, there is agreement that more PD is needed for teachers enacting literacy strategies specific to the disciplines (Dunkerly-Bean & Bean, 2016; Moje, 2015).

> "Even though disciplinary literacy builds upon the skills of content area literacy, success with the latter does not guarantee the former."

Disciplinary Literacy and Need for Professional Development

This review explores the nature of disciplinary literacy professional development thus far and begins to address how PD might be developed in future research. Although literature reviews have been done on perspectives of disciplinary literacy (Moje, 2007) and how disciplinary literacy applies to specific disciplines (Hillman, 2014), the research literature lacks focus on what PD has been given to teachers to support their implementation of disciplinary literacy. While reviews of disciplinary literacy show promise for socially just pedagogy and

developing disciplinary knowledge (Moje, 2007), and educational policy such as the Common Core State Standards show a trend toward disciplinary literacy (Dunkerly-Bean & Bean, 2016) being implemented in instruction, it is unclear how PD is keeping pace with these developments. Moje (2015) noted the importance of going further with research on disciplinary literacy and PD to help teachers enact elements of this framework. Although there are some reports and articles exploring PD for specific contexts, such as teaching English language learners (ELLs) in the science discipline (Lee & Buxton, 2013), a comprehensive review specifically focusing on PD and disciplinary literacy is needed, and this review begins to address that gap.

Professional Development

Research has demonstrated professional development is helpful to teachers; however, more research is needed on both student outcomes related to PD and levels of its implementation (Borko, 2004). In particular, PD is needed as it aids even trained teachers in addressing new challenges that arise in the application of practice and in the continual development of pedagogical research and knowledge (Mizell, 2010). PD does not exist in a vacuum, but rather, should be integrated across the spectrum of teachers' professional roles—from their initial teacher preparation to in-service practice (Darling-Hammond et al., 2017). We build on Darling-Hammond et al.'s definition of PD as "structured professional learning that results in changes in teacher practices and improvements in student learning outcomes" (p. v). Desimone (2009) suggested effective PD includes focus on content knowledge, active learning, coherence, duration, and collective participation. The development of content knowledge is an important component of disciplinary literacy, but enhancement of content knowledge is not simply a matter of being an expert in the field (Shulman, 1987). Teachers' prior

knowledge plays a role in their current content knowledge (Minor et al., 2016), and teachers adopt content knowledge from PD at different levels (Borko, 2004). Furthermore, content knowledge for the purpose of teacher development is complicated by other forms of knowledge such as pedagogical knowledge, forming what Shulman (1987) termed pedagogical content knowledge. Thus, helping teachers attain the knowledge and skills necessary to implement disciplinary literacy warrants further exploration.

Method

In this section, we discuss the design of this systematic literature review, the data sources, and data analysis.

Research Design

This study is a systematic literature review, a design that follows research questions and an explicit approach of analysis when untangling scholarship (Khan et al., 2003). Our research questions for this review were the following, and we detail our systematic analysis in the subsequent sections: (a) What are the prominent themes in PD focused upon disciplinary literacy? and (b) From these themes, what are the implications for the future needs of teachers regarding PD and disciplinary literacy?

Data Sources

We used the search terms *professional development*, *disciplinary literacy*, and *content area literacy* as this combination captures relevant literature addressing both disciplinary literacy and the PD given to prepare teachers to implement it. Disciplinary literacy is a relatively specific form of literacy and often still referred to as content area literacy (Alvermann et al., 2011; Biancarosa, 2012). Using both terms recognizes that disciplinary literacy has its

roots in content area literacy (Dunkerly-Bean & Bean, 2016).

Using these criteria, we searched Academic Search Premier, Education Full Text, ERIC, and ProQuest databases, limiting our search to peer-reviewed academic journals. We did not limit dates. The term *disciplinary literacy,* and disciplinary literacy practices, did not become prevalent until around 2008, so we included articles focused upon literacy practices in various disciplines whether they referred to this as disciplinary literacy, content area literacy, or another similar term.

Data Analysis

As we examined articles to determine relevance, we followed specific criteria. We focused upon articles relevant to secondary in-service teacher education as we wanted to focus our findings on PD being given to current teachers rather than teacher education programs for future teachers. We also excluded dissertations and unpublished papers because we wanted to limit our findings to peer-reviewed research. After reviewing 594 results of our initial search, 58 articles met all the previously discussed criteria. These articles included theoretical, research, and pedagogical literature, 39 of which were research studies; see sources in Appendix A.

Data analysis was qualitative in nature. We worked individually to find emergent initial codes and then discussed coding until 100% inter-rater reliability was attained. These initial codes were drawn by going line by line through each text and describing them as actions and events. Then, we collapsed similar initial codes to create focused codes, which led to theoretical codes, or those conclusions drawn from relationships between the focused codes (Charmaz, 2014). Appendix B describes our initial codes, the number of sources in which these codes

emerged (grey boxes), and how these codes were collapsed into four focused codes (bolded headings).

Results

After coding 58 articles, we discuss four focused codes. These codes help to address our first research question: What are the prominent themes in PD focused upon disciplinary literacy? Our focused codes include the following: disciplinary literacy as strategy instruction, differentiation and disciplinary literacy, measures of disciplinary literacy, and a PD model.

Disciplinary Literacy as Strategy Instruction

Disciplinary literacy is conceptualized with each discipline functioning as a unique culture with specific literacy strategies, whereas content area literacy focuses on general literacy strategies that can be implemented in any discipline irrespective of discipline culture (Moje, 2015). Yet, the research literature does not confirm that perspective of distinct practices being engaged based on the discipline. Research we examined regarding literacy practices of various disciplines focused upon the use of overall literacy strategies including the following: comprehension (35 sources), assessment (2 sources), metacognition (8 sources), vocabulary (23 sources) and writing (17 sources). There were 18 sources coded as having *discipline-specific* strategies, defined as discussion of a strategy as it pertained to a specific discipline. For example, Binkley et al. (2011), in a study of three social studies teachers and their PD for integrating literacy strategies in their curriculum, found reading in social studies focused on viewing the text in light of the author's perspective. Boyd et al. (2012) similarly discussed vocabulary instruction as it relates to the specific culture of history, calling it a "stepping-stone to historical inquiry" (p. 19), whereas Carpenter et al. (2015) discussed how one might focus upon

language in history through critical language awareness. However, such discussion of discipline-specific literacies was limited and reflects the need expressed in a year-long study of PD on disciplinary literacy by Cantrell et al. (2008). They found teachers had limited understanding of how literacy practices might be content specific even after "extended content literacy training" (Cantrell et al., 2008, p. 84) and pointed to a need for further PD of teachers on discipline-specific literacies, a gap demonstrated in this review by the dearth of research on both discipline-specific literacy strategies and the training of teachers to teach such strategies.

In addition to the strategies teachers implemented, several initial codes related to how teachers taught these strategies, such as the codes for *hands-on instruction, homework*, and *teacher enactment of strategies.* Oliveira et al. (2013) looked at seven middle schools with high student performance compared to three average-performing schools in a mixed-methods study. These authors found best practice when middle-school science included hands-on instruction, defined as relevant to students' lives and inclusive of guided science inquiry, as well as limited class time devoted to reviewing student homework. Another practice of high-performing science teachers was the inclusion of "literacy-building" (p. 313) approaches in their science instruction. Adams and Pegg (2012) found in their qualitative study of 26 teachers receiving PD on the integration of science, mathematics, and literacy over a two-year period that teachers applied disciplinary literacy strategies in three distinct patterns: rehearsal, reorganizational, or transitional. They define rehearsal as revisiting content material,

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reorganizational as helping students develop conceptual understandings (i.e., not just understanding, but personally connecting to content), and transitional as combining the previous two to aim for a conceptual understanding. These studies show it is not enough to identify and deliver discipline specific strategies to teachers, but PD should also focus on teachers' goals for students' literacy learning and how their enactment of strategies may differ depending upon these goals. In other words, shifting teacher practice not only requires knowledge of what disciplinary literacy is and how literacy practices are defined in their discipline, but may also include "shifts in previous instructional patterns" (Adams & Pegg 2012, p. 159). This differentiation in the enactment of disciplinary literacy was echoed in multiple studies (Clary et al., 2012; Ness, 2007; Strahan et al., 2010; Wardrip et al., 2015; Wilson et al., 2009). Wardrip et al. (2015) discussed the need for the "*deprivatizing of practice*" (p. 452) for teachers to learn from each other across disciplines how these strategies might differ depending on enactment that takes into consideration such variables as content, pacing, and the success of potential strategies. This need to acknowledge the variation in enactment of disciplinary strategies seems to support the vision of the culture of disciplinary literacy rather than general strategies that can be systematically enacted across disciplines.

Differentiation and Disciplinary Literacy

Whereas the previous section discussed how teacher enactment may affect the culture of disciplinary literacy, multiple sources emphasized the influence

of the varying needs of students. For example, eight sources focused on ELLs. Meltzer and Hamann (2006) discussed the skyrocketing enrollment of ELLs as well as an increased realization that all teachers were responsible for student literacy. School leaders were realizing the need to address all students' disciplinary literacy whether they were "monolingual, bilingual, or trilingual speakers" (Meltzer & Hamann, 2006, p. 23) with resources, such as PD, that remain limited. Lee and Buxton (2013) discussed a double burden ELL teachers face when developing English language and literacy as well as academic learning across the curriculum. These teachers require five areas of support: (a) content area strategies, (b) language support strategies, (c) discourse strategies, (d) home language support, and (e) developing home culture. Their research found that while PD has begun to give teachers needed support for their content knowledge, support was not available for language development of ELLs. This language development also has specific purposes as discussed by Gebhard (2010, p. 798):

> (1) construct ideas (e.g., everyday versus disciplinary conceptions of phenomena and events); (2) manage and organize the flow of information depending on whether interactions take place orally, in writing, or through computer-mediated modes; and (3) enact relationships (e.g., differences of familiarity and status).

Thus, this academic language development is quite complex and is a challenge for even ELL students with specific support from language specialists (Schleppegrell & O'Hallaron, 2011). As most of ELL language instruction will take place in general education classrooms, mainstream teachers need more support. In a discussion of policy needed to support states' strategies for improving adolescent literacy, Snow et al. (2008) discussed literacy

initiatives such as Reading First, which was a federal funding initiative available to the states to prepare students for both primary and post-primary literacy demands. One of the needs these researchers included in their PD that went beyond the guidance of Reading First was the inclusion of how to address demographic changes such as the rising number of ELL students. Such training is needed as several studies found teaching literacy to students with differentiated needs was a common struggle for teachers and research addressing this need was limited (Jones & Lee, 2014; Lewis et al., 2007; Meltzer & Hamann, 2006). The importance of addressing support for teachers to differentiate their disciplinary literacy instruction was shown in Oliveira et al. (2013); they found differentiated instruction enhanced science learning and achievement. In order to see how impactful disciplinary literacy is for students of all levels, measures are also needed, which is discussed subsequently.

Measures of Disciplinary Literacy

Two areas emerged related to the focused code *measures in disciplinary literacy*: measures needed in professional development and measures showing change from PD. In the measures needed in PD, both assessment and standards were key areas discussed. Regarding assessment, Biancarosa (2012) summed up what other sources mentioned with a strong statement: "Currently, good formative and summative assessment of disciplinary literacy and digital literacy do not exist" (p. 27). This data is needed to make informed decisions about disciplinary literacy policy, implementation, and PD (Biancarosa, 2012; Binkley et al., 2011). Butler et al. (2015) suggested that when teachers are involved in developing these assessments, it is an integral part of their PD. Learning about these assessments should entail defining indicators of assessment, shared responsibility in assessment creation,

methods for tracking literacy development, and understanding the various types of formative and summative assessment (Butler et al., 2015; Gilles et al., 2013). In addition, PD should be given on how to tailor these assessments to students of varying ability levels and needs. For example, Meltzer and Hamann (2006) discussed the need for designing assessments that differentiate between students' knowledge of content versus their knowledge of the structure of the assessment itself for ELLs. Another example of success with designing assessments as a critical component of disciplinary literacy PD is Taylor and Gordon (2014), who found designing learning scales helped both students to monitor their own learning and teachers to adjust their instruction.

Analysis also revealed the negative consequences of assessing teachers on their PD learning. Rush (2013) and Butler et al. (2015) described how when teachers felt data was used to assess their performance, it could "derail" (Butler et al., 2015, p. 19) both the PD and teachers' relationships with leaders such as literacy coaches. Rush (2013) and Strahan et al. (2010) noted the need to clarify, both in PD and in teaching collaborations, the literacy coach's role and whether that would include evaluation of a teacher, as this component of coaching was often in tension with the success of the coaching model. Although multiple sources discussed the need for common assessment of disciplinary literacy, high-stakes tests were not an answer to this need. Schoenbach et al. (2010) suggested that high-stakes testing may work against disciplinary literacy as these assessments force teachers to rush to cover content rather than contemplate the practices of a given discipline. Jones and Lee (2014) and Ness (2007) echoed the effect

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these assessments have on teachers focusing on breadth of content material over depth.

Another area related to measures needed in the PD of disciplinary literacy for teachers was standards. Sources discussing the Common Core State Standards were influential in acknowledging the need for disciplinary literacy as they called for literacy in specific content areas (Duguay, 2012; Gilles et al., 2013; Girard & Harris, 2012; Zygouris-Coe, 2012). However, there was also concern the strict adherence to these standards could lead teachers to focus too heavily on covering content and not enough on the needs of individual students (Clary et al., 2012; Duguay 2012). In addition, some teachers' "pre-existing notions about content standards and curriculum mandates" led them to feel constraints about their own agency (Clary et al., 2012, p. 34). Overall, Lewis et al. (2007) discussed the need for these standards and their call for the teaching of specific literacies within various disciplines to be a catalyst for needed PD.

In addition to the need to include assessment as a component of disciplinary literacy PD, sources also discussed how to measure growth from such PD. These measures included shifts in teacher learning, student outcomes, and teacher self-efficacy. Studies such as Cantrell et al. (2008) seem to demonstrate that PD is a necessary part of disciplinary literacy in order for teachers to understand how to integrate content and literacy. This study used interview data to study middle and high-school teachers' perceptions of a year-long PD focused on content literacy. They found 64% of teachers reported significant shifts in learning from viewing themselves as teachers of content to seeing themselves as both content and literacy teachers.

Other shifts for teachers included understanding the process of reading and dispelling the notion the reading process occurs naturally. This type of training is needed as another study found that secondary content teachers, including English, math, social studies, and science, did not understand the reading process or how to teach this process with specific strategies prior to PD (Clary et al., 2012). This PD was important as teachers also demonstrated a deficit view of students prior to the PD, often blaming them for not wanting to read and write. Shifts in teacher learning showed them overcoming this deficit view once they had more reported understanding of literacy strategies, student needs, and the need for adolescent literacy. Thibodeau (2008) observed other measures of teacher learning including:

> increased knowledge about literacy, increased capacity for the integration of new instructional techniques, increased feelings of self-efficacy, increased motivation for the changes required by the instructional innovation, and the ability to sustain the effort the changes required over the long-term (p. 59).

Wilson et al. (2009), in a study of a yearlong PD of a content literacy framework, described metacognitive thinking as a measure of teacher learning.

Butler et al. (2015) defined teacher self-efficacy as the belief "in their ability to achieve particular outcomes in particular circumstances" (p. 5). Twenty-four of the 58 (41%) sources analyzed discussed self-efficacy as a measure of learning. Self-efficacy for teachers is an important concept in disciplinary literacy due to the need to understand each specific discipline's content and culture. However, such self-efficacy is often lacking. Girard and Harris (2012) found that even teachers holding an undergraduate degree in their discipline may not feel that their expertise is adequate. When provided PD however, Butler et al. (2015) found large gains in self-efficacy as 90% of participants described an increase in efficacy, with over half of these participants specifying these gains in the areas of competence, confidence, or control. This success came in part because of collaborative inquiry with their colleagues and a stronger foundation in theory and principles of knowledge. However, Cantrell et al. (2008) found this self-efficacy varied when student need was also considered. For example, although 64% of their participants felt better equipped to teach literacy to most students, 68% expressed uncertainty in teaching students with reading difficulties. Duguay (2012) and Lee and Buxton (2013) also noted that without PD, content area teachers were likely to feel ill prepared to teach ELLs. Gilles et al. (2013), in a study of middle school teachers asked to identify their own reading practices in their disciplines, found teachers thinking metacognitively about themselves as readers helped overcome limited self-efficacy with content literacy practices. Michelson and Bailey (2016) also emphasized the need for content area teachers to understand their reading processes within their discipline and stated that because this is lacking, it is often hard for them to teach such processes to students. Styslinger et al. (2015) increased teacher efficacy in this area by having teachers model for one another, as this gave teachers an environment to "live literacy in the safe company of colleagues" (p. 477).

Student outcomes are another measure of growth for PD on disciplinary literacy. Studies such as De La Paz et al. (2014), in which the authors studied PD on a cognitive apprenticeship intervention and its influence upon middle school students' ability to write historical arguments, showed teachers receiving PD had students with statistically significant gains in the areas of historical argument writing and essay length over a control group

without such PD. The teachers with higher fidelity to the PD had students with more significant gains, although all teachers with the PD had students improve more than the control group. Other studies such as Taylor and Gordon (2014), in a study of collaborative ongoing PD, also showed gains for adolescent literacy, but with other student measures such as reading proficiency. Although such studies show PD on disciplinary literacy has the potential to influence both teaching and student learning, more studies are needed that focus on student outcomes when examining PD related to disciplinary literacy (McDonald et al., 2008). This need is not just specific to disciplinary literacy, however, as research has found gaps in other education literature suggesting more attention be paid to PD and student outcomes (Borko, 2004; Collopy, 2008; Howell et al., 2017). Lee and Buxton (2013) discussed the need for more research on increasing teacher content knowledge and delivering that content so that it supports student achievement. Understanding student outcomes is important not only to understand the influence of PD, but also for teacher buy-in and designing future PD (Thibodeau, 2008; Wardrip et al., 2015). It is vital for teachers to see the impact of student learning to understand the relevance of the PD, and a "focus on student learning is central to maintaining focus on students" (Wardrip et al., 2015, p. 449). When considering these student outcomes, it is also important to remember they are context-dependent (Oliveira et al., 2013).

Professional Development Model

Desimone (2009) found research supports the following essential features of effective professional development overall: content focus, active learning, coherence, duration, and collective participation. In PD specific to disciplinary literacy, the element of duration is one focus. The studies of this review paid particular attention to offering more than what

Sulzer et al. (2002, p. 38) described as "sit and get" PD, in which teachers are given a one-time PD. Instead, the majority of sources included description of systemic, sustained PD including workshops or in-services followed by additional training including classroom visits, coaching, and hands-participation (Adams & Pegg 2012; Cantrell et al., 2008; De La Paz et al., 2014; Gold et al., 2011; Townsend, 2015). However, De La Paz et al. (2014) noted that despite this drive for sustained PD efforts, there were times when its implementation was limited by constraints from school or district officials.

Other noteworthy approaches to sustaining PD included using *rounds* (Gold et al., 2011) and *observation-reflection cycles* (Townsend,2015). Gold et al. (2011) studied PD aimed at improving literacy in Philadelphia's high schools. Part of this framework included *rounds*, which were defined as "the practice of teachers visiting each other's classrooms in order to observe, share and form professional communities of practice" (p. i). They found this PD element was important in sustaining the knowledge teachers gained in other PD opportunities. To extend PD given in workshops, Townsend (2015) implemented *observation-reflection cycles*: "In each cycle, a university researcher would observe and video-record one of the teachers teaching a lesson. The teacher would watch the recording, and a follow-up reflection would take place" (p. 381). They noted such individual attention was needed as teachers no longer adopted common strategies across disciplines but integrated strategies as needed to their own teaching ecology. As literacy practice is changing, so must its PD change and help teachers "come closer to approximating an apprenticeship model in the disciplines" (Townsend, 2015, p. 387). Several sources including Cantrell et al. (2008) and Biancarosa (2012) echoed this call to change PD related to disciplinary literacy so it reflects practices embedded in disciplines. Other commonalities in

the PD for disciplinary literacy included a call for inquiry (Butler et al., 2015; Fancsali et al., 2007; Ness 2007), need for collaborative models (Binkley et al., 2011; Cantrell et al., 2008; Dobbs et al., 2016; Sulzer et al., 2002), and the inclusion of literacy coaching as part of the model (Campbell & Sweiss, 2010; Cantrell et al., 2008).

Of the 47 sources describing various types of PD models related to disciplinary literacy, only 5 described online efforts of implementing PD. Although research has noted the struggles with implementing PD online and its dependence upon context (see Hunt-Barron et al., 2015), we were surprised that in an increasingly digital age, there was not more discussion of the affordances and challenges of this type of implementation, and this is an area where further research seems warranted. These few studies included Lewis et al. (2007) who discussed state-wide efforts, such as those in North Carolina, to provide PD options related to disciplinary literacy in the form of online courses for content area teachers. Others discussed online PD efforts as an approach to sustaining the learning from PD (Adams & Pegg 2012; Lannin et al., 2014). Participants in Lannin et al.'s (2014) study of content area writing used a class Ning, or social networking platform, as a way to continue collaboration begun in the PD. Adams and Pegg (2012) used technology in the form of a project website as a platform for participants to access PD resources as well as a discussion platform. In Styslinger et al. (2015), selected teachers blogged about their PD, giving rural teachers flexibility as well as room to go beyond their school environment in their learning. Alvermann et al. (2011) was the singular study that did not discuss digital tools in terms of an extension of conventionally delivered PD; instead, they observed online pedagogical training in the form of nine modules in which participants used disciplinary knowledge as a way to approach instructional strategies appropriate for their pedagogical context.

Collaboration was one of the most commonly reported critical features of PD for disciplinary literacy. Collaboration occurred in many forms with teachers, coaches, and researchers learning from one another through modeling, supporting one another, and sharing knowledge (Binkley et al., 2011; Jones & Lee, 2014). Collaboration occurred across peers, teams, and with coaches (Cantrell et al., 2008). In addition, studies discussed the necessity that collaboration occur within a discipline and across disciplines to overcome the isolation teachers, especially secondary teachers, often faced (Clary et al., 2012; Ippolito et al., 2014; Thibodeau, 2008; Wardrip et al., 2015). In Jones and Lee (2014), participants rated 13 forms of PD; a common reason for rating PD types highly was collaboration with colleagues. Another study suggested such collaboration can have positive influences on teacher practice related to content literacy, student performance, and for the school as a whole (Thibodeau, 2008). However, Dobbs et al. (2016) noted that those collaborating might have different priorities, some focusing on products, such as lesson planning and assessment, while others more on processes, such as how to use planning meetings. Regardless, effective leadership is needed to guide collaboration to be inclusive of both the process and products of orienting the collaboration of teachers beyond their individual classrooms. This learning to work together may be a point of PD on its own, does not form inadvertently (Michelson & Bailey, 2016), and is especially needed in secondary settings (Styslinger et al., 2015).

Discussion

In reviewing the four focused codes discussed, we saw theoretical codes emerge demonstrating both successes and challenges in disciplinary literacy with implications for the future. These theoretical codes help us address our second research question: What

are the implications for the future needs of teachers regarding PD and disciplinary literacy? Thus, in the following section, we will discuss these successes, including the recognition of needs in disciplinary literacy and a willingness to collaborate, followed by the challenges that remain, specifically, how disciplinary literacy might be further contextualized and integrated.

Successes in Recognizing Needs and Forging Collaborations

Part of the success of reviewed research is the recognition that disciplinary literacy must entail standards and measures of progress toward those standards, although there are certainly those that dispute how those standards and measures are implemented (e.g., Burke, 2016). The Common Core State Standards are inclusive of disciplinary literacy (Duguay, 2012; Gilles et al., 2013; Zygouris-Coe, 2012), which may serve as a catalyst for needed PD of teachers on the teaching of disciplinary literacy. Yet, to understand how and what progress is being made toward these standards, the field is in need of measures of disciplinary literacy (Biancarosa, 2012). While high-stakes testing can have detrimental influence upon disciplinary literacy (Schoenbach et al., 2010), effective formative and summative assessments are needed not only to understand students' learning, but also to gauge teacher learning (Butler et al., 2015; Gilles et al., 2013). Developing these needed assessments may be an effective and needed form of PD for disciplinary literacy (Butler et al., 2015). In assessments, disciplinary instruction, and PD overall, more attention is needed to differentiate for the local ecologies of classrooms, including populations such as ELLs (Lee & Buxton, 2013; Meltzer & Hamann, 2006; Snow et al., 2008).

> **"Collaboration is especially important to help teachers and literacy coaches integrate disciplinary literacy and overcome the lagging self-efficacy needed to integrate content and pedagogical knowledge."**

Another strength of disciplinary literacy integration and the PD of teachers is the focus on collaboration. The research available on PD as it related to disciplinary literacy discussed the varying roles and relationships integral to such work. These roles were addressed in PD models that were not one-time attempts at teacher development (Sulzer et al., 2002). These collaborations were important between figures within schools such as literacy coaches, PD administrators, school leadership, and teachers, in addition to between schools and institutes of higher education and between research partners (Clary et al., 2012). Collaboration is especially important to help teachers and literacy coaches integrate disciplinary literacy and overcome the lagging self-efficacy needed to integrate content and pedagogical knowledge (Strahan et al., 2010). School leadership has both direct and indirect effects on teachers' disciplinary literacy, and more research is needed, in particular, on those indirect influences (Oliveira et al., 2013). In addition, studies may address how research partners can become part of the PD of teachers' disciplinary literacy. Wardrip et al. (2015) suggested this possibility but stated that research on such partnerships and their influence on teacher development are limited.

Challenges to Context and Integration

Moje (2015) encouraged the understanding of disciplinary literacy as more than the practices within a subject or content area. Rather, Moje suggested that disciplinary literacy is understanding disciplines as cultures and subcultures not only

requiring a knowledge of literacy practices, but also of the emotions, values, and interactions of these cultures. Thus, this robust definition rejected looking at either the domains or the practices within those domains in silos. However, this approach is not currently reflected in the literature and is therefore a gap in how we are preparing teachers to enact disciplinary literacy. Not only was disciplinary literacy compartmentalized as it was typically addressed in social studies, mathematics, science or English/language arts, but this instruction also focused on strategies specific to standards in subject areas rather than the disciplinary practices. The majority of sources addressing disciplinary literacy focused on strategies for learning vocabulary, comprehension, and other discrete skills rather than how one might approach those skills based upon the culture of the discipline. Although sources demonstrated potential of such an approach (Binkley et al., 2011; Boyd et al., 2012), they also noted that even once teachers had received PD, they still struggled to see how literacy practices might be discipline specific (Cantrell et al., 2008). Thus, an area of further research is not only what literacy practices are discipline specific, but how to teach these strategies, and how to structure PD so teachers retain such practices. This suggests PD requires shifts in instructional practice, with PD delivered in ways that make disciplinary teaching less opaque and increasingly contextual.

Finally, there is a need in the PD of teachers of disciplinary literacy to integrate their training across contexts of pedagogical content knowledge. As previously mentioned, research informing teachers about disciplinary literacy was limited to core subject areas and missing from this research was how disciplinary literacy could be enacted across disciplines. When such efforts are made, research has shown that it helps create a literacy culture in education that is currently lacking (Sulzer et al., 2002; Wardrip et al., 2015). Yet teachers report that they are not receiving training that brings disciplines together (Thibodeau, 2008). Also, missing from this discussion was how the digital realm is related to disciplinary literacy and its PD. Technology was neither addressed in how it is used to further disciplinary literacy nor how it might be utilized to develop PD on disciplinary literacy. The research needed regarding digital and disciplinary literacy must go beyond its limited recognition of a need for more digital inclusion and address how such implementation is to occur as an integrated part of the culture of the discipline. Teachers' struggle with this integration is documented by studies such as Hutchison and Reinking (2011). Efforts to build such a research base are underway from journals such as *Journal of Adolescent and Adult Literacy*. In their column on bridging digital and disciplinary literacies, Manderino and Castek (2016) described the need for such knowledge for students: "Learners' ability to use the Internet's networking and knowledge-building resources is only as good as their skills in disciplinary inquiry: asking questions, constructing meaning from data, generating creative solutions, and reflecting on how to improve these solutions for different contexts" (p. 79). In addition, to both extend and support conventional PD and as a means of delivering PD to teachers, there needs to be further research into technology as a component of disciplinary PD (Adams & Pegg, 2012; Alvermann 2011; Howell et al., 2021).

> **"The research needed regarding digital and disciplinary literacy must go beyond its limited recognition of a need for more digital inclusion and address how such implementation is to occur as an integrated part of the culture of the discipline."**

Limitations

The method of systematic reviews has the benefit of exploring barriers, strengths, and needs in a certain area, but by focusing on one area, there enters a weakness: by applying specific search criteria, more holistic research on the topics may be excluded (Grant & Booth, 2009). Thus, we purposely sought to understand the crossroads of disciplinary literacy and professional development for in-service teachers. Yet, by focusing on this intersection, we acknowledge research important to both professional development and disciplinary literacy may have been missed. Furthermore, we acknowledge, as others do (see Brozo et al., 2013), that this review is a necessary continuation of the relatively new field of disciplinary literacy, and we hope it consolidates past research and incites needed research for the future.

Conclusion

Moje (2015) concluded a framework for disciplinary literacy with a call for professional development: "Finally, teachers need both teaching and planning time and professional learning supports to enact demanding disciplinary literacy teaching practices"

(p. 273). Although experts disagree on the definition of disciplinary literacy, especially as it relates to content area literacy (cf., Dunkerly-Bean & Bean 2016; Shannahan, 2017), there is agreement that more PD is needed for teachers enacting literacy strategies specific to their disciplines (Dunkerly-Bean & Bean, 2016; Moje, 2015). While there are several conceptual arguments that focus on the *what* of disciplinary literacies and give detailed history of what encapsulates the definition of disciplinary literacy (Dunkerly-Bean & Bean, 2016; Moje, 2015), that work does not focus on *how* to prepare teachers to face the implementation of such instruction. We discuss the successes and challenges of PD related to disciplinary literacy, with particular focus on the *how*—the need to show teachers how to integrate strategies and differentiate instruction, calls for measures, the structure of past and potential PD, and collaboration to support teachers—with the hope that this synthesis of research will provoke intentional design of more PD for teachers. We hope that disciplinary literacy PD in turn drives positive student outcomes as some research has already begun to suggest (De La Paz et al., 2014; Taylor & Gordon, 2014).

References

Adams, A.E., & Pegg, J. (2012). Teachers' enactment of content literacy strategies in secondary science and mathematics classes. *Journal of Adolescent & Adult Literacy*, *56*(2), 151-161. https://doi.org/10.1002/JAAL.00116

Alvermann, D., Friese, E., Beckmann, S., & Rezak, A. (2011). Content area reading pedagogy and domain knowledge: a Bourdieusian analysis. *The Australian Educational Researcher*, *38*(2), 203-220.

Biancarosa, G. (2012). Adolescent literacy: More than remediation. *Educational Leadership, 69*(6), 22-27.

Binkley, R., Keiser, M., & Strahan, D. (2011). Connected coaching: How three middle school teachers responded to the challenge to integrate social studies and literacy. *Journal of Social Studies Research*, *35*(2), 131-163.

Boardman, A.G., Klingner, J.K., Buckley, P., Annamma, S., & Lasser, C.J. (2015). The efficacy of collaborative strategic reading in middle school science and social studies classes. *Reading and Writing*, *28*(9), 1257-1283. https://doi.org/10.1007/s11145-015-9570-3

Borko, H. (2004). Professional development and teacher learning: Mapping the terrain. *Educational Researcher*, *33*(8), 3-15.

Boyd, F.B., Sullivan, M.P., Popp, J.S., & Hughes, M. (2012). Vocabulary instruction in the disciplines. *Journal of Adolescent & Adult Literacy*, *56*(1), 18-20. https://doi.org/10.1002/JAAL.00097

Brozo, W., Moorman, G., Meyer, C., & Stewart, T. (2013). Content area reading and disciplinary literacy: A case for the radical center. *Journal of Adolescent & Adult Literacy*, *56*(5), 353–357. https://doi.org/10.1002/jaal.153

Burke, L., McCluskey, N., Williamson, E., Rebarber, T., & Estrada, W. (2016). *Common core and the centralization of American education.* The Heritage Foundation.

Butler, D.L., Schnellert, L., & MacNeil, K. (2015). Collaborative inquiry and distributed agency in educational change: A case study of a multi-level community of inquiry. *Journal of Educational Change*, *16*(1), 1-26. https://doi.org/10.1007/s10833-014-9227-z

Campbell, M.B., & Sweiss, C.I. (2010). The secondary literacy coaching model: Centrality of the standards and emerging paradigms. *Journal of Reading Education*, *35*(3), 39-46.

Cantrell, S., Burns, L., & Callaway, P. (2008). Middle- and high-school content area teachers' perceptions about literacy teaching and learning. *Literacy Research and Instruction*, *48*(1), 76-94. https://doi.org/10.1080/19388070802434899

Carpenter, B.D., Achugar, M., Walter, D., & Earhart, M. (2015). Developing teachers' critical language awareness: A case study of guided participation. *Linguistics and Education*, *32*, 82-97. https://doi.org/10.1016/j.linged.2015.03.016

Cervetti, B., Barber, J., Dorph, R., Pearson, P., & Goldschmidt, P. (2012). The impact of an integrated approach to science and literacy in elementary school classrooms. *Journal of Research in Science Teaching*, *49*(5), 631–658. https://doi.org/10.1002/tea.21015

Charmaz, K. (2014). *Constructing grounded theory*. Sage.

Clark, L., Majumdar, S., Bhattacharjee, J., & Hanks, A.C. (2015). Creating an atmosphere for stem literacy in the rural south through student-collected weather data. *Journal of Geoscience Education*, *63*(2), 105-115.

Clary, D. M., Styslinger, M. E., & Oglan, V. A. (2012). Literacy learning communities in partnership. *School-University Partnerships, 5*(1), 28-39.

Collopy, R. M. (2008). Professional development and student growth in writing. *Journal of Research in Childhood Education, 23*(2), 163-178.

Darling-Hammond, L., Hyler, M. E., & Gardner, M. (2017). *Effective teacher professional development.* Learning Policy Institute. https://learningpolicyinstitute.org/sites/default/files/product-files/Effective_Teacher_Professional_Development_REPORT.pdf.

De La Paz, S., Felton, M., Monte-Sano, C., Croninger, R., Jackson, C. Deogracias, J. S., & Hoffman, B. P. (2014). Developing historical reading and writing with adolescent readers: Effects on student learning. *Theory and Research in Social Education, 42*(2), 228-274. https://doi.org/10.1080/00933104.2014.908754

DeFrance, N. L., & Fahrenbruck, M. L. (2016). Constructing a plan for text-based Discussion. *Journal of Adolescent and Adult Literacy*, *59*(5), 575-585. https://doi.org/10.1002/jaal.477

Desimone, L. M. (2009). Improving impact studies of teachers' PD: Toward better conceptualizations and measures. *Educational Researcher, 3*(38), 181-199. https://doi.org/10.3102/0013189X08331140

Dobbs, C. L., Ippolito, J., & Charner-Laird, M. (2016). Creative tension: Turn the challenges of learning together into opportunities. *Journal of Staff Development*, *37*(6), 28-31.

Duguay, A. (2012). *CREATE: A comprehensive model for instruction of academic language and literacy in the content areas.* Center For Research on The Educational Achievement and Teaching of English Language Learners.

Dunkerly-Bean, J., & Bean, T. (2016). Missing the *savoir* for the *connaissance*: Disciplinary and content area literacy as regimes of truth. *Journal of Literacy Research, 48(*4), 448-475. https://doi.org/10.1177/1086296X16674988

Fancsali, C., Jacobs, L., & Weinbaum, A. (2007). *Building capacity for professional development in adolescent reading: The National Writing Project's national reading initiative (Evaluation Summary Report 2003-2006).* Academy for Educational Development.

Fang, Z. (2014). Preparing content area teachers for disciplinary literacy instruction: The role of literacy teacher educators. *Journal of Adolescent and Adult Literacy*, *57*(6), 444-448. https://doi.org/10.1002/jaal.269

Frey, N. (2006). 'We can't afford to rest on our laurels': Creating a district-wide content literacy instructional plan. *NASSP Bulletin*, *90*(1), 37-48. https://doi.org/10.1177/0192636505283862

Gebhard, M. (2010). Teacher education in changing times: A systemic functional linguistics (SFL) perspective. *TESOL Quarterly*, *44*(4), 797-803. https://doi.org/10.5054/tq.2010.237335

Gilles, C., Wang, Y., Smith, J., & Johnson, D. (2013). 'I'm no longer just teaching history.' PD for teaching Common Core State Standards for literacy in social studies. *Middle School Journal, 44*(3), 34-43.

Girard, B., & Harris, L. M. (2012). Striving for disciplinary literacy instruction: Cognitive tools in a world history course. *Theory and Research in Social Education*, *40*(3), 230-259. https://doi.org/10.1080/00933104.2012.705183

Gold, E., Edmunds, K., Maluk, H., & Reumann-Moore, R. (2011). Boosting adolescent and young adult literacy: An examination of literacy teaching and learning in Philadelphia's accelerated high schools. *Research for Action*.

Grant, M., & Booth, A. (2009). A typology of reviews: an analysis of 14 review types and associated methodologies. *Health Information and Libraries Journal*, *26*(2), 91–108. https://doi.org/10.1111/j.1471-1842.2009.00848.x

Gross, P. A. (2010). Not another trend: Secondary-level literacy coaching. *The Clearing House: A Journal of Educational Strategies, Issues, And Ideas, 83*(4), 133-137. https://doi.org/10.1080/00098651003774844

Gutchewsky, K., & Curran, J. (2012). Supporting older students' reading. *Educational Leadership, 69*.

Hillman, A. M. (2014). A literature review on disciplinary literacy. *Journal of Adolescent and Adult Literacy, 57*(5), 397-406. https://doi.org/10.1002/jaal.256

Hinchman, O., & O'Brien, D.G. (2019). Disciplinary literacy: From infusion to hybridity. *Journal of Literacy Research*, *51*(4), 525–536. https://doi.org/10.1177/1086296X19876986

Howell, E., Hunt-Barron, S., Kaminski, R., & Sanders, R. (2017). Teaching argumentative writing to teachers and students: Effects of professional development. *Professional Development in Education, 44*(2), 169-189. https://10.1080/19415257.2016.1272478

Howell, E., Perez, S., & Abraham, W. (2021). Toward a professional development model for writing as a digital, participatory process. *Reading Research Quarterly*, *56*(1), 95–117. https://doi.org/10.1002/rrq.294

Hunt-Barron, S., Tracy, K. N., Howell, E., & Kaminski, R. (2015). Obstacles to enhancing professional development with digital tools in rural landscapes. *Journal of Research in Rural Education*, *30*(2), 1-14.

Hutchison, A., & Reinking, D. (2011). Teachers' perceptions of integrating information and communication technologies into literacy instruction: A national survey in the United States. *Reading Research Quarterly*, *46*(4), 312-333. https://doi.org/10.1002/RRQ.002

Ippolito, J., Dobbs, C. L., & Charner-Laird, M. (2014). Bridge builders: Teacher leaders forge connections and bridge coherence to literacy initiative. *Journal of Staff Development, 35* (3), 22-26.

Ippolito, J., Dobbs, C. L., Charner-Laird, M., & Lawrence, J. F. (2016). Delicate layers of learning: Achieving disciplinary literacy requires continuous, collaborative adjustment. *Journal of Staff Development*, *37*(2), 34.

Jones, S. L., & Lee, E. A. (2014). Literacy-related PD preferences of secondary teachers. *Alberta Journal of Educational Research, 60*(2), 245-263.

Khan, K., Kunz, R., Kleijnen, J., & Antes, G. (2003). Five steps to conducting a systematic review. *Journal of the Royal Society of Medicine*, *96*(3), 118–121. https://doi.org/10.1258/jrsm.96.3.118

Kooman, M. H., Weaver, S., Blair, R. B., & Oberhauser, K. S. (2016). Disciplinary literacy in the science classroom. Using adaptive primary literature. *Journal of Research in Science Teaching, 53*(6), 847-894. https://doi.org/10.1002/tea.21317

Kosanovich, M. L., Reed, D. K., & Miller, D. H. (2010). *Bringing literacy strategies into content instruction: Professional Learning for Secondary-Level Teachers.* Portsmouth, NH: RMC Research Corporation, Center on Instruction.

Lannin, A. Kohnen, A., Kline, K., Singer, N., Stokers, V., & Knowles, A. (2014). From English language arts teacher to literacy expert: Reimagining our roles. *English Journal, 104*(2), 54-60.

Lee, O., & Buxton, C. A. (2013). Teacher PD to improve science and literacy achievement of English language learners. *Theory into Practice, 52*(2), 110-117. https://doi.org/10.1080/00405841.2013.770328

Lewis, K., McColskey, W., Anderson, K., Bowling, T., Dufford-Melendez, K., & Wynn, L. (2007). *Evidence-based decision-making: assessing reading across the curriculum interventions* (Issues and Answers Report, REL 2007–No. 003). U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Regional Educational Laboratory Southeast. http://ies.ed.gov/ncee/edlabs.

Manderino, M., & Castek, J. (2016). Digital literacies for disciplinary learning: A call to action. *Journal of Adolescent and Adult Literacy*, *60*(1), pp. 79-81. https://doi.org/10.1002/jaal.565

Margolis, J. (2008). When teachers face teachers: Listening to the resource 'right down the hall'. *Teaching Education*, *19*(4), 293. https://doi.org/10.1080/10476210802425628

McDonald, T., Thornley, C., Fitzpatrick, R., Elia, A., Stevens, S., Teulilo, G., & McDonald, L. (2008). *Developing teacher–researcher partnerships to investigate best practices: Literacy learning and teaching in content areas of the secondary school.* Teaching and Learning Research Initiative.

Meltzer, J., & Hamann, E. T. (2006). Double-duty literacy training. *Principal Leadership, 6*(6), 22-27.

Michelson, J., & Bailey, J. A. (2016). Common goal unites district: Leaders and teachers build literacy and a collective responsibility for student learning. *Journal of Staff Development*, *37*(2), 24-27.

Minor, E., Desimone, L., Lee, J., & Hochberg, E. D. (2016). Insights on how to shape teacher learning policy: The role of teacher content knowledge in explaining differential effects of professional development. *Education Policy Analysis Archives*, *24*(61), 1-34. 61. https://doi.org/10.14507/epaa.24.2365

Mizell, H. (2010). *Why professional development matters*. Learning Forward.

Moje, E. B. (2007). Developing socially just subject-matter instruction: A review of the literature on disciplinary literacy teaching. *Review of Research in Education, 31*(1), 1-44. https://doi.org/10.3102/009173X07399946

Moje, E. B. (2008). Foregrounding the disciplines in secondary literacy teaching and learning: A call for change. *Journal of Adolescent and Adult Literacy*. *52*(2)*,* 96-107. https://doi.org/10.1598/JAAL.52.2.1

Moje, E. B. (2015). Doing and teaching disciplinary literacy with adolescent learners: A social and cultural enterprise. *Harvard Educational Review, 85*(2), 254-278. https://doi.org/10.17763/0017-8055.85.2.254

Mucher, S. (2007). Building a culture of evidence through professional development. *The History Teacher*, *40*(2), 265-273.

National Governors Association Center (NGAC) for Best Practices and Council of Chief State School Officers (CCSSO). (2010). *Common Core State Standards for English language arts and literacy in history/social studies, science, and technical subjects*. Common Core Standards Initiatives. http://www.corestandards.org/ELA-Literacy

Ness, M. (2007). Reading comprehension strategies in secondary content area classrooms. *The Phi Delta Kappan, 89*(3), 229-231. https://doi.org/10.1177/003172170708900314

Nichols, W. D., Young, C. A., & Rickelman, R. J. (2007). Improving middle school professional development by examining middle school teachers' application of literacy strategies and instructional design. *Reading Psychology, 28*(1), 97-130. https://doi.org/10.1080/02702710601115497

O'Brien, D. G., & Stewart, R. A. (1990). Preservice teachers' perspectives on why every teacher is not a teacher of reading: A qualitative analysis. *Journal of Reading Behavior*, *22*(2), 101-129.

Oliveira, A. W., Wilcox, K. C., Angelis, J., Applebee, A. N., Amodeo, V., & Snyder, M. A. (2013). Best practice in middle-school science. *Journal of Science Teacher Education, 24*(2), 297-322. https://doi.org/10.1007/s10972-012-9293-0

Polkinghorne, F. W. (2013). Integrated reading literacy interventions (IRLIS): A mixed-method analysis of the perceived characteristics for effective PD. *The Journal of Research in Business Education*, *55*(2), 36-49.

Rafferty, C. D. (1994). Will it take content literacy to ensure implementation? *Contemporary Education*, *65*(2), 82-85.

Rush, L. S. (2013). Literacy coaching in Wyoming secondary schools: A situational analysis of roles in context. *Journal of Literacy Research, 45*(3), 267-294. https://doi.org/10.1177/1086296X13493039

Schleppegrell, M. J., & O'Hallaron, C. L. (2011). Teaching academic language in L2 secondary settings. *Annual Review of Applied Linguistics*, *31*, 3-18. https://doi.org/10.1017/S0267190511000067

Schoenbach, R., Greenleaf, C. L., & Hale, G. (2010). Framework fuels the need to read. *Journal of Staff Development, 31*(5), 38-42.

Shannahan, T. (2017, July 30). Don't let content area reading experts confuse you about disciplinary literacy. Shanahan on literacy [Web blog post]. http://www.shanahanonliteracy.com/blog/dont-let-content-area-reading-experts-confuse-you-about-disciplinary-literacy#sthash.U4Igt8sc.BQo4VsUu.dpbs

Shanahan, T., & Shanahan, C. (2008). Teaching disciplinary literacy to adolescents: rethinking content- area literacy. *Harvard Educational Review. 78*(1), 40-59. https://doi.org/10.17763/haer.78.1.v62444321p602101

Shulman, L. S. (1987). Knowledge and teaching: foundations of the new reform. *Harvard Educational Review, 57*(1), 1. https://doi.org/10.17763/haer.57.1.j463w79r56455411-23.

Snow, C. E., Martin, T., & Berman, I. (2008). State literacy plans: Incorporating adolescent literacy. *Harvard Educational Review, 78*(1), 211-230. https://doi.org/10.17763/haer.78.1.m96u215h587348hn

Strahan, D., Gietner, M., & Lodico, M. (2010). Collaborative PD toward literacy learning in a high school through connected coaching. *Teacher Development, 14*(4), 519-532. https://doi.org/10.1080/13664530.2010.533493

Styslinger, M. E., Clary, D. M., & Oglan, V. A. (2015). Motivating study groups across the disciplines in secondary schools. *Professional Development in Education*, *41*(3), 467-486. https://doi.org/10.1080/19415257.2014.901235

Sulzer, D., Wolfson, T., & Rabenburg, P. (2002). It takes a team to ensure literacy. *Principal Leadership (Middle School ed.)*, *2*(7), 35-39.

Taylor, R. T., & Gordon, W. R., III. (2014). 4 schools, 1 goal: University-district partnership nets results for struggling readers. *Journal of Staff Development, 35*(3), 16-20.

Thibodeau, G. M. (2008). A content literacy collaborative study group: High school teachers take charge of their professional learning. *Journal of Adolescent and Adult Literacy, 52* (1), 54-64. https://doi.org/10.1598/JAAL.52.1.6

Townsend, D. (2015). Who's using the language? Supporting middle school students with content area academic language. *Journal of Adolescent and Adult Literacy, 58*(5), 376-387. https://doi.org/10.1002/jaal.374

Vaughn, S., Klingner, J. K., & Bryant, D. P. (2001). Collaborative strategic reading as a means to enhance peer-mediated instruction for reading comprehension and content-area learning. *Remedial and Special Education, 22*(2), 66-74. https://doi.org/10.1177/074193250102200201

Wardrip, P., Gomez, L., & Gomez, K. (2015). We modify each other's lessons: The role of literacy work circles in developing professional community. *Teacher Development, 19* (4), 445-460. https://doi.org/10.1080/13664530.2015.1051186

Warner, A., & Myers, B. (2011). Agriscience teachers' concern profiles for content area reading strategies. *Journal of Agricultural Education, 52*(4), 109-122. https://doi.org/10.5032/jae.2011.04109

Wilson, N. S., Grisham, D. L., & Smetana, L. (2009). Investigating content area teachers' understanding of a content literacy framework: A yearlong PD initiative. *Journal of Adolescent and Adult Literacy, 52*(8), 708-718. https://doi.org/10.1598/JAAL.52.8.6

Woodard, R., & Kline, S. (2015). Moving beyond compliance: Promoting research-based professional discretion in the implementation of the Common Core State Standards in English Language Arts. *Mid-Western Educational Researcher*, *27*(3), 243-263.

Zygouris-Coe, V. I. (2012). Disciplinary literacy and the Common Core State Standards. *Topics in Language Disorders, 32*(1), 35-50.

Appendix A
Sources Included in Coding

Studies	Other Research (e.g., reviews, theoretical, practitioner, etc.)
Adams & Pegg (2012)	Biancarosa (2012)
Alvermann et al. (2011)	Boyd et al. (2012)
Binkley et al. (2011)	Fancsali et al. (2007)
Boardman et al. (2015).	Fang (2014)
Butler et al. (2015)	Gebhard (2010)
Campbell & Sweiss (2010)	Gutchewsky & Curran (2012)
Cantrell et al. (2008)	Kosanovich et al. (2010)
Carpenter et al. (2015)	Lannin et al. (2014)
Clark et al. (2015)	Lee & Buxton (2013)
Clary et al. (2012)	Lewis et al. (2007)
De La Paz et al. (2014)	Meltzer & Hamann (2006)
DeFrance & Fahrenbruck (2016).	Michelson & Bailey (2016)
Dobbs et al. (2016)	Ness (2007)
Duguay (2012)	Rafferty (1994)
Frey (2006)	Schlleppegrell & O'Hallaron (2011)
Gilles et al. (2013)	Schoenbach et al. (2010)
Girard & Harris (2012)	Snow et al. (2008)
Gold et al. (2011)	Sulzer et al. (2002)
Gross (2010)	Woodard & Kline (2015)
Ippolito et al. (2014)	
Ippolito et al. (2016)	
Jones & Lee (2014)	
Kooman et al. (2016)	
Margolis (2008)	
McDonald et al. (2008)	
Mucher (2007)	
Nichols et al. (2007)	
Oliveira et al. (2013)	
Polkinghorne (2013)	
Rush (2013)	
Strahan et al. (2010)	
Styslinger et al. (2015)	
Taylor & Gordon (2014)	
Thibodeau (2008)	
Townsend (2015)	
Vaughn et al. (2001)	
Wardrip et al. (2015)	

Warner & Myers (2011)	
Wilson et al. (2009)	

Appendix B

Initial Codes to Focused Codes

Disciplinary Literacy as Strategy Instruction

- Assessment Strategy, 2 sources
- Discipline-Specific Strategies, 18 sources
- General Comprehension Strategies, 35 sources
- Hands-on Instruction, 1 source
- Homework, 1 source
- Language Learning Strategy, 1 source
- Metacognition, 8 sources
- Teacher Enactment of Strategies, 9 sources
- Vocabulary Strategy, 23 sources
- Writing to Learn Strategy, 17 sources

Measures of Disciplinary Literacy

- Assessment, 29 sources
- Shift in Teacher Learning, 16 sources
- Standards, 24 sources
- Student Outcomes, 16 sources
- Teacher Self-Efficacy, 24 sources

Differentiation and Disciplinary Literacy

- Differentiation of Instruction, 7 sources
- English Language Learner, 8 sources

PD Model

- Collaboration, 32 sources
- Duration of PD, 24 sources
- PD Model, 51 sources