Pre-Service Teachers' Beliefs about and Knowledge of Literacy across the Disciplines

Jang, Bong Gee   Syracuse University
Department of Reading and Language Arts
Associate Professor (1st author)

Wiens, Peter   University of Nevada, Las Vegas
Department of Teaching and Learning
Associate Professor (Co-author)

Park, Sohee   Syracuse University
Department of Reading and Language Arts
Visiting Researcher (Corresponding author)

Meyer, Carla K.   Duquesne University
Department of Instruction and Leadership in Education
Associate Professor (Co-author)

I. Introduction

It has been widely documented in the United States that both pre-service and in-service teachers are often reluctant to address literacy in their content instruction (e.g., Draper et al., 2005; Hall, 2005; O'Brien et al., 1995; Simonson, 1995). Several underlying reasons foster the opposition. It is partially because the content literacy approach (O'Brien et al., 1995) was misinterpreted as a dominant movement of "every teacher [is] a teacher of reading" requiring content teachers to have the double-burden of content and literacy instruction. In addition, the traditional content literacy framework was often too general and disconnected from discipline-specific characteristics and needs (Shannahan & Shannahan, 2008). This resistance is somewhat problematic because many U.S. states have adopted the Common Core State Standards (CCSS), which emphasize literacy as the core of effective instruction across different subject areas and encourage all teachers to contribute to discipline-specific literacy development (Zygouris-Coe, 2012).

One notable trend in recent research has documented content-area teachers' beliefs about literacy across the disciplines (LAD) can be shaped by professional development and transfer with lasting impact on teachers' practices (e.g., Cantrell et al., 2008; Hall, 2005; Ka-

linowski et al., 2019; McCoss-Yergian & Krepps, 2010). In addition, teachers' beliefs were identified to support the development of their pedagogical and content knowledge about LAD (Bogard et al., 2017; Cantrell & Hughes, 2008; Wetzel et al., 2016). However, most of those findings were related only to one aspect, either beliefs or knowledge, and do not provide a more comprehensive picture of the relationship between beliefs and knowledge. In this regard, more research needs to be conducted regarding the detailed relationships among the LAD training, the pre-service teachers' beliefs, and their pedagogical knowledge about LAD.

In this study, we purposefully employ the term "literacy across the disciplines" instead of content literacy or disciplinary literacy. Content literacy is defined as "the ability to use reading and writing for the acquisition of new content in a given discipline" (McKenna & Robinson, 1990, p. 184). Shanahan and Shanahan (2008) conceptualized this content literacy as intermediate literacy, which needs to be mastered by the end of middle school. They suggested that high school students need to acquire more specialized, advanced, discipline-specific literacy strategies, which they termed as "disciplinary literacy". However, we believe that this dichotomous distinction between content literacy and disciplinary literacy may mislead subject teachers to believe that one can be taught separately from the other, which is impossible in any real classroom (Brozo et al., 2013). Further, neither framework includes both the similarities and the differences among different disciplines. Based on these concerns, this study adopts the notion of literacy across the disciplines from previous studies (Jang et al., 2018; O'Byrne et al., 2021; Scott et al., 2018) and defines it as "both general and discipline-specific literacy practices within and across academic domains" (Jang et al., 2018, p. 46).

The purpose of this study is to investigate the differences in elementary and secondary pre-service teachers' beliefs about and pedagogical content knowledge of LAD. Given the importance of using LAD strategies as tools for facilitating content learning, this study will

contribute to a better understanding of how to prepare pre-service teachers for more effective literacy instruction across subject areas and how to improve current teacher education programs and accreditation.

More specifically, this study investigated the following research questions:

- What are the differences in elementary and secondary pre-service teachers' beliefs about LAD among pre-service teachers previously enrolled in a LAD course, those who are currently enrolled, and those who have not enrolled?
  - Hypothesis: Pre-service teachers enrolled in both elementary and secondary teacher education programs will show more positive beliefs about LAD while taking, or after taking a LAD course.
- What are the differences in elementary and secondary preservice teachers' pedagogical content knowledge of LAD among preservice teachers previously enrolled in a LAD course, those who are currently enrolled, and those who have not enrolled?
  - Hypothesis: Pre-service teachers enrolled in both elementary and secondary teacher education programs will have more knowledge on LAD while or after taking a LAD course.

II. Background

1. Theoretical frameworks

1) Teacher beliefs theory

Theorizing why individuals enact a certain behavior, social psychologists have hypothesized that an individual's beliefs influence their performance of a specific behavior. Rokeach (1968) defined beliefs as "any simple proposition, conscious or unconscious, inferred from what a person says or does, capable of being preceded by the

phrase, 'I believe that ...'" (p. 113). Pajares (1992) revisited Rokeach's earlier conceptualization and defined beliefs as "an individual's judgment of the truth or falsity of a proposition" (p. 316). He explained that it is an important but challenging task to develop new educational beliefs in pre-service teachers because their beliefs had already been shaped during their time as K-12 students. Lortie (1975) described this process of forming educational beliefs as the apprenticeship of observation and this is why pre-service teachers often dismiss concepts introduced in university coursework in favor of previous experience/knowledge of teaching.

Buehl and Beck (2014) proposed a more comprehensive model of the relationship between teachers' beliefs and instructional practice. Based on the assumption that teachers' beliefs and practices mutually influence each other, they explained multiple factors as "supports or hindrances to teachers in implementing their beliefs" (p. 78). According to the model, teachers' beliefs are shaped and influenced by both internal (e.g., experience, knowledge, self-awareness, and self-reflection) and external factors (e.g., student ability, school culture and community, and education-related policies). The most notable implication of this model is that it clearly theorizes the influence of multi-layered external contexts such as classrooms, schools, districts, and state and national level factors. Among those multiple factors, this study focused on how their beliefs and knowledge were shaped by the training they received.

In the teacher education field, it has been widely known that teachers' beliefs influence teachers' implementation of new instructional practices (e.g., Jenkins, 2005; Power et al., 2006) and interactions with their students (e.g., Reeves, 2006). However, the concept of teachers' beliefs has often been used interchangeably with a related concept of teachers' attitudes, and the difference between the two concepts is unclear in many cases (e.g., McGaha & Linder, 2014; Tournaki & Samuels, 2016). As Richardson (1996) suggested, these two constructs can be differentiated in that attitudes are a teacher's emo-

tional and affective orientation toward an instructional practice, but beliefs are cognitive orientations toward it (e.g., Mahlios et al., 2008; Pajares, 1993). Further, beliefs are different from knowledge in that "knowledge refers to factual propositions and is subject to the standards of truth, whereas beliefs are suppositions, not subject to outside evaluation" (Turner et al., 2015, p. 361). In this regard, we note that the instrument used in this study, Vaughan (1977), measures teachers' beliefs on reading instruction across different disciplines although he titled the instrument teachers' attitudes toward teaching reading in content classrooms. All fifteen items in the scale require teachers to respond to each statement based on their cognitive orientation toward reading instruction in general and discipline-specific instruction.

2) Pedagogical Content Knowledge (PCK)

Shulman (1986; 1987) first coined the term, pedagogical content knowledge (PCK) and defined it as "that special amalgam of content and pedagogy that is uniquely the province of teachers, their special form of professional understanding" (Shulman, 1987, p. 8). Since then, literacy researchers have applied the PCK concept to literacy education and teacher preparation and investigated what types of PCK should be required for both prospective and in-service teachers.

Recent research has suggested that elementary teachers need appropriate levels of both content and pedagogical knowledge regarding reading to enhance their reading instruction (Anders et al., 2000; Fisher & Frey, 2014; Hoffman & Pearson, 2000; Snow et al., 2005). This PCK (Shulman, 1986; 1987) includes language structure, reading development, and effective instructional methods. Additionally, Snow et al. (2005) proposed that it is essential for every reading teacher to develop a deep professional knowledge of teaching reading situated in diverse and complex classroom contexts.

2. Previous research

1) Pre-service teachers' beliefs about LAD

Though some research has shown the differences of LAD instruction in changing pre-service teachers' beliefs about LAD (Hong-Nam & Swanson, 2011; Nourie & Lenski, 1998), there is a growing body of research in the area of pre-service teacher-training experiences that have shown positive belief shifts about LAD at both elementary and secondary levels. At the elementary level, Fang and Ashley (2004), Hong-Nam and Swanson (2011), and Leader-Janssen and Rankin-Erickson (2013) have documented mixed influences of models for literacy instruction to develop the beliefs of pre-service educators. For example, Hong-Nam and Swanson (2011) reported that pre-service teachers enrolled in elementary and early childhood education programs showed significant changes in their confidence in using content literacy strategies, but not in attitudes toward teaching reading after taking a content literacy course. In addition, Warren-Kring and Rutlege (2011) found a significant increase in reading comprehension of secondary students when pre-service teachers tutored them during a content literacy course; This coincided with improved attitudes toward content literacy of the pre-service teachers acting as tutors. This is noteworthy since Applegate and Applegate (2004) found that about 54% of the surveyed pre-service teachers (N=193) were unenthusiastic about reading. Further, Gritter (2010) explored how to best teach literacy within the content areas and found that content-area courses need to provide a context for pre-service secondary teachers where they can gain an understanding that "good content-area instruction rests on what students already know, what they need to know, and the literacy tools that enable students to close knowledge gaps" (p. 165).

As discussed above, effective pre-service teacher training, as well as effective field experiences (Daisey, 2012; Hall, 2005; Risko et al., 2008) can transform pre-service teachers' beliefs, which is needed in

an increasingly complex field, especially when those positive beliefs may be connected to increased pre-service teachers' knowledge of LAD. This study will contribute to the field by simultaneously examining both beliefs and knowledge development of pre-service teachers regarding LAD. Additionally, considering that most studies used a case study design focusing on a small number of specific participants (e.g., Carlson, 2015), we believe that the current study extends this line of research based on a larger sample size, including both elementary and secondary teacher candidates, using multivariate statistical analyses.

2) Pre-service teachers' knowledge of LAD

Hall (2005) explored how teacher educators could help secondary pre-service content-area teachers integrate reading instruction and found that LAD courses may result in pre-service teachers having more positive beliefs about LAD. She suggested that providing opportunities for pre-service teachers to practice teaching literacy in classrooms may help them see the benefits of LAD instruction. In addition, she concluded that one LAD course may not be adequate to prepare pre-service teachers, which may explain their doubt in their abilities and may result in a lack of transfer of positive beliefs, LAD knowledge, and implementation of LAD practices in their future classrooms.

There has been encouraging research since Hall conducted her analysis. Freedman and Carver (2007) found that when literacy becomes the content of secondary pre-service teachers' disciplinary instruction, it may help these novice educators grasp "the theory and concomitant practices [needed] to facilitate their secondary students' acquisition of content knowledge through increasingly sophisticated literacy development and use" (p. 664). For example, when pre-service teachers participated in a tutoring program for adolescents and were prompted to make connections between adolescent literacy and issues prevalent in urban school settings, their understanding of LAD increased (Conley et al., 2005). In addition, at the elementary level,

Fang and Ashely (2004) found that both pre-service teachers' LAD knowledge and their attitudes substantially increased when emerged in an intensive field-based experience.

Based on the RAND Reading Study Group's (2002) model of reading comprehension, Meyer (2013) coined the term, foundational knowledge regarding LAD, and defined it as "declarative knowledge needed by content-area teachers to design high-quality instruction" (p. 57). This foundational knowledge includes four key constructs: reader/writer, text, activity, and sociocultural context. Using this conceptual framework, a new survey instrument was designed and developed to measure knowledge of LAD. This instrument was administered to middle and secondary content-area teachers and the results indicated that pre-service teachers "have limited knowledge to support the needs of adolescent literacy learners" (p. 67). Therefore, the need to increase this knowledge base in pre-service teachers becomes critical. This study further delineates these efforts by examining specific types of knowledge of LAD and their relationship with beliefs about LAD.

III. Methods

1. Participants and setting

Participants of this study were 225 undergraduate students (female=158, male=28, unidentified=48) enrolled in both elementary (n=112) and secondary teacher education programs (n=113) at a highly selective state university in the southeastern part of the United States. The ethnicity of the sample was 75% Caucasian, 12% Asian/Pacific Islander, 6% African American, 2% Hispanic, and 5% "unspecified." Among the secondary students, there were 28 English, 29 social studies, 10 science, 12 math, 14 foreign languages, and 15 other majors. Forty-nine percent of the participants (111 students) responded

that they have already taken a content-literacy course and 17.3% reported that they were taking the course at the time when they responded to the survey. Thirty-three percent (75 students) reported that they had not taken any content-literacy course. Among the initial 232 participants, seven students who did not complete the survey were eliminated from the analysis.

2. Procedures

Participants were invited to participate in this study through an email message as part of a student Participant Data Program (Wiens, 2014) run by the university's Teacher Education Department. Participants earned credits towards a research requirement by participating in this study. Pre-service teachers who desired to participate in the study were able to follow a link in the email to complete the survey online. The study was open to participants for the fall semester and lasted until the end of the following spring semester.

3. Program context

Three literacy professors collaboratively created the syllabus used to teach the LAD course in consultation with other professors in different subject areas. This course is required for all secondary teacher candidates and is offered every semester. Elementary teacher candidates had the option to take the course as an elective. Throughout the semester, students read and discussed multiple topics such as differentiated instruction, culturally responsive instruction, and adapting literacy instructional strategies to discipline-specific instruction. The course textbook (McKenna & Robinson, 2013) is organized based on the Before-, During- and After-reading (BDA) instruction framework and includes multiple instructional strategies fostering LAD.

There were four major assignments in this course curriculum: 1) text difficulty assessment, 2) text set creation, 3) teaching practice

video clip, and 4) a lesson plan design. In the text difficulty assessment, students analyzed a textbook of their own subject using both qualitative (e.g., the author's assumptions about prior knowledge) and quantitative (e.g., Lexile estimates) methods. The text set (Lupo et al., 2018) assignment required students to create a multimodal text set centered on a theme (e.g., planets or the Civil Rights movement). Additionally, students were required to submit three practice teaching video clips, each of which focuses on before-, during-, and after-reading activities. These video clips were recorded in their field placement sites or outside of class in small group settings with peers. The students were expected to refine their thinking and practice based on feedback they received for each clip from the course instructor and their peers. Lastly, the capstone project required candidates to develop a lesson plan designed to support students in learning content from a text using the BDA framework. There were no formal field experiences required for this course, but the students were encouraged to apply the instructional strategies and practices to authentic instructional settings including other related teaching practicums or any potential teaching opportunities.

Instructors usually spent the initial 20-30 minutes of a class reviewing the previous lesson and overviewing the current lesson with short mini-lectures. Then, for the next 30 minutes, students discussed their weekly readings and LAD strategies they learned from multiple resources. For the remaining time, students usually practiced discipline-specific strategies in small groups with the same content majors and debriefed what they learned and practiced with each other. In addition, they frequently participated in online discussions about articles describing discipline-specific applications (e.g., math, science, history, and language arts) of content-literacy strategies.

4. Data sources

All the data were collected via the online participant pool system.

Two instruments served as data collection tools. Four additional questions were included to collect information related to their previous enrollment in a LAD course, gender, program enrollment (elementary and secondary), and specific subject areas. Participants accessed the survey containing both measures through the online website. The two surveys took approximately one hour to complete.

1) Beliefs about LAD.

The first instrument (Vaughan, 1977) consists of 15 items to measure beliefs about teaching reading in content-area classrooms. Students' responses were collected using a 7-point Likert scale (1-strongly disagree; 7-strongly agree). This scale includes both positive items (e.g., "Technical vocabulary should be introduced to students in content classes before they meet those terms in a reading passage.") and negative items (e.g., "The sole responsibility for teaching students how to study should lie with reading teachers."). Those negative items were scored in reverse. The reliability coefficient (McDonald's ω) of the entire scale was .87, which identifies this instrument as a reliable measure. This measure was reviewed and adopted after being compared with other related instruments (e.g., Chin, 1975; Dupuis & Askov, 1977; Konopak et al., 1994). It should be noted that "attitudes" in the title of this survey are conceptualized as overall beliefs about LAD (Vaughan, 1977).

2) Pedagogical knowledge about LAD.

The second measure (Meyer, 2013) is composed of 45 items developed to assess pre-service teachers' pedagogical content knowledge of LAD. All the items are scored in a binary manner (correct=1; incorrect=0). McDonald's ω for the instrument was 0.85. This measure consists of four constructs: 1) reader/writer, 2) instructional activities, 3) text, and 4) sociocultural context. Following the RAND (2002) model, these four constructs as defined as follows:

  • The reader[/writer] who is doing the comprehension [and com-

posing]
- The text that is to be comprehended [and written]
- The activity in which [reading and writing] is a part
- The sociocultural context that shapes and is shaped by the reader[/writer] and that interacts with each of the three elements above (p. 11)

Sample items for each construct are shown in Table 1. Cronbach's α's for each subscale were .81, .90, 84, and 78, respectively.

Table 1. Sample items of the Meyer (2013) instrument

Construct	Sample question
Reader/Writer (15 items)	A student's prior knowledge about a concept is important to comprehension because it helps him/her _____. a. integrate old and new information to construct new understandings b. focus on the text. c. decode unfamiliar words using context clues d. read more fluently
Instructional activities (14 items)	Teacher think alouds _____. a. provide opportunity for students to practice comprehension strategies b. make invisible cognitive processes visible to the student c. are student centered d. none of the above
Text (8 items)	Content area textbooks require readers to be familiar with _____. a. a variety of text structures b. the problem of the text c. the origins of the content d. the everyday application of the content
Sociocultural context (8 items)	According to the ideals of sociocultural theory, teachers must _____ in their content area in order to teach literacy skills used by experts in that field (e.g. American history). a. expose students to the literacy practices b. thoroughly lecture about major concepts c. develop a learning community that uses the literacy practices d. both a and b

5. Data analysis

Regarding our first research question, a separate 2×3 analysis of variance (ANOVA; Lomax, & Hahs-Vaughn, 2012) was conducted to investigate the differences in the pre-service teachers' beliefs about and knowledge about LAD based on their previous enrollment in the content-literacy course (1=taken, 2=taking, and 3=not taken) and program enrollment (1=elementary, 2=secondary). Normality was supported by the Shapiro-Wilk test for each of the six combinations (all p's>.05/6). Levene's test for homogeneity of variance indicated that the variances of the six groups were not significantly different; $F(5, 219)=1.70$, $p=.14$.

To investigate our second research question, we performed a 2×3 multivariate analysis of variance (MANOVA; Tabachnick & Fidell, 2014). The independent variables were both the previous enrollment in LAD course and the program enrollment (elementary and secondary). The dependent variable was the scores of pedagogical knowledge regarding LAD. Box's test supported the equality of covariance matrices, multivariate $F(50, 29022.11)=1.139$, $p=.23$. Mahalanobis distance revealed two multivariate outliers in the Taken group ($p < .001$). All analyses were performed using SPSS (Ver. 24.0) software.

IV. Results

1. Descriptive statistics

Descriptive statistics, including means and standard deviations for each group, are provided in Table 2. Correlation coefficients between the beliefs and the four types of knowledge on LAD varied from .24 to .41 as shown in Table 3. Positive beliefs about content-literacy instruction were more closely related to the knowledge on reader/writer and sociocultural contexts in content-literacy instruction.

Table 2. Descriptive statistics

Course	Level	N	Beliefs		RW		IA		Text		SC	
			M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Taken	ES	53	79.91	6.95	8.23	1.65	7.79	1.93	5.55	1.08	5.45	1.46
	SS	58	80.68	9.54	8.19	1.99	7.97	1.70	5.36	1.33	5.36	1.65
	Total	111	80.31	8.37	8.21	1.83	7.88	1.80	5.45	1.22	5.41	1.56
Taking	ES	21	83.43	6.81	8.67	2.11	8.24	1.97	5.33	1.20	5.29	1.76
	SS	18	80.78	7.51	8.56	1.62	7.28	1.84	5.44	1.15	5.89	1.53
	Total	39	82.21	7.17	8.62	1.87	7.80	1.95	5.39	1.16	5.56	1.67
Not Taken	ES	38	76.79	8.07	8.13	2.41	7.37	2.14	4.89	1.48	5.05	1.72
	SS	37	77.72	9.17	7.30	2.21	7.35	1.74	4.68	1.29	5.08	1.61
	Total	75	77.25	8.58	7.72	2.33	7.36	1.94	4.79	1.39	5.07	1.65
Total	ES	112	79.51	7.63	8.28	2.01	7.73	2.01	5.29	1.28	5.29	1.61
	SS	113	79.76	9.16	7.96	2.05	7.66	1.75	5.15	1.32	5.35	1.63

※ *ES: Elementary; SS: Secondary, RW: Reader/Writer, IA: Instructional Activities, SC: Social Context*

Table 3. Correlation coefficients

	B	RW	IA	T	SC
Beliefs (B)	-	.36**	.25**	.35**	.40**
Reader/Writer (RW)		-	.35**	.35**	.41**
Instructional Activities (IA)			-	.24**	.37**
Text (T)				-	.31**
Social Context (SC)					-

**. Correlation is significant at the 0.01 level (2-tailed).

2. ANOVA

As shown in Table 4, results of the 2 × 3 ANOVA revealed a statistically significant difference in beliefs about LAD among the enrollment groups; $F(2, 219)=5.17$, $p<.05$, $\eta^2=.045$. Follow-up Tukey post-hoc test revealed that there was no significant difference between the Taken ($M_{taken}=80.29$, $SD=.79$) and Taking ($M_{taking}=82.10$, $SD=1.33$) groups. However, statistically significant differences were identified 1) between the Taken ($M_{taken}=80.29$, $SD=.79$) and the Not Taken ($M_{not\ taken}=77.25$, $SE=.963$) groups, and 2) between the Taking ($M_{taking}=82.10$, $SD=1.33$) and the Not Taken ($M_{not\ taken}=77.25$, $SD=.963$) groups. This means that pre-service teachers who are either currently taking the LAD course or have already taken it showed more positive beliefs about LAD than those who had not taken the course. However, the difference in the participants' beliefs between the two future teaching level groups was not found to be statistically significant; $F(1, 219)= .068$, $p=.794$, $\eta^2=.001$. Lastly, the interaction between the LAD course and program enrollment was not statistically significant; $F(2, 219)=.713$, $p=.491$, $\eta^2=.006$.

Table 4. Results from ANOVAs

	Course	Level	Course×Level
Beliefs about LAD	5.17**	-	-
Knowledge about LAD	2.21**	-	-
Reader/Writer	3.42**	-	-
Instructional activities	-	-	-
Text	6.58***	-	-
Social context	-	-	-

*** $p \langle .01$, ** $p \langle .05$, * $p \langle .10$

– Statistically not significant

3. MANOVA

Wilks' criterion indicated that the composite pedagogical knowledge scores were significantly different among the enrollment group, multivariate $F(8, 432)=2.08$, $p<.05$. Results reflected a moderate association between the enrollment groups and the composite knowledge score, $\eta^2=.37$. Separate univariate ANOVAs indicated the significant difference in both Reader/Writer, $F(2, 215)=3.42$, $p<.05$, and Text knowledge, $F(2,215)=6.58$, $p<.01$ among the three-course-enrollment groups. Post-hoc comparisons showed that students who took the LAD course ($M_{taken}=8.29$, $SE=.181$) or are currently taking the course ($M_{taking}=8.75$, $SE=.308$) scored significantly better in the test assessing the reader/writer knowledge of LAD instruction than those who did not take the course ($M_{not\ taken}=7.80$, $SE=.220$). In addition, both the Taken ($M_{taken}=5.48$, $SE=.120$) and Taking ($M_{taking}=5.40$, $SE=.204$) groups scored significantly better in the text knowledge compared to the Not Taken group ($M_{not\ taken}=4.81$, $SE=.146$). However, no significant differences were observed in sociocultural context knowledge and instructional activities based on course enrollment. Finally, there was no significant difference in the knowledge of LAD among the program enrollment groups; multivariate $F(4, 212.000)=1.454$, $p=.22$, $\eta^2=.027$.

V. Discussion and Conclusion

1. Discussion

Although pre-service teachers' beliefs and knowledge served as significant indicators in predicting their success as in-service teachers (i.e. Daisey, 2009; Fang & Ashley, 2004; Hong-Nam & Swanson, 2011; Konopak et al., 1994; Leader-Janssen & Rankin-Erickson, 2013; Scott et al., 2018; Warren-Kring & Warren, 2013), this line of research has unfortunately received limited attention by researchers whom study

LAD. The current study attempted to look at the beliefs and knowl-edge of pre-service teachers in regard to LAD. Our study reported correlation coefficients between teacher beliefs and different types of knowledge of LAD ranging from .24 to .41, which indicates moderate relationships between them. More specifically, data from this study suggest teacher candidates who had a content-literacy course or who were currently taking the course held more positive beliefs about LAD instruction and were more knowledgeable about LAD in terms of reader/writer and text than those who did not take the course.

Our findings indicated that pre-service teachers who are either currently taking the LAD course or have already taken it showed more positive beliefs about LAD than those who had not taken the course. According to Nourie and Lenski (1998), beliefs are a constant con-struct and hard to change within a short period as reported. In this regard, our findings suggest that pre-service teachers' enrollment in a LAD course may contribute to shaping their positive beliefs about LAD if authentic curriculum (e.g., text set creation and teaching prac-tice video clip) and collaborative reflection opportunities are provid-ed for them. Earlier studies (i.e. Bean & Zulich, 1990; 1992) reported pre-service teachers' reluctance is shaped mainly by the disconnect between their disciplinary features and the university content-literacy course. We believe that it is important not only to use multiple disci-pline-specific texts (i.e., Draper, 2002; Gillis, 2014), but it is also im-perative to incorporate active cross-disciplinary collaborations (e.g., Draper, 2008; Draper et al., 2012) to develop a more authentic LAD course.

In addition, the MANOVA findings indicated that teacher candi-dates who are either currently taking the LAD course, or have already taken it, scored significantly higher on the pedagogical knowledge as-sessment than those who did not take it. This result is consistent with and extends previous qualitative findings (i.e., Fang, 2014; Kukner & Orr, 2015) in that we specified and investigated four dimensions of pedagogical knowledge on LAD. Developing pre-service teach-

ers' knowledge of content-literacy instruction is especially important because it transfers into their actual teaching practices when they become classroom teachers (Alger, 2009). More specifically, their pedagogical knowledge directly influences their selection of texts and instructional strategies for content instruction (Bean, 1997). We believe that both the practice teaching video clip assignments (i.e., Shanahan, & Tochelli, 2014) and differentiated approaches to content-literacy instruction contributed to the teacher candidates' development of pedagogical content knowledge regarding LAD.

It is interesting to note that only the reader/writer and the text subsections of the knowledge instrument showed significant differences but not the sociocultural context and the instructional activities subsections. We believe there are several plausible reasons for this difference. The LAD course focused on understanding multiple types of literacy practices and texts and how to differentiate LAD instruction using the information. However, it did not require any formal field experience where they could have applied what they learned to actual instructional contexts. We assume that more authentic field experiences such as a tutoring practicum (Chandler-Olcott & Hinchman, 2005) might contribute to developing the pre-service teachers' knowledge about sociocultural context and instructional activities. In addition, an increased focus on culturally responsive instruction (Ladson-Billings, 1995) may help pre-service teachers better grasp the importance of the role of sociocultural context.

We also believe a reasonable explanation exists for the lack of significance in relation to the instructional strategies subset of the assessment. First, we contend that it is difficult to know how to implement and differentiate actual instructional strategies effectively even for pre-service teachers with positive beliefs about content-literacy instruction, as discussed by Dynak and Smith (1994). More specifically, we assume the ability to effectively identify appropriate instructional strategies requires a nuanced expertise of how content literacy and one's discipline intersect for significant differences to be obtained.

While the course provides the foundational information, we contend the expertise to make these instructional decisions must be honed in the field. Because knowledge of both specific instructional strategies and related sociocultural contexts is relatively more critical and situated, pre-service teachers may take more time to develop these skills (Snow et al., 2005).

Finally, it should be noted that there was no significant difference in terms of beliefs and pedagogical content knowledge between preservice teachers in the elementary and secondary programs. This result indicates that both preservice teachers in the elementary and secondary programs recognize the importance of teaching literacy and have a similar level of PCK about LAD. Some may argue that LAD is more beneficial for secondary school level because secondary schools include individual content-area teachers compared to elementary schools where one teacher teaches all of the disciplines. However, in this study, these similar tendencies of beliefs and PCK about LAD between preservice teachers in elementary and secondary levels show that the concept of LAD can bring together both school levels. In particular, considering some researchers argue there are distinguishable literacy levels such as basic, intermediate, and disciplinary literacy (e.g., Shanahan & Shanahan, 2008) and that the disciplinary literacy approach is for secondary school levels; the result from this study demonstrates that the LAD can be an alternative approach to emphasize literacy instruction across elementary and secondary school levels. By future studies investigating elementary and secondary teachers' beliefs and PCK about disciplinary literacy, the effectiveness of LAD may be compared and consolidated.

2. Strengths and limitations

We believe this study offers the following noteworthy aspects regarding LAD instruction and teacher education for pre-service teachers. First, our study provided a clear theoretical foundation to differ-

entiate between teacher beliefs and knowledge, which sets apart this study from others. In addition, we offered a much larger sample size than many published studies, and this enabled us to conduct both univariate and multivariate quantitative analyses, which produced more nuanced findings. Finally, we delineated pre-service teachers' pedagogical knowledge of LAD instruction into four subcomponents: 1) reader/writer, 2) instructional activities, 3) text, and 4) sociocultural context.

Although we found multiple meaningful findings, the authors acknowledge that there are limitations of this study. We employed a survey design using only self-report measures of both beliefs about and knowledge toward content-literacy instruction. Some items may have been misunderstood by the respondents and there might be an issue regarding social desirability bias. Another potential limitation is that some of the survey items were geared for LAD instruction for 4th grade and above and might have been not covered directly in the course curriculum.

Additionally, it should be acknowledged that the participants in this study were members of the teacher education program at a highly selective university. This population may not be representative of other populations of teacher education students. Likewise, the sampling technique for the survey involved finding any willing participants. Therefore, it is possible that only certain kinds of teacher education students elected to participate in our voluntary survey.

Finally, it is unclear what specific aspects of the course contributed to or were associated with the differences in both beliefs and knowledge. We could not analyze how much of this is the actual difference and how much is pre-existing beliefs, particularly because enrollment was an elective for the elementary majors; so there could be a pre-existing difference in elementary majors who enrolled vs. those who did not.

3. Conclusion

Based on these results, it is suggested that we need to delineate our understanding regarding pre-service teachers' beliefs and pedagogical knowledge about LAD in relation to their previous enrollment in LAD courses and their program characteristics (e.g., Brayko, 2013). We propose that future research adopt causal experimental research designs to test how different course formats influence pre-service teachers' development of pedagogical beliefs and knowledge about LAD. In addition, as the PCK was differentiated into multiple subscales in this study, pedagogical beliefs about LAD need to be delineated. We suggest that future research develop a more nuanced instrument to assess pre-service teachers' beliefs about LAD instruction. We need a more balanced protocol that connects teachers' beliefs to their LAD knowledge Lesley, (Lesley, 2014; Meyer, 2013) and differentiated implementation (Jang et al., 2018), which will result in both meeting the diverse needs of students and developing them into life-long readers and writers.

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ABSTRACT

Pre-Service Teachers' Beliefs about and Knowledge of Literacy across the Disciplines

Jang, Bong Gee · Wiens, Peter · Park, Sohee · Meyer, Carla K.

This study examined whether elementary and secondary pre-service teachers' previous enrollment in a literacy across the disciplines (LAD) course and program enrollment (elementary and secondary) influence their beliefs about, and pedagogical knowledge of, LAD. Data from 225 undergraduate students registered in a teaching education program were analyzed using both univariate and multivariate analytic methods. Results indicated that prospective teachers who are currently taking the LAD course or have taken it previously not only harbor more positive beliefs about LAD instruction but also are more knowledgeable in LAD than those who did not take the course. We suggest future inquiry investigating how to develop more effective and authentic formats of LAD courses in teacher education programs.

KEYWORDS   Literacy across the disciplines, Teacher beliefs, Pedagogical content knowledge, Content literacy, Preservice teacher education