10-2017

Minding the Gap: Mentor and Pre-service Teachers' Ability Perceptions of Content Area Literacy Instruction

Treavor Bogard
University of Dayton, tbogard1@udayton.edu

Mary-Kate Sableski
University of Dayton, msableski1@udayton.edu

Jackie Marshall Arnold
University of Dayton, jarnold1@udayton.edu

Connie L. Bowman
University of Dayton, cbowman1@udayton.edu

Journal of the Scholarship of Teaching and Learning, Vol. 17, No. 4, October 2017, pp. 44-66.
doi: 10.14434/josotl.v17i4.21885

Minding the Gap: Mentor and Pre-service Teachers' Ability Perceptions of Content-Area Literacy Instruction

Treavor Bogard
University of Dayton
tbogard1@udayton.edu

Mary-Kate Sableski
University of Dayton

Jackie Arnold
University of Dayton

Connie Bowman
University of Dayton

Abstract: This mixed method study compared how student teachers rated their ability in implementing components of content-area literacy compared to their clinical educators' perceptions of the student teachers' actual performance. The researchers collaborated with preK-12 clinical educators to develop a scaled survey to rate level of skill in four components of content literacy instruction. 112 clinical educators (CEs) and 183 student teachers (STs) representing five teacher licensure programs completed the survey. A two-way multivariate analysis of variance measured the effect of Role (CE and ST) and Teacher Licensure Program on ability perception. Results indicated that Role and Program each significantly affected ratings of the four content literacy component skills measured, but the effect of Role did not significantly differ based on Program. Participants' written explanations of their ability ratings revealed how their mental models of content literacy accounted for differences in ability perception by Role. Implications are provided for enhancing pre-service teachers' perceptual and qualitative awareness of the practices that underlie highly effective content-area literacy instruction.

Keywords: Pre-service teacher education, content-area literacy, expert-novice differences, mental models, ability perception, clinical experiences.

The Common Core State Standards (CCSS), currently adopted in 42 states in the U.S., reflect a societal concern that students are college and career ready by the time they graduate the 12th grade ("Standards in Your State," n.d.). One characteristic of the new standards is their prominent positioning of disciplinary literacies, defined as "discipline-specific cognitive strategies, language skills, and habits of practice" (Chauvin & Theodore, 2015, p. 2). As such, disciplinary literacies entail ways of speaking, thinking, reading, and writing that are consistent with those of experts in a domain. Goals for developing students' disciplinary literacies in English language arts/literacy (ELA) and mathematics begin in the primary grades and continue through grade 12 with key skills repeating with increasing complexity in a spiral progression. However, students' success at applying grade-appropriate disciplinary literacies often depends upon their sufficient understanding of the subject matter, which can be developed through content literacy.

Content literacy is a generalized set of skills that can be applied across disciplines to help students to access subject matter content (Chauvin & Theodore, 2015). It includes explicit instruction in comprehension, modeling of reading and thinking strategies to support interpretation of complex texts, and intensive writing to support thinking and learning (Moss, 2005). Effective content literacy instruction provides students strategies for understanding new material, enabling them to engage more successfully with domain-specific literacy practices and extend content mastery toward deeper learning of a domain. Such skillful instruction requires that educators have highly-evolved mental models of content literacy. Mental models can be defined as "rich, complex, interconnected, interdependent, multi-modal representations of what someone knows" (Jonassen & Strobel, 2006, p. 4). To successfully implement the CCSS, pre-service teachers require mental models that enable them to situate content-area literacy instruction within domain-specific disciplinary practices.

The need for pre-service teachers to develop mental models of content literacy is also evident in states' use of embedded performance assessments of teacher preparedness for professional licensure. The edTPA, for example, is a portfolio-based assessment conducted during student teaching ("About edTPA," n.d.). Currently, 736 teacher preparation programs in 39 states use the edTPA to measure the depth and breadth of the mental models that pre-service teachers draw upon as they plan, instruct, and assess students in their content areas ("Participation Map," n.d.). In effect, teacher candidates must develop mental models *prior to student teaching* that enable them to perceive, reflect upon, and implement the qualities and attributes of highly-skilled teaching in their content areas in ways that align with expert educators' perceptions of instructional effectiveness.

Purpose of the Study

As teacher educators who are interested in the relationship between mental model development and teaching effectiveness, we wondered how pre-service teachers' mental models of content-area literacy might influence their perceptions of content-area literacy instruction ability. More specifically, we wanted to know if differences in ability perception between novice and expert educators might reveal some specific areas where pre-service teachers could benefit from additional support for developing their mental models of content literacy instruction prior to student teaching. In this mixed-methods study, we report how student teachers across five preK-12 teacher licensure programs rated and explained their ability in implementing components of content-area literacy instruction compared to how clinical educators rated and explained the student teachers' actual performance. Our research questions were:

1. To what extent do Student Teachers' (STs') self-perception of ability in providing content-area literacy instruction differ from Clinical Educators' (CEs') perceptions of the STs' ability?

2. In what ways might STs' and CEs' explanations of their ability perceptions reveal their mental models of content-area literacy instruction?

Theoretical Perspectives

Based on the premise that the ability to teach effectively is learned, and not a set of knowledge and skills that individuals naturally possess (Ball & Forzani, 2010), this research is informed by perspectives on mental model development, instructional expertise, and characteristics of highly effective literacy teachers.

Mental Model Development in Learning to Teach

The special knowledge and skills that underlie effective teaching are embedded in a complex, interconnected set of mental models that guide teachers' thinking and actions in the classroom (Caine & Caine, 1998). Learning to teach requires developing a robust set of mental models that grows through time, experience, and deliberate practice teaching in a content area. Mental models contain "the knowledge and structure in memory, as propositions, productions, schemas, neural networks, or other forms" (Zhang 1997, p. 180). Unlike schema, which is knowledge stored in the head and divorced from context and situation, a mental model consists of knowledge that is situationally and contextually bound (Derry, 1996). Mental models form when individuals construct, test, and adjust their understanding of a situation *in situ* as they respond to emergent and shifting variables that arise in a work environment (Chi, 2008). Jonassen (2005) identified "planning, data collecting, collaborating, accessing information, data visualizing, modeling, and reporting" (2005, p. 91) as processes learners apply toward the development of mental models. Through time, deliberate practice, feedback, and reflection, mental models gain coherence and conceptual complexity (Jonassen & Strobel, 2006; Kim, 2012). They grow to include "the essential parts, states, or actions of the system as well as the essential relations among them, so that the learner can be able to see how the systems works" (Mayer, 1989, p. 59). Although they are tacit, mental models structure how individuals respond to novel situations and their continued development depends upon the application of knowledge within dynamic, problem-based contexts (Bogard, Liu, & Chiang, 2013).

According to Kim (2012), "the development of mental models can be characterized as progressing through qualitatively different mental stages, from a lower level toward an expert-like level" (p. 62). At each stage there are observable differences in how one approaches a task and operates in a work environment. Dreyfus and Dreyfus (2005) described five stages of expertise that correspond with the development of mental models of a disciplinary practice. The *novice* has learned abstract, conceptual knowledge, free of context, but has not yet made connections between knowledge and practice and, therefore, has difficulty applying conceptual knowledge to relevant work situations. They display rigid compliance with taught rules and procedures. The *advanced beginner* recognizes situations in which conceptual knowledge is applied, but does not discern which aspects of a problem situation are most important. They approach all aspects of work separately and with equal importance. The *competent learner* can determine which elements of a situation are critical, but due to limited connections and retrieval cues, does not apply the full range of knowledge that is relevant to the situation. They rely on deliberate planning and formation of routines. A *proficient learner* identifies and evaluates the problem holistically and applies relevant concepts and skills to the situation. They possess the ability to prioritize actions and adapt to the situation at hand. An *expert* intuitively makes a decision about what the problem is and how it may be resolved, relying on a tacit understanding instead of rules and guidelines. As individuals move

through stages of expertise, their mental models grow to integrate conceptual knowledge with organized sets of actions that guide one's perceptual awareness of when, where, why, and how to respond in a given situation, enhancing the quality of one's performance (Bogard et al., 2013).

Highly effective educators' mental models of content-area instruction integrate pedagogical skills, content knowledge, and context-specific conditions. They bring this tacit awareness to the instructional context, and it determines what and how they perceive, act on, and respond to during the teaching-learning cycle. Expert teachers, for example, can recognize patterns of student behaviors that cue their application of instructional strategies and interventions that are just right for the situation at hand (Bransford, Brown, & Cocking, 2000; Tsui, 2003). By contrast, pre-service teachers, as novices, lack well-developed mental models and therefore fail to perceive variables that impact student learning or the efficacy of their instructional methods even though they may have procedural knowledge of instructional processes, routines, and methods (Tsui, 2003). As a result, novice and expert educators approach the same classroom situations with different levels of perceptual awareness of what elements are most important to attend to, resulting in different performance outcomes.

Four Ways Development of Mental Model Impacts Content Literacy Instruction

Research on exemplary literacy teachers suggests that they work from a well-integrated set of mental models of content literacy that facilitate student learning and achievement (Allington & Johnston, 2001; Pressley, Allington, Wharton-McDonald, Block, & Morrow, 2001). These studies designated exemplary literacy teachers as those who facilitate consistent gains in their students' academic achievement and who have highly regarded professional reputations based on recommendations from school administrators, colleagues, and parents (Allington & Johnston, 2001; Pressley et al., 2001). Although not identified as experts specifically, they exhibit expert-like teaching behaviors such as acute perceptual awareness, quick decision-making, and effective deployment of strategies and scaffolds. These professionals have mental models of content-area instruction that enable them to be *coherent* and *integrative* when planning and delivering subject matter. In addition, they are *perceptive* and *responsive* when managing the emergent variables at play in the teaching-learning cycle. We discuss these four qualities below.

Coherence. Coherence is the quality of being logical and consistent, and refers to the forming of a unified whole. Expert educators are concerned about the continuity of instruction over time. Therefore, they attend to how the sequence of learning builds and how students will make connections and ultimately apply knowledge and skills to new tasks (Berliner, 2001). Similarly, highly effective literacy teachers demonstrate coherent instruction by reinforcing skills application and transfer across a range of instructional events. They integrate research-supported structures and routines such as read-alouds, process writing, curriculum integration, thematic instruction, and explicit teaching to move learning forward (Pressley et al., 2001; Worthy, Consalvo, Russell, & Bogard, 2011). By contrast, novice educators tend to focus on the execution of a single lesson, classroom routine, or procedure without consideration of how the learning will build over time or how their students will transfer the learning to new tasks.

Integration. Integration is the combining of essential or fundamental parts that are necessary to make a whole complete. Expert teachers have mental models that integrate knowledge of students, the curriculum, classroom organization, student learning processes, and the subject matter (Tsui, 2003). With this integrated knowledge base, they plan instruction that is student-centered. They are able to coordinate materials, methods, and activities to facilitate student

connections to past and future learning, even to other content areas. They are able to pick and choose instructional resources and approaches that are aligned to the learning goals and appropriate for scaffolding students' mastery of content and skills. For example, rather than relying on a single method or program (Allington & Johnson, 2001), highly effective literacy educators combine and coordinate instructional strategies, materials, and texts in consideration of students' needs and interests. In doing so, they facilitate meaningful contexts and purposes for skills application and development, including cross-disciplinary connections and transfer of that knowledge (Worthy et al., 2011). Novices, having less well-developed mental models of teaching, are unlikely to integrate these knowledge bases; they may focus mostly on the subject matter and on planning what they will do to get content across rather than what the students need to do to transfer content knowledge and skills to future learning (Westerman, 1991).

Perceptiveness. Perceptiveness is having insight into emerging situations that inform the application of problem-solving strategies. Expert teachers, for example, can quickly identify issues impacting the efficacy of instruction and anticipate potential problems based on their acute perceptual awareness of student behaviors and patterns of classroom dynamics (Tsui, 2003). As a result, they are selective in attending to classroom events and interactions that reveal confusion, off-task behavior, misconceptions, and other challenges to students' learning. Thus, classroom situations cue experts' use of scaffolding strategies just in time (Bransford et al., 2000; Worthy et al., 2011). Novice teachers, however, do not readily perceive conditions that indicate where, when, and why students need additional support. Consequently, they do not recognize patterns of interaction or behaviors that may foretell students' challenges with content, procedures, and skills application. Compared to experts, they are less selective in focusing their attention on critical aspects of classroom dynamics and student learning processes. As a result, novices often fail to activate or apply their procedural knowledge of instructional strategies when needed (Tschannen-Moran & Hoy, 2007).

Responsiveness. Responsiveness entails a readiness to respond and take action with interest, enthusiasm, or insight. Being highly perceptive, expert teachers are more adept than novices at adjusting instruction in response to students' emergent needs. Because their knowledge is stored in condition-action form, and bound to rules of applicability (Berliner, 2001; Bransford et al., 2000), experts are capable of making thoughtful, in-the-moment decisions that are appropriate for the situation at hand. Such adeptness has been called "thinking on one's feet" (Schon, 1983), "active knowing" (Ryle, 1949), and "tacit personal knowledge" (Polyani, 1958). For example, highly effective literacy instructors prompt students to extend thinking and the application of strategies to problem tasks. In doing so, they provide a gradual release of responsibility that creates independent student use of strategies (Pearson, Roehler, Dole, & Duffy, 1990; Worthy et al., 2011). Although they may have a lesson plan, they deviate from procedures and improvise new actions to help students achieve mastery. Novice teachers are more rigid and therefore less inclined to differentiate instruction just in time based on student cues (Tsui, 2003; Westerman, 1991). Being mostly focused on themselves, the content, and procedures, they tend to be inflexible when it comes to deviating from their plans. Their mental models have not yet formed to include an intimate knowledge of classroom dynamics and outside factors that influence students' receptiveness toward instruction and their processing of content (Bogard et al., 2013; Mayer; 1989). Consequently, novice teachers often miss opportunities to redirect learning or to offer individual students alternative strategies for achieving mastery.

Mental Models and Ability Perception

As discussed in the previous sections, the formation of mental models can be seen as impacting the coherence and integration of content instruction as well as teacher perceptiveness and responsiveness. Furthermore, the differences in mental model development between expert and novice educators cause them to perceive, implement, and refer to different aspects of the teaching-learning cycle as evidence of having successfully carried out instruction. Expert teachers, for example, perceive ability according to how effectively instructional practices facilitate students' mastery and transfer of content, constructive dispositions toward the subject matter, and attainment of long-term curricular goals (Berliner, 2001). Pre-service teachers tend to overestimate their skills, basing their performance on their procedural knowledge of implementing lesson plans, instructional methods, classroom procedures, and routines (Tschannen-Moran & Hoy, 2007). Thus, the mental models from which expert and novice teachers operate influence their qualitative awareness of classroom-learning situations as well as their application of knowledge and skill (Bogard et al., 2013; Bowman & Herrelko, 2014).

In the area of content literacy instruction, research is needed to identify where pre-service teachers' ability perceptions differ significantly from their more seasoned, mentor educators' perceptions of their actual performance. Knowing these differences may point to specific areas where pre-service teachers, as novices, can benefit from more support for developing their mental models of content literacy instruction. With proper support for building mental models in these areas, pre-service teachers can be better prepared for instruction and attuned to the features and applications of content literacy that expert teachers perceive as indicative of highly effective teaching.

The Study

Our university is located in the Midwest region, supporting a student population of approximately 10,900 students. Our Teacher Education Department is a four-year licensure program that incorporates early childhood (K-3), middle childhood (4-9), adolescent and young adult (7-12), and intervention specialist (K-12) programs. Our department aspires to embrace diversity for the promotion of social justice, to facilitate the development of scholarly practitioners, to build community, and to support students as they engage in critical reflection. Candidates, as pre-service teachers, experience field placements starting their first year, continue throughout their four years, and incorporate rural, suburban, and urban placements where practicing teachers serve as clinical educators (CEs). CEs, as mentor teachers, are required to have a minimum of three years' experience teaching in their licensed content area and have participated in professional development for mentoring beginning teachers. Although we do not claim that each CE who mentors a pre-service teacher is a pedagogical expert, each is an advanced practitioner and the majority of CEs hold a master's degree in their content area. Additionally, CEs are vetted by the university's field placement office to ensure that they have a successful track record of teaching in the content areas in which they serve as a mentor.

In this study, we wanted to know if there are differences in how expert and novice teachers perceive ability in content literacy instruction, and if so, how their mental models of content literacy instruction might account for these differences and reveal areas where pre-service teachers, as novices, might benefit from more support in developing mental models that underlie highly effective teaching. Our research questions were:

1. To what extent do Student Teachers' (STs') self-perception of ability in providing content-area literacy instruction differ from Clinical Educators (CEs') perceptions of the ST's ability?
2. In what ways might STs' and CEs' explanations of their ability perceptions reveal their mental models of content-area literacy instruction?

Data Sources

We utilized a mixed-methods design (Johnson & Onwuegbuzie, 2004) to answer our research questions. According to Creswell et al. (2011), "problems most suitable for mixed methods are those in which the quantitative approach or the qualitative approach, by itself, is inadequate to develop multiple perspectives and a complete understanding about a research problem or question" (p. 6). Our inquiry was appropriate for mixed methods because we wanted to understand any significant differences between CEs' and STs' ability perception ratings from a mental model perspective. This required 1) identifying high-needs areas in which STs needed to grow; 2) developing a scaled-survey for measuring potential differences in ability perception in these areas, and 3) having respondents provide a written explanation of their ability ratings.

To achieve these aims, our data collection was a two-phase process that occurred across two school years. During Phase 1, we administered an open-ended questionnaire to obtain qualitative input from CEs on areas of literacy instruction in which they felt their STs were most challenged as a novice educator. Then, in Phase 2, we used results from our qualitative data analysis from Phase 1 to develop a scaled survey for rating ability perceptions for the skills CTs identified as high-priority areas. As we describe below, this is a form of integration that occurred by connecting the analysis of results of the initial phase with the data collection of the second phase of research (Creswell et. al., 2011).

Open-ended questionnaire. The first phase of data collection began in May 2012. We wanted to get qualitative input from CEs on the high-priority areas that they deemed most important for STs to effectively implement. We administered an open-ended questionnaire during an end-of-term debriefing session with CEs who had just finished mentoring STs over the spring semester. The questionnaire asked CEs to identify and describe areas of literacy instruction where they perceived their STs to be highly skilled, challenged, and underprepared (See Appendix 1). Our goal was to use this input to develop a Likert-type scale that would be used for rating perceptions of ability in the key areas CEs identified. Questionnaires were completed by 174 CEs who had mentored an ST. They included preK-12 educators across reading/language arts, social studies, math, science, music, foreign language, and art. Among the participants were 49 high school educators, 53 middle school educators, 56 primary grade educators, and 16 pre-K educators. Using a constant comparative method, we coded the CEs' responses to capture reoccurring and salient patterns in areas of instructional skills development (Corbin & Strauss, 2008). Our grounded analysis indicated that the areas they identified fell into one or more of following categories: Administering Assessments, Planning Instruction, Explicit Reading/Writing Instruction, and Sustaining a Supportive Learning Environment. Each of these categories comprised specific sub-themes, or skills, that commonly surfaced in CEs' responses.

Scaled survey. In our second phase of data collection we developed a scaled survey for measuring CEs' and STs' ability perceptions of content literacy. The categories and corresponding sub-themes from the open-ended questionnaire became the basis for the survey questions. Thus, findings from Phase 1 became the items for a scaled survey instrument to assess perceptions of

ability differences between CEs and STs (See Appendices B and C). In this study, we only report findings from the *Explicit Reading and Writing Instruction* section of the survey, as the sub skills in this area best represented our focus on content literacy. These skills included: implementing guided reading, modeling reading strategies, teaching vocabulary/word study, and teaching writing. Using a Likert-type scale, the survey asked STs to rate their perceived ability in each of these areas on a scale of 0 (no ability) to 10 (high ability). Using the same scale, CEs were asked to rate the STs' actual ability in these areas of instruction.

Written responses. Typically, capturing aspects of individuals' mental models involves use of qualitative protocols such as think aloud, stimulated recall, written explanation, and concept mapping to elicit what a person is thinking and perceiving relative to a problem situation (Kim, 2012; Zhang, 1997). Therefore, in addition to asking respondents to rate perceived ability in each of the skills CEs identified, the survey asked them to provide a written explanation of their ability ratings by providing an example from their teaching practice that would tap their mental models of content-area literacy. Thus, the survey elicited both quantitative and qualitative data from respondents. Quantitative data consisted of ability ratings in teaching areas related to *Explicit Reading and Writing Instruction*. Qualitative data included written statements that would corroborate their ratings. This approach of combining quantitative and qualitative data enabled us to analyze any significant differences between STs' and CEs' ability perceptions of skills from a mental model perspective.

Survey Respondents

In May 2013, we asked STs and their CEs to complete the survey anonymously during an end-of-program seminar held the final week of student teaching. Seminars for CEs and STs occurred separately on different days. In total, 295 people agreed to take the survey; 112 were CEs and 183 were STs. As shown in Table 1, respondents represented five different teacher licensure programs: Early Childhood (ECE), Middle Childhood (MCE), Adolescent to Young Adult (AYA), Intervention Specialist (IS), and Multi-age (Multi).

Table 1. Participants by Program, Grade Level, and Role

Program	Grade Levels	# CEs	#STs
Early Childhood Education (ECE)	K-3	31	49
Middle Childhood Education (MCE)	5-9	30	47
Adolescent to Young Adult Education (AYA)	7-12	26	47
Intervention Specialist (IS)	K-12	22	32
Multiage (Multi) – music, art, foreign language	K-12	3	8

Note. CEs = Clinical Educators; STs = Student Teachers.

Data Analysis

To answer our first research question, we conducted a two-way multivariate analysis of variance (*MANOVA*) to examine the effects of Role (Student Teacher, Clinical Educator) and Program (ECE, MCE, AYA, IS, Multi-age) on ratings of the four *Explicit Reading and Writing Instruction* skills (Guided Reading, Modeling Reading Strategies, Teaching Vocabulary, Teaching Writing).

Then, to answer our second research question, we analyzed open-ended responses from the

survey, once again using the constant comparative method (Corbin & Strauss, 2008). Doing so allowed us to discern trends in 1) how participants conceptualized the skills we measured and 2) how CEs and STs conceptualized ability in relation to each skill. Finally, we compared the qualitative findings with the overall results of the *MANOVA*. To identify possible connections between participants' ability perception ratings and their mental models of content literacy, we merged participants' ability perception ratings by role with the patterns of explanation that emerged in response.

Findings

Effect of Role and Program on Ability Perceptions

We begin our findings with the overall results of the two-way MANOVA to convey the effect of Role and Program on participants' ability perceptions in content literacy instruction. The *MANOVA*, using Pillai's Trace, revealed there was a significant main effect for Role, $F(4, 282) = 10.190$, $p < .001$, with a large effect size (partial eta squared = .13), and there was a significant main effect for Program, $F(16, 1140) = .2065$, $p = .008$, with a small effect size (partial eta squared = .03). However, the interaction of Role and Program was not significant, $F(16, 1140) = .061$, $p = .34$. Thus, Role and Program each significantly affected ratings of the four *Explicit Reading and Writing Instruction* skills, but the effect of Role did not significantly differ based on Program.

Effect of Role on ability perception. Univariate analyses indicated that Role had a significant effect on each of the four *Explicit Reading and Writing Instruction* skill ratings: Guided Reading, $F(1, 285) = 22.64$, $p < .001$, medium effect size (partial eta squared = .074); Modeling Reading Strategies, $F(1, 285) = 29.53$, $p < .001$, medium effect size (partial eta squared = .094); Teaching Vocabulary, $F(1, 285) = 38.378$, $p < .001$, medium-large effect size (partial eta squared = .119); and Teaching Writing $F(1, 285) = 30.361$, $p < .001$, medium-large effect size (partial eta squared = .096). Thus, the findings indicated that STs scored themselves significantly higher than CEs on all four *Explicit Reading and Writing Instruction* skill ratings.

Effect of Program on ability perception. Univariate analyses indicated that Program had a significant effect on three of the four Reading/Writing Instruction skill ratings, although the effect size was smaller than Role: Modeling Reading Strategies, $F(4, 285) = 4.379$, $p = .002$, medium effect size (partial eta squared = .058); Teaching Vocabulary, $F(4, 285) = 4.033$, $p = .003$, medium effect size (partial eta squared = .054); and Teaching Writing $F(4, 285) = 6.448$, $p < .001$, medium effect size (partial eta squared = .083). The independent variable Program had no significant effect on the Guided Reading skill rating. Post-hoc comparisons using Tukey HSD tests indicated that the means for Program ECE and Program MCE were significantly different for the Modeling Reading Strategies, Teaching Vocabulary, and Teaching Writing skill ratings. The means for Program ECE and Program AYA also were significantly different for the Modeling Reading Strategies, Teaching Vocabulary, and Teaching Writing skill ratings. Finally, the means for Programs ECE and Multi-age were significantly different for the Teaching Writing skill ratings.

Influence of Mental Models on Ability Perception

While there were significant differences in ability perception by role, the numerical data could not explain the influence of respondents' mental models in accounting for these differences. For this we turned to their written explanation of their ratings to further contextualize the findings. By

merging qualitative data with the statistical analysis (Creswell et al., 2011), we were able to 1) discern qualitative differences in ability perceptions between STs and CEs and 2) explain the results from a mental model perspective.

Implementing guided reading. Guided reading is "small-group reading instruction designed to provide differentiated teaching that supports students in developing reading proficiency" (Fountas & Pinnell, 1996, p. 25). CEs identified the need for STs to develop their abilities at forming and reforming guided reading groups based on informal assessments, students' reading levels, and reading skills focus. CEs also stressed the importance of selecting texts for guided reading sessions that were at the students' zone of proximal development. However, CEs conceptualizations of guided reading were not always consistent across programs. Secondary educators (AYA) respondents, for example, conceived of guided reading as a close reading strategy to be modeled during whole group instruction for discerning the author's message, word meanings, and text structure.

As shown in Table 2, STs rated their ability at implementing guided reading significantly higher than their CEs in all program areas. Our qualitative analysis indicated that STs based ability on their frequency and experience of implementing guided reading as an instructional routine. For example, an ECE pre-service teacher wrote, "I worked with guided reading groups every day and used many different strategies in these groups." STs perceived familiarity and experience with implementing guided reading as legitimizing their ability; their explanations of ability were mostly procedurally based rather than learner-centered.

Table 2. Descriptive Statistics for Dependent Variable Guided Reading Skill as a Function of the Independent Variables Role and Program

Program	Role	N	Mean	Std. dev.
Early Childhood Education (ECE)	ST	49	8.31	1.661
	CE	31	7.13	2.907
Middle Childhood Education (MCE)	ST	47	7.66	1.418
	CE	30	5.80	3.089
Adolescent to Young Adult (AYA)	ST	47	7.47	2.636
	CE	26	5.81	3.086
Intervention Specialist (IS)	ST	32	9.03	1.150
	CE	22	6.05	3.093
Multiage (Multi)	ST	8	6.88	2.416
	CE	3	5.00	4.583

Note. CE = Clinical Educators; ST = Student Teachers.

By contrast, CEs were attuned to the substance, appropriateness, and rotation of guided reading groups. They tended to base STs' ability on the intentionality, responsiveness, and management of guided reading as operating within a larger reading program. For example, an ECE mentor teacher wrote, "She appeared challenged with the amount of work we do and the amount of groups we have per classroom. Also, what to teach in guided reading and selecting materials to use was a challenge." CEs tended to focus on selecting texts that aligned with students' abilities and interests that were appropriate for modeling the reading strategy focus. Their responses suggested that they operated from a mental model in which they perceived guided reading as the center of a literacy program, a means of differentiating instruction and focusing on students' challenges and progress as readers. CEs' responses indicated that the focus and formation of

guided reading groups evolve in response to a dynamic set of performance and contextual variables. Therefore, they perceived ability in guided reading based on STs' responsiveness to students' needs and the management of time and texts. STs, however, had not yet formed mental models that integrated guided reading procedures with real-time dynamics of the classroom.

Modeling reading strategies. The reading strategies CEs cited as challenging for STs concerned deepening text comprehension. These included strategies for questioning students at higher levels of understanding during read-aloud, teaching text connections, providing text evidence (citing text), integrating graphic organizers, and applying discipline-specific reading skills.

As shown in Table 3, STs' self-perceptions of their ability at modeling reading strategies were significantly higher than their CEs' ratings in all programs. STs tended to base their ability at modeling reading strategies on having completed that modeling as a step in a larger instructional sequence or unit of study. For example, an AYA ST wrote: "I taught a reading strategy in one of my units specifically, and then taught them throughout the year as well." Once again, STs emphasized their experience and procedural knowledge as evidence of their ability, suggesting that their mental models were procedurally bound, limiting their perceptual awareness of the other factors that influence responsiveness and coherence of instruction.

Table 3. Descriptive Statistics for Dependent Variable Modeling Reading Strategies Skill as a Function of the Independent Variables Role and Program

Program	Role	N	Mean	Std. dev.
Early Childhood Education (ECE)	ST	49	8.69	1.084
	CE	31	7.06	2.804
Middle Childhood Education (MCE)	ST	47	7.91	1.679
	CE	30	5.73	3.248
Adolescent to Young Adult (AYA)	ST	47	7.36	2.345
	CE	26	5.77	3.050
Intervention Specialist (IS)	ST	32	9.22	1.289
	CE	22	6.05	3.015
Multiage (Multi)	ST	8	7.00	2.390
	CE	3	5.00	4.583

Note. CE = Clinical Educators; ST = Student Teachers.

In contrast, CEs' responses included awareness of challenges that students would likely encounter when processing disciplinary content, including when and how to model a reading strategy to help students construct meaning of complex texts. For example, one AYA CE wrote, "The candidate needed more skill in the processing of content, breaking it down for understanding, and teaching reading strategies with content. He knew the pedagogy but not how to apply it." CEs' comments suggested that their mental models integrated content knowledge with reading strategies for constructing meaning. They focused on helping students to gain command of both content knowledge and strategies.

Teaching vocabulary and word study. Vocabulary and word study involved teaching word knowledge and meanings to facilitate comprehension of key ideas and concepts within complex texts. In the area of vocabulary instruction, CEs indicated a need for STs to improve skill in teaching vocabulary words in context and using word walls to facilitate repeated exposure of key

terms and word meanings. In the area of word study, CEs emphasized the need for STs to focus their instruction on teaching phonics and decoding strategies within authentic texts. They also stressed skills-based instruction at the word level that focused on recognizing patterns within words and word derivation. As shown in Table 4, STs' ability self-perceptions of teaching vocabulary and word study were significantly higher than CEs' ratings. Of all the licensure programs, ECE STs were most closely aligned with their CEs' perceptions than those in the upper grades (MCE and AYA) and there was a significant difference in skill ratings between ECE and the other programs. This may be attributable to the fact that explicit and systematic word study occurs more frequently in elementary than in middle and high school classrooms.

Table 4. Descriptive Statistics for Dependent Variable Teaching Vocabulary Skill as a Function of the Independent Variables Role and Program

Program	Role	N	Mean	Std. dev.
Early Childhood Education (ECE)	ST	49	8.76	1.128
	CE	31	7.58	2.277
Middle Childhood Education (MCE)	ST	47	7.98	1.391
	CE	30	6.17	2.854
Adolescent to Young Adult (AYA)	ST	47	8.23	1.913
	CE	26	5.73	3.067
Intervention Specialist (IS)	ST	32	9.19	0.931
	CE	22	5.95	2.591
Multiage (Multi)	ST	8	7.88	1.642
	CE	3	6.00	5.292

Note. CE = Clinical Educators; ST = Students Teachers.

STs' explanations of their own ability in teaching vocabulary and word study were primarily procedural accounts emphasizing how they previewed key words and new terms that were highlighted in instructional materials. For example, an MCE ST wrote, "I always stressed and reviewed key words in the unit." Their explanations were limited to describing how they carried out vocabulary and word study as one step in an instructional routine. CEs also relied on instructional materials in this area, but tended to be more flexible and strategic than STs, foregrounding vocabulary instruction as being contextualized, integrated, and student-centered. Therefore, they tended to base ability on reinforcing word meanings before, during, and after reading. An MCE CE wrote, "The candidate needed to be more aware of vocabulary skills. [She] assumed students understood certain passages, when there were some unfamiliar words to them." CEs' responses were attuned to building students' skills in decoding unfamiliar words and inferring words' meanings in context so they could transfer these skills to other texts. In addition, CEs based ability on anticipating where in a text students would likely need support for deciphering word meanings, even for terms that were not identified *a priori* in the teacher's manual. The STs, on the other hand, tended to rely on teacher manuals and based ability on implementing vocabulary and word study as a segment of instruction.

Teaching writing. In the area of writing instruction, CEs emphasized the need for teaching the writing process, running a writer's workshop, and teaching grammar and convention in the context of writing. As shown in Table 5, STs rated their ability in teaching writing higher than the CEs' perceptions of their actual abilities. An MCE ST wrote: "Every week I had a graded writing

assignment. In the first couple of days we wrote this type of assignment as a whole class. Later in the week, students completed the writing assignment on their own." STs often described the writing process as an organizing principle for sequencing instruction. In contrast, CEs focused on the writing process as a recursive cycle within which skills and strategy lessons occurred. They based ability on continuity of instruction: modeling habits of mind, writing craft, and convention during the writing process that students could carry forward to new drafts and pieces of writing. For example, an MCE CE wrote, "She [the ST] did not know how to teach a writing lesson that was progressive where you revise the piece and build upon the writing strategy taught and apply it to other [writing] lessons." This and similar comments suggested that CEs operated from mental models that had integrated process writing with disciplinary skills and strategies for increasing students' abilities and self-efficacy as writers. Thus, CEs' responses, far more than STs', saw beyond the immediate writing topic and the final draft toward cultivating students' independence and resilience in writing through the gradual release of strategies that students could carry forward to future assignments. In comparison, STs' explanations of ability were often teacher-centered and procedurally informed accounts of the writing process as a sequence of tasks that led to a final draft.

Table 5. Descriptive Statistics for Dependent Variable Teaching Writing Skill as a Function of the Independent Variables Role and Program

Program	Role	N	Mean	Std. dev.
Early Childhood Education (ECE)	ST	49	8.53	1.324
	CE	31	7.58	1.979
Middle Childhood Education (MCE)	ST	47	7.62	1.649
	CE	30	5.60	3.081
Adolescent to Young Adult (AYA)	ST	47	7.62	2.152
	CE	26	5.54	3.075
Intervention Specialist (IS)	ST	32	8.47	1.481
	CE	22	5.73	3.195
Multiage (Multi)	ST	8	6.75	1.909
	CE	3	4.33	4.041

Note. CE = Clinical Educators; ST = Student Teachers.

Discussion

The four components of content literacy we measured were those that CEs identified as high-priority growth areas for the STs they mentored: Implementing guided reading, modeling reading strategies, teaching vocabulary/word study, and teaching writing. In each of these areas STs rated their ability significantly higher than their CEs did. By analyzing respondents' written explanations of ability ratings, we found that STs and CEs focused on different aspects of teaching performance as markers of ability. Based on this finding, it is reasonable to conclude that pre-service teachers and their mentors operated from different sets of mental models that influenced their qualitative awareness of practices that underlie effective teaching. Differences in their mental model development accounted for differences in how the pre-service teachers and their more expert mentors perceived ability. More broadly, these findings support the theoretical notion that development of mental models is acquired through experiential knowledge, and that ability

perception is one indicator of the mental models that guide one's teaching practice.

In rating ability, STs prioritized carrying out instructional methods, procedures, and strategies as evidence of their skill and ability. Being more focused on their execution of methods and delivery of content, their responses did not concern the efficacy of their instructional practices in advancing growth in student learning or skills mastery. Their written explanations characterized advanced beginners in that they regarded many components of instruction separately and with equal importance. We might infer that they were not yet attuned to reading critical cues in the classroom for prioritizing and adjusting procedural instruction in response to student abilities, engagement, and situational dynamics that impact teaching effectiveness.

In rating STs performance, CEs perceived STs as being capable in implementing methods and teaching content-area strategies in a predetermined situation, but did not in their ability to readily discern when or why to do so in response to critical cues in the learning environment or in consideration of students' transfer of skills to future learning. Therefore, CEs were attuned to not only STs' knowledge and application of methods, but also the efficacy of these practices for moving students forward in their learning. Collectively, CEs' responses perceived coherence, integrated instruction, perceptiveness of the learning environment, and responsiveness to students as indicators of high ability, indicating that they operated from a more robust set of mental models than STs did. Given that it takes an average of ten years, or ten-thousand hours, of deliberate practice in a domain to become a true expert in that domain (Ericsson, Prietula, & Cokely, 2007), one might conclude that the CEs' ratings of STs' performance indicate a level of proficiency that is commensurate with the STs' time and experience in education.

As novices, STs regarded themselves as highly skilled and prepared to implement content literacy instruction. There may be important value in pre-service teachers slightly overestimating their abilities. High ability perceptions signal confidence and expectations of success, qualities that enable persistence and risk taking when encountering challenging classroom situations. Yet novice teachers must also learn to critically self-assess their performance in ways that will hasten their mental model development, particularly in light of the professional demands and expectations that are placed on new teachers. For one, new teachers, as novices, are held to the same accountability standards as expert teachers as soon as they enter the profession. Another pressure is that many states utilize performance-based assessments of teacher preparedness such as the edTPA for teacher licensure, requiring that pre-service teachers enter student teaching with mental models that enable them to perform at a level that corresponds with expert educators' perceptions of teaching effectiveness.

Pre-service teachers will need to move beyond procedural knowledge of pedagogical strategies toward the formation of robust mental models that integrate teaching methods with knowledge of students, disciplinary literacies, classroom dynamics, and desired learning outcomes. With heightened perception and qualitative awareness that accompanies this development, pre-service teachers will be better prepared to engage content literacy as a dynamic, fluid set of instructional practices in response to students' immediate learning needs.

Implications

Pre-service teachers' growth of mental models is more likely to occur through supervised clinical experiences in which instruction guides their attention such that the candidates align themselves to the dynamics of the learning environments and attune to the real-time cues in the teaching-learning cycle that bear on their students' progress as learners (Blue Ribbon Panel, 2010). Within

this structure, controlled, stimulatory experiences embedded into methods coursework can help pre-service teachers build coherent mental models that enable highly skilled and strategic content literacy instruction. Problem-based learning, case-based inquiry, simulations, and clinical rounds that supplement supervised field experiences and that require reflectivity in the teaching-learning process may hold promise (Bowman & Herrelko, 2014). For example, partnering with local schools to hold clinical round class sessions, in which pre-service teachers visit the classrooms in one school, then meet on-site with their instructor to debrief their observations and make links to class content, is a promising practice. These approaches situate methods instruction in scenarios that compel teacher candidates to acquire knowledge of content methods around conditions of applicability; thus, they can better recognize when, where, why, and how to apply a skill in consideration of the variables that are at play in the classroom dynamic. Such mental models of teaching extend beyond mere execution of strategies to include awareness of the changing variables of a complex problem context and to adjust strategy accordingly.

In doing this work, teacher educators will do well to have teacher candidates reflect on their ability perceptions throughout their professional development. Lesson plan reflections provide an ideal context for this to occur alongside instructor feedback aimed at building mental models in the skills the ST applied. As this study has shown, the aspects of instruction that STs prioritize, notice, and name as an indication of ability will be telling of the mental models that guide their practice. Mental models can grow as they reflect and discuss with expert educators how they would prioritize, coordinate, and adjust their instruction in response to students' learning behaviors, academic performance, patterns of difficulty, and other emergent variables. As a result, pre-service teachers will be better prepared to enact a "well-planned, prioritized, set of cognitions and actions" (Funke & Frensch, 1995, p. 4). They will need these richer models to respond to both the complexities of teaching and the increasingly demanding measures of teaching effectiveness.

Limitations and Directions for Further Research

As in any study, our study has limitations to the generalizability of its results and implications. First, the study relied upon self-perception data, so any reported perceptions, both in the case of the ST and CE, could be an inaccurate indication of actual performance due to the subjective nature of the survey's scale. Second, written explanations of ability depended upon the respondents to report accurately their use of the instructional strategies, and these reports were not verified by participant observation in a naturalistic setting. Finally, participants' explanations of their ability ratings revealed some variability in how participants in different programs conceptualized pedagogical terms in the survey, so inconsistency in the participants' conceptions of the terminology could have had an impact on the results, particularly in the area of guided reading. Nevertheless, the current findings indicate areas where pre-service teachers and their mentors tend to see differently and suggest specific areas for growing mental models that can enhance pre-service teachers' implementation of content literacy instruction.

Future research will include direct observation and interviews of expert-novice pairs to gain a better understanding of how mental models develop through enacting the teaching-learning cycle over time. The use of a paired survey between STs and CEs is recommended to better discern the relationship between supervised clinical experiences, ability perceptions, and mental models. Another direction for future research would be to follow the STs into their teaching positions. The work candidates did during their undergraduate clinical experiences to build mental models of effective teaching would theoretically be reflected in their first year of teaching. The first year of

teaching is a time of extensive mental model testing and refining as teachers apply the strategies learned in student teaching and university coursework to their own classrooms. Future studies could identify participants to follow to examine the shifts in their mental models and the influence of teaching context—for example, the urban, suburban, or rural location of the teacher's school—on the shifting mental models, as well.

Appendix

Appendix 1. Open-Ended Questionnaire for Clinical Educators.

1. Areas appeared challenged in teaching reading
2. Strategies used to support struggling readers and writers
3. Strategies used to support English language learners
4. Areas appeared unaware or underprepared in teaching reading/writing
5. Areas appeared unaware or underprepared in supporting English language learners
6. Areas showed most growth in teaching reading

Appendix 2. Pre-Service Teacher Survey.

Pre-Service Teacher Survey

Please rate on a scale of 0 to 10 each of the following categories in regards to the Level of Skill you have experienced with each area. 0 indicates that you felt extremely challenged in this area and 10 indicates you felt extremely skilled in this area.

Extremely Challenged **0 1 2 3 4 5 6 7 8 9 10** **Extremely Skilled**

Administering Assessments											
Administering/analyzing formal assessments	0	1	2	3	4	5	6	7	8	9	10
Administering/analyzing informal assessments	0	1	2	3	4	5	6	7	8	9	10
Using ongoing formative assessments	0	1	2	3	4	5	6	7	8	9	10
Monitoring student progress	0	1	2	3	4	5	6	7	8	9	10
Planning instruction											
Planning lessons	0	1	2	3	4	5	6	7	8	9	10
Planning differentiated instruction	0	1	2	3	4	5	6	7	8	9	10
Explicit content-area reading/writing instruction											
Implementing guided reading	0	1	2	3	4	5	6	7	8	9	10
Modeling reading strategies	0	1	2	3	4	5	6	7	8	9	10
Teaching vocabulary/word study	0	1	2	3	4	5	6	7	8	9	10
Teaching writing	0	1	2	3	4	5	6	7	8	9	10
Sustaining a supportive learning environment											
Maintaining classroom management	0	1	2	3	4	5	6	7	8	9	10
Applying a variety of instructional methods	0	1	2	3	4	5	6	7	8	9	10
Providing verbal clarifying and written feedback	0	1	2	3	4	5	6	7	8	9	10
Varying participation structures	0	1	2	3	4	5	6	7	8	9	10
Providing multisensory inputs	0	1	2	3	4	5	6	7	8	9	10
Pacing instruction	0	1	2	3	4	5	6	7	8	9	10
Scaffolding learning activities	0	1	2	3	4	5	6	7	8	9	10

Demographic Information

PLEASE COMPLETE THE FOLLOWING INFORMATION: (Circle or fill in the answer)

Program Area: ECE MCE AYA IS MULTIAGE

Grade taught: _____ **Are you in the Urban Teacher Academy?** YES NO

Concentration: English Science Language Arts/Reading Social Studies Art Music Religion Math Foreign Language

School: Urban Suburban Rural

Please provide an example of when you felt either extremely challenged or extremely skilled in the following areas.

Administering assessments:

_____

_____

_____

_____

Planning instruction:

_____

_____

_____

_____

Explicit content-area reading/writing instruction:

_____

_____

_____

_____

Sustaining a supportive learning environment:

_____

_____

_____

_____

Appendix 3. Clinical Educator Survey.

Clinical Educator Survey

Please rate on a scale of 0 to 10 each of the following categories in regards to the **Level of Skill** that you think the student teacher experienced with each area. 0 indicates that the student teacher was extremely challenged in this area and 10 indicates that the student teacher was extremely skilled in this area.

Extremely Challenged **0 1 2 3 4 5 6 7 8 9 10** **Extremely Skilled**

Administering Assessments											
Administering/analyzing formal assessments	0	1	2	3	4	5	6	7	8	9	10
Administering/analyzing informal assessments	0	1	2	3	4	5	6	7	8	9	10
Using ongoing formative assessments	0	1	2	3	4	5	6	7	8	9	10
Monitoring student progress	0	1	2	3	4	5	6	7	8	9	10
Planning instruction											
Planning lessons	0	1	2	3	4	5	6	7	8	9	10
Planning differentiated instruction	0	1	2	3	4	5	6	7	8	9	10
Explicit content-area reading/writing instruction											
Implementing guided reading	0	1	2	3	4	5	6	7	8	9	10
Modeling reading strategies	0	1	2	3	4	5	6	7	8	9	10
Teaching vocabulary/word study	0	1	2	3	4	5	6	7	8	9	10
Teaching writing	0	1	2	3	4	5	6	7	8	9	10
Sustaining a supportive learning environment											
Maintaining classroom management	0	1	2	3	4	5	6	7	8	9	10
Applying a variety of instructional methods	0	1	2	3	4	5	6	7	8	9	10
Providing verbal clarifying and written feedback	0	1	2	3	4	5	6	7	8	9	10
Varying participation structures	0	1	2	3	4	5	6	7	8	9	10
Providing multisensory inputs	0	1	2	3	4	5	6	7	8	9	10
Pacing instruction	0	1	2	3	4	5	6	7	8	9	10
Scaffolding learning activities	0	1	2	3	4	5	6	7	8	9	10

Demographic Information

PLEASE COMPLETE THE FOLLOWING INFORMATION: (Circle or fill in the answer)

Program Area: ECE MCE AYA IS MULTIAGE

Grade taught: _____ **Are you in the Urban Teacher Academy?** YES NO

Concentration: English Science Language Arts/Reading Social Studies Art Music Religion Math Foreign Language

School: Urban Suburban Rural

Please provide an example of when you noticed the student teacher being either extremely challenged or extremely skilled in the following areas.

Administering assessments:

_____

_____

_____

_____

Planning instruction:

_____

_____

_____

_____

Explicit content-area reading/writing instruction:

_____

_____

_____

_____

Sustaining a supportive learning environment:

_____

_____

_____

_____

References

About edTPA. (n.d.). Retrived from: http://www.edtpa.com/Home.aspx

Allington, R. L., & Johnston, P. H. (2001). *Reading to learn: Lessons from exemplary fourth grade classrooms.* New York, NY: Guilford.

Ball, D.L., & Forzani, F.M. (2010). Teaching skillful teaching. *Educational Leadership, 68*(4), 40-45.

Berliner, D. C. (2001). Learning about and learning from expert teachers. *International Journal of Educational Research 35*, 463-482.

Blue Ribbon Panel (2010). *Transforming teacher education through clinical practice: A national strategy to prepare effective teachers*. The National Council for Accreditation of Teacher Education. Retrieved from http://www.ncate.org/Public/ResearchReports/NCATEInitiatives

Bransford, J. D., Brown, A. L., & Cocking, R. R. (2000). How experts differ from novices. In J. D. Bransford, A. L. Brown, & R. R. Cocking (Eds.), *How people learn: Brain, mind, experience, and school* (pp. 31-50). Washington, D.C.: National Academy Press.

Bogard, T., Liu, M., Chiang, V. (2013). Thresholds of Knowledge Development in Complex Problem Solving: A Multiple-Case Study of Advanced Learners' Cognitive Processes. *Educational Technology Research and Development,* 61(3), 465-503. DOI 10.1007/s11423-013-9295-4.

Bowman, C. L., & Herrelko, J. M. (2014). Bridging theory to practice with classroom rounds. *Journal of the Scholarship of Teaching and Learning*, *14*(4), 51-66.

Caine, R.N., & Caine, H. (1998). Building a bridge between the neurosciences and education: Cautions and possibilities. *NASSP Bulletin*, *82*(598), 1-8.

Chauvin, R., & Theodore, K. (2015). Teaching content-area literacy and disciplinary literacy. *SEDL Insight*, *3*(1), 1-10.

Chi, M.T.H. (2008). Three types of conceptual change: Belief revision, mental model transformation, and categorical shift. In S. Vosniadou (Ed.), *Handbook of research on conceptual change* (pp. 61-82). Hillsdale, NJ: Erlbaum.

Corbin, J. M., & Strauss, A. M. (2008). *Basics of qualitative research: Techniques and procedures for developing grounded theory*. Los Angeles, CA: Sage.

Creswell J.W., Klassen A.C., Clark V.L.P., & Clegg Smith K. (2011). *Best Practices for Mixed Methods Research in the Health Sciences.* Washington, D.C.: Office of Behavioral and Social Sciences Research, National Institutes of Health.

Derry, S. J. (1996). Cognitive schema theory in the constructivist debate. *Educational*

Psychologist, 31(3), 163-174.

Dreyfus, H., & Dreyfus, S. (2005). Expertise in real world contexts. *Organization Studies 26* (5), 779–792. doi:10.1177/0170840605053102

Ericsson, K. A., Prietula, M. J., & Cokely, E. T. (2007). The making of an expert. *Harvard Business Review*, *85*(7/8), 114.

Fang, Z., & Coatoam, S. (2013). Disciplinary literacy: What you want to know about it. *Journal of Adolescent & Adult Literacy, 56*(8), 627–632.

Fountas, I.C., & Pinnell, G.S. (1996). *Guided reading: Good first teaching for all children*. Portsmouth, NH: Heinemann.

Funke, J., & Frensch, P. A. (1995). Complex problem solving research in North America and Europe: An integrative review. *Foreign Psychology, 5*, 42-47.

Johnson, B. R., & Onwuegbuzie, A.J. (2004). Mixed methods research: A research paradigm whose time has come. *Educational Researcher, 33*(7), 14-26.

Jonassen, D. H. (2005). Tools for representing problems and the knowledge required to solve them. In S. Tergan & T. Keller (Eds.), *Lecture notes in computer science* (Vol. 3426, pp. 93–95). Berlin: Springer.

Jonassen, D. H., & Strobel. J. (2006). Modeling for meaningful learning. In D. Hung and M.S. Khine (Eds.), *Engaged learning with emerging technologies* (pp. 1-27). Dordrecht, The Netherlands: Springer.

Kim, M. K. (2012). Theoretically grounded guidelines for assessing learning progress: Cognitive changes in ill-structured complex problem-solving contexts. *Educational Technology Research and Development*, *60*(4), 601–622. doi:10.1007/s11423-012-9247-4

Mayer, R. E. (1989). Models for understanding. *Review of Educational Research*, *59*, 43-64.

Moss, B. (2005). Making a case and a place for effective content-area literacy instruction in the elementary grades. *Reading Teacher*, *59*(1), 46-55. doi:10.1598/RT.59.1.5s

Participation Map. (n.d.). Retrieved from: http://edtpa.aacte.org/state-policy

Pearson, P. D., Roehler, L. R., Dole, J.A., & Duffy, G.G. (1990). *Developing expertise in language to learn.* Portsmouth, NH: Heinemann.

Polyani, M. (1958). *Personal knowledge.* Chicago, IL: University of Chicago Press.

Pressley, M., Allington, R., L., Wharton-McDonald, R., Block, C. C., & Morrow, L. M. (2001).

Learning to read: Lessons from exemplary first-grade classrooms. New York, NY: Guilford.

Ryle, G. (1949). *The concept of mind.* London, United Kingdom: Hutchinson.

Schön, D. A. (1983). *The reflective practitioner: How professionals think in action*. New York, NY: Basic Books.

Standards in your state. (n.d.). Retrieved from: http://www.corestandards.org/standards-in-your-state/

Tschannen-Moran, M., & Hoy, A. W. (2007). The differential antecedents of self-efficacy beliefs of novice and experienced teachers. *Teacher and Teacher Education, 23*, 944-956.

Tsui, A. B. M. (2003). Characteristics of expert and novice teachers. In C.A. Chapelle and S. Hunston (Eds.), *Understanding expertise in teaching: Case studies in ESL* (pp. 22-41). Cambridge, United Kingdom: Cambridge University Press.

Zhang, J. (1997). The nature of external representations in problem solving. *Cognitive Science, 21*(2), 179-217.

Worthy, J., Consalvo, A., Russell, K., Bogard, T. (2011). Spaces for academic and interpersonal growth in a primary literacy workshop classroom. In *The 55th Yearbook of the Literacy Research Association*, 60:55-67. Oak Creek: Literacy Research Association.

Westerman, D. A. (1991). Expert and novice teacher decision-making. *Journal of Teacher education, 42*(4), 292-305.