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Annotations of Awareness: A Framework for Externalizing Thinking to Promote Metacognitive Discourse in High School English and Social Studies Classrooms

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ANNOTATIONS OF AWARENESS: A FRAMEWORK FOR EXTERNALIZING THINKING TO PROMOTE METACOGNITIVE DISCOURSE IN HIGH SCHOOL ENGLISH AND SOCIAL STUDIES CLASSROOMS

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ABSTRACT

Teachers find it challenging to integrate metacognition into the classroom to promote critical thinking, but such rigorous instruction is one way to improve access to quality education for all students, no matter their access to outside-of-school resources. To help teachers find more comfort and confidence in designing for increased critical thinking and metacognitive discourse and to help close the theory-practice gap in metacognition research, I conducted a mixed-methods case study focusing on assessment-design interventions. Using the Metacognitive Framework for Assessment Design and Annotations of Awareness, both designed in response to my literature review, my 90-day action research included three Plan-Do-Study-Act cycles. Qualitative-data collection included surveys, observations and conversations, interviews, reflection logs, and design-session transcripts. Quantitative-data collection included Likert-scale portions of pre- and post-surveys and assistant-superintendent scores of teacher assessments pre and post study. Eight teachers (six English and two social studies) at a traditional public high school in South Carolina participated. Activity theory helped guide my iterative research design, my coding, and my findings. The benefits of the Metacognition Framework were measured and substantiated. Six themes emerged to reveal how the Framework supports critical thinking and metacognition: (a) *Finding Clarity through Abstraction*, (b) *Moving Backwards to Move Forwards*, (c) *Giving More Feedback to Give Less*, (d) *Slowing Down to Speed Up*, (e) *Focusing on the Discrete for Transfer*, and (f) *Students Guiding the Teachers*. Teacher self-ratings in confidence improved on average. Pre- and post-study assessment scores in the Thinking and Problem-Solving

domains of the South Carolina Teaching Standards 4.0 Rubric (South Carolina Department of Education [SCDE], 2021d) revealed maintenance of or growth in rigor for five teachers, while the scores for the other three teachers offered guidance on how to hold up the 4.0 Rubric (SCDE, 2021d) to the realities and priorities of teaching. South Carolina public schools should integrate the Framework in secondary English and social studies classrooms utilizing school-level instructional coaching and district induction programs in order to support teachers in crafting assessments for increased student critical thinking and increased metacognitive discourse.

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CHAPTER ONE

INTRODUCTION AND OVERVIEW

Problem of Practice

The problem of practice for this study is that teachers find it challenging to overtly and meaningfully integrate metacognition into the classroom to promote critical thinking. While South Carolina high school state standards frame skills that do ask students to move beyond recognition and recall, critical thinking and metacognition often go unsupported in an intentional and sustained way. All teachers want their students to think critically for themselves—to evaluate information and arguments, to make connections and identify patterns, to solve problems, to construct meaning, to experiment, to reflect, and to take action (Fullan & Quinn, 2016). Such higher-order thinking is not only what will prepare students for the cognitive demands they will face professionally, but it will also equip students with the means to understand their society and secure their agency and voice as they take "active control" (De Corte, 2003, p. 143) in recognizing and regulating their learning (De Corte, 2003). Metacognition should promote not only the practice of critical thinking but also enable more flexibility as students face varying cognitive challenges.

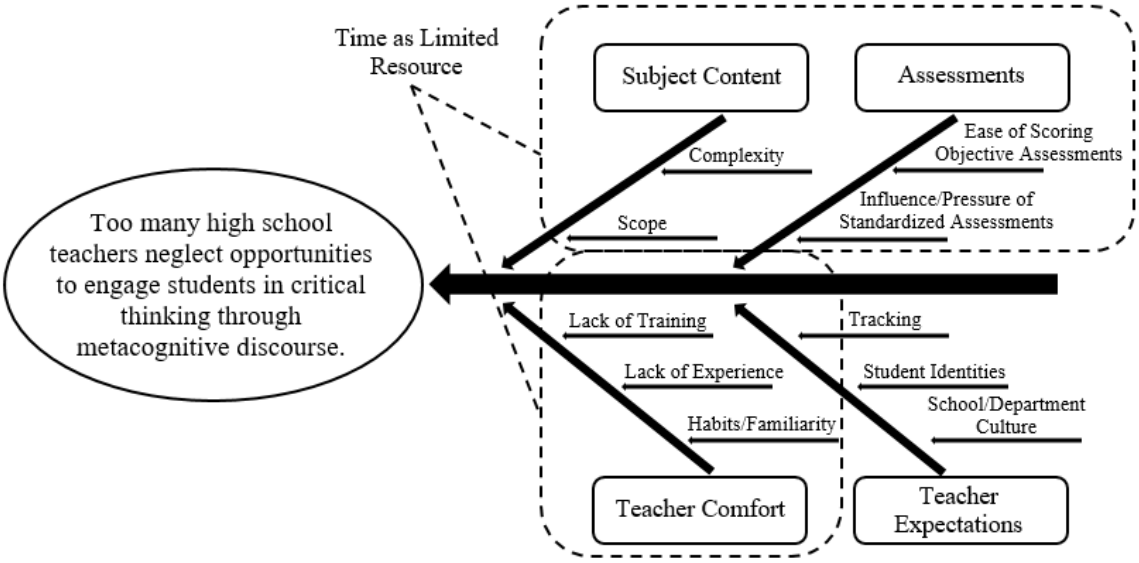
Education systems, South Carolina public schools included, consistently talk about preparing students for college and career in the 21st century, but do they concertedly prepare teachers to do this? Schools have to move beyond "just defining the deep learning competencies" to "identifying their interrelationships, practices that foster progression in their development, and ways to cultivate and share those practices with consistency for all learners" (Fullan & Quinn, 2016, p. 88). While needed, defining on

paper what critical thinking is does not define what it actively looks like for a teacher instructing students within demanding, domain-specific content. Similarly, instructional approaches that encourage and support critical thinking within and beyond the content will not become practical or scalable unless they are delineated with clarity and flexibility.

There are many factors that prevent sustained and intentional classroom support for critical thinking through metacognition: content gaining overshadowing content application (Ennis, 2018; Wilson & Bai, 2010), feedback reduced to a score on a test (Dudley-Marling, 2015; Hattie & Timperley, 2007; Kennedy, 2010), teachers lacking confidence and competence in strategies to support higher-level thinking (Braund & Soleas, 2019; Veenman et al., 2006; Zohar & Lustov, 2018), and teachers unfairly placing lowered expectations on students (Dudley-Marling, 2015; Gorski, 2018). Using a fishbone diagram (see Figure 1) "as a framework for illustrating the various root causes contributing to the problem of practice" (Perry et al., 2020, p. 60), I delineated these four categories of causes (subject content, assessments, teacher comfort, and teacher expectations) as to why too many high school teachers neglect to offer students access to and engagement in critical thinking afforded through metacognition (problem of practice). The first three categories of causes can be explained, at least partially, by a scarce teacher resource: time, time within each class period and time outside of full and demanding teaching schedules.

Figure 1

Fishbone Diagram of Problem-of-Practice Causes



One root cause sensitive to time constraints it that teachers feel pressure to "cover" their content. While more time becomes available to "cover" content when students are not engaged in the multiple stages of production, a myopic focus on imparting to students domain-specific knowledge, no matter the sweeping scope or the daunting complexity, is only the first step toward higher-order learning (Young, 1997). Unfortunately, "most classrooms worldwide are still predominately characterized by pedagogy of knowledge transmission that focuses on lower-order cognitive levels" (Zohar & Lustov, 2018, p. 88). The sheer numbers of South Carolina state standards per content area only contribute to this mindset of covering content versus teaching students "in adequate intellectual depth" (Schmoker, 2018, p. 47).

Another time-sensitive category of cause deals with assessment practices. Such a shortsighted focus in instruction is due in part to the increasing requirements of

standardized testing that offer little individually meaningful cognitive feedback—task feedback, processing feedback, or self-regulation feedback (Hattie & Timperley, 2007)—for students and pressure teachers into thinking they have to focus more on content retention and assessments that mirror state and national tests. Also, the speed and diminished cognitive load of grading such objective tests appeal to teachers and encourage such classroom-level practices. As Kennedy (2010) asserts, "Reform efforts, which are frequently combined with accountability measures and high-stakes testing, have tended to be prescriptive, often disempowering teachers" (p. 384).

A third root cause tied to time constraints is teachers' discomfort with integrating critical thinking and metacognition into their classrooms. This "disempowerment" due to prescriptive reform efforts (Kennedy, 2010), along with limited time, discourages educators from pursuing the skills and pedagogies needed for higher-order teaching and learning, skills and pedagogies that are currently "fragile" (Zohar & Lustov, 2018, p. 97) for many teachers. Such limited or tentative knowledge maintains the present "scarcity of metacognitive learning in classrooms" (Zohar & Lustov, 2018, p. 97). Teacher responses from a 2001 study reveal this "discomfort" (Braund & Soleas, 2019, p. 112) with integrating metacognition in the classroom:

> In fact, many teachers lack sufficient knowledge about metacognition: When we interviewed teachers about metacognition their incidental responses did not go beyond "independent learning...," while a further query about how they applied metacognition in their lessons only resulted in blanks (Veenman, Kok & Kuilenburg, 2001; but see also Zohar, 1999). (Veenman et al., 2006, p. 10)

If teachers are to grow more comfortable with promoting critical thinking and metacognition in their classrooms, they need practical strategies and professional support, and these efforts and "measures to inform improvement must be embedded in the regular work of teaching and learning" (Bryk et al., 2015, p. 100). Teachers attending isolated professional-development (PD) sessions or reading up on these topics outside of their busy schedules will not likely change their practices profoundly or consistently enough. Sustained, embedded PD needs to focus on theory and pedagogy but do so in ways that are "practical and user-friendly, yet not 'mechanical'" (Zohar & Lustov, 2018, p. 98). Effective PD opportunities for teachers, embedded or isolated, remain largely inaccessible, though, with a dearth of research in the domain of teacher pedagogy to guide their design:

> Yet, teachers' beliefs and teaching practices aimed at developing students' metacognitive thinking are understudied (Zohar & Barzilai, 2013). Therefore, it is important to gain an appreciation of the struggle to integrate metacognition and identify crucial supports for teachers, as the lack of research hinders ability to design more effective teacher education in pre-service and in-service settings. (Braund & Soleas, 2019, p. 106)

Teachers, and teachers of teachers, also experience less comfort and competence in integrating metacognition due to the fact that it is a "complex construct" (Lai, 2011, p. 27), "a fuzzy concept with indistinct boundaries" (Papleontiou-Louca, 2003, p. 11). Some of the more immediate challenges that create teacher "discomfort" (Braund & Soleas, 2019, p. 112) with metacognition integration include: concerns over student engagement,

logistics, teacher skepticism, teacher understanding, supports, and collaboration (Braund & Soleas, 2019).

The fourth category of causes on the fishbone diagram—teacher expectations, however, has little to do with limited time for the demands of teaching and everything to do with teacher ideologies. Lowered expectations might come from a place of not acknowledging assets in students in less-advanced tracks. They might arise from teacher-held biases and prejudices tied to student identities. They might be strongly influenced by the teaching culture that surrounds the teacher. No matter the sources, such dismissal of student opportunity and potential denies students' access to curricula that engage them in higher-order thinking (Gorski, 2018). Lowered expectations bound by standardized accountability often lead to a focus on mere remediation for students falling behind, but this only further hinders their growth (Dudley-Marling, 2015).

Efforts to meet students where they are and to cover the content, even through remediation, do not have to neglect higher-order learning, though. With thoughtful learning endeavors that require student planning, monitoring, and evaluation—student design, all students can utilize metacognition to access more critical thinking (Kramarski & Mevarech, 2003; Perry, 1998). Unfortunately, teachers designing then implementing curricula to "take a metacognitive approach to instruction, emphasize higher order thinking skills, teach basic skills in meaningful contexts, and use a range of formative assessment tools" is the exception to the rule (Kennedy, 2010, p. 384).

Research Question

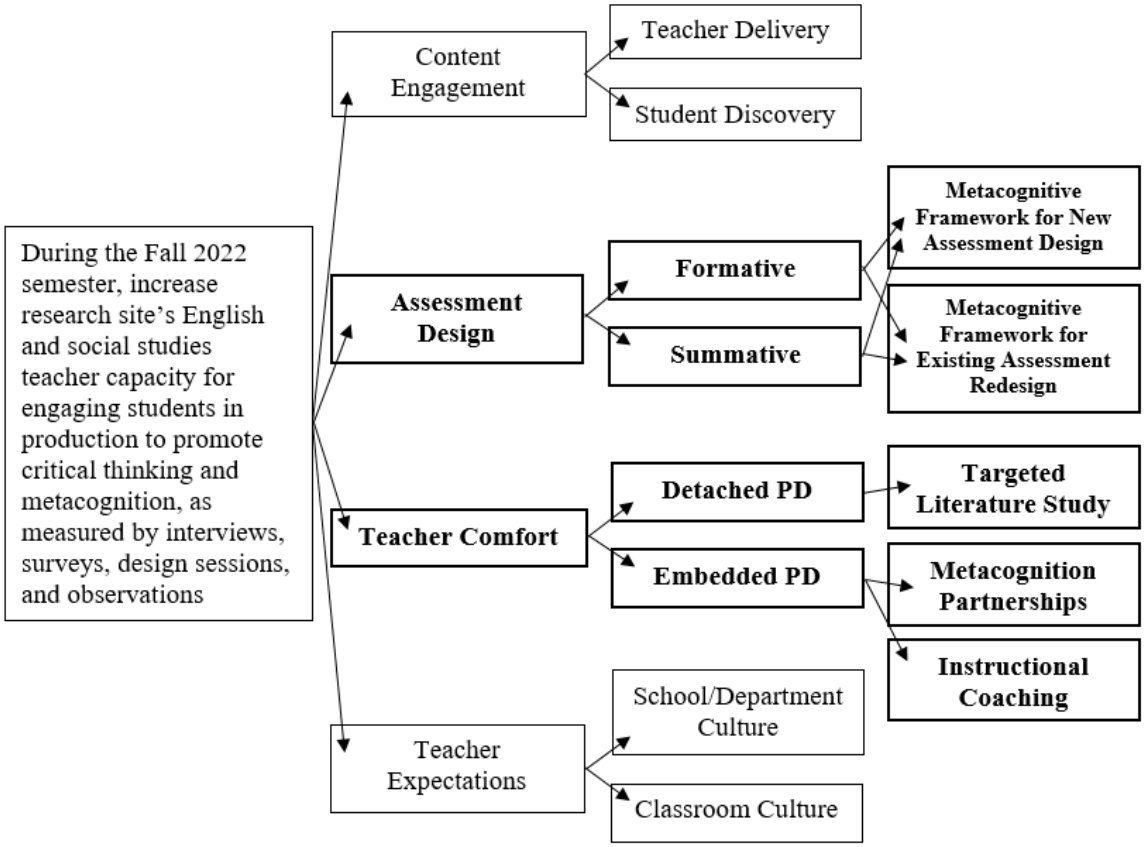
Using a driver diagram (see Figure 2) to identify "leverage points" for possible "positive effects" (Perry et al., 2020, pp. 91-92), my four primary divers for change responded directly to the four causes from my fishbone diagram (see Figure 1). With my primary drivers identifying where I should focus my efforts of intervention, my secondary drivers identified what needed to change for improvement (Perry et al., 2020). Lastly, my diver diagram addressed how I could approach intervention with specific change ideas. I decided to narrow my focus and concentrate on just two primary drivers: Assessment Design and Teacher Comfort. My action research employed five change ideas: Metacognitive Framework for New Assessment Design, Metacognitive Framework for Existing Assessment Redesign, Targeted Literature Study, Metacognition Partnerships, and Instructional Coaching.

This focused "map" for approaching change informed my overarching research question: How does embedded PD focusing on assessment design grow teachers' capacities to impact students' critical thinking and metacognition as demonstrated by student production? As a teacher and instructional coach, such a research focus harnessed my "sphere of influence" (Hinnant-Crawford, 2020, p. 130) at the study site and my skillsets as an educator. Also, coming alongside English and social studies teachers to help them design and redesign their assessments created the opportunity for "simple, applicable, and easily implemented ways of integrating metacognition that fit within their existing teaching routines" (Braund & Soleas, 2019, p. 119). Such an approach to PD

realized the limited resource of time and offered the potential for modeling for teachers the practices in which we want students to engage.

Figure 2

Driver Diagram for Change



Key Terminology

Cognition and Metacognition

Cognition is thinking, and metacognition is thinking about thinking. The two are discrete yet intertwined and may even be "mutually dependent on each other" (Ku & Ho, 2010, p. 253). And while a teacher could use the same class activity to engage students in either cognition or metacognition, the goal of the endeavor helps distinguish which is at

play (Ku & Ho, 2010). Cognition is used to "achieve a particular goal" (Livingston, 2003, p. 3), while metacognition is used to "ensure the goal has been reached" (Livingston, 2003, p. 3). While "cognitive activities help to acquire, retain and transfer knowledge for task execution" (Ku & Ho, 2010, p. 253), "metacognitive activities allow one to regulate and govern task execution (i.e., how a task is carried out to ensure satisfactory level of performance)" (Ku & Ho, 2010, p. 253). Since metacognition employs "higher-order cognitions that supervise" (Ku & Ho, 2010, p. 252) thinking—"perception of what is known or unknown, knowledge of oneself as a thinker and regulation of how one goes about thinking a problem" (Ku & Ho, 2010, p. 252), it often bookends a cognitive task, especially a failed task, as the "learner attempts to rectify the situation" (Livingston, 2003, p. 4).

Within classrooms on any given day, teachers can and do use cognitive strategies to help students with thinking, and many students, by their high school years, have enough ownership of these skillsets to pull from them as they navigate their learning (see Figure 3). This, in and of itself, is moving into metacognition if students implement these approaches with awareness, discretion, and intention to reach a learning goal. Teachers can also help students with metacognition by using metacognitive strategies that scaffold and model the processes involved in complex, multistep thinking (see Figure 3). Such explicit teacher support can help ensure students engage more frequently in metacognition with clarity and confidence.

Figure 3

Cognitive and Metacognitive Endeavors

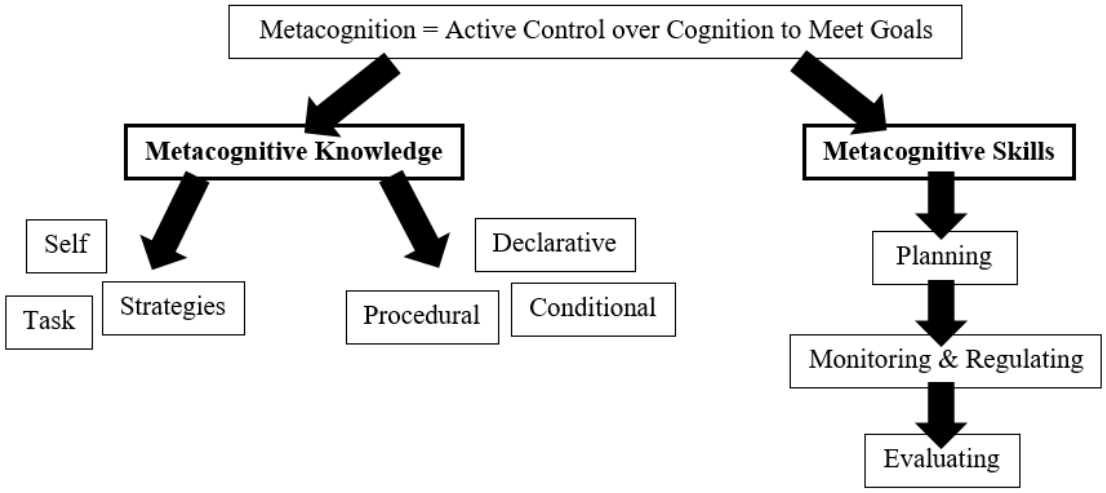
Student **Cognitive Information Processes**	**Teacher-Employed** **Cognitive Strategies**
Attending & Selective Perceiving	Highlighting, Underlining, Outlining, Adjunct Questioning
Rehearsal	Paraphrasing, Chunking, Using Imagery
Encoding	Concept Mapping, Making Analogies
Retrieval	Utilizing mnemonics, Using Imagery
	Using embedded strategy training interventions specific to the context and content but requiring learners to draw upon and modify domain-specific knowledge
Student **Metacognitive Information Processes**	**Teacher-Employed** **Metacognitive Strategies**
Executive Control (Planning, Monitoring, Evaluating) In Response to Higher-Order Thinking (Evaluating Arguments, Asking Research Questions, Dealing with Controversies, Making Comparisons, Designing, Controlling Variables, Drawing Conclusions, Corroborating Information Sources, Establishing Causal Relationships)	Integrating Procedural Prompts; Offering Complex, Multistep Directions on How to Think; Think-Aloud Modeling; Simulating Dialogues of Student, Teacher, or Expert Solving a Problem or Processing Material; Adjunct Questioning Requiring Specific Thinking Processes

Note. Content and format are adapted from Young, 1997 and Zohar & Lustov, 2018.

Metacognition can be broken into two components: knowledge and regulation or skills (Ku & Ho, 2010; Livingston, 2003; Zohar & Lustov, 2018). As depicted in Figure 4, metacognitive knowledge (on the left) includes understanding of self, task, and necessary strategies (Ku & Ho, 2010; Livingston, 2003). Metacognitive regulation (on the right) includes the actual strategies applied to accomplish planning, monitoring and regulating, and evaluating (Ku & Ho, 2010; Zohar & Lustov, 2018).

Figure 4

Metacognition Mapped Out



Note. Content is from Livingston, 2003; Ku & Ho, 2010; Wilson & Bai, 2010; and Zohar & Lustov, 2018.

Another way to categorize metacognitive knowledge is through the lens of how it is engaged (see Figure 4): declarative (what), procedural (how), and conditional (when and why) (Wilson & Bai, 2010). Considering teachers' engagement with metacognition, declarative knowledge is "knowledge of what they should teach" (Wilson & Bai, 2010, p. 272). Procedural knowledge is "knowledge of how a teacher teaches something" (Wilson & Bai, 2010, p. 272). Conditional knowledge is "the understanding that the teaching of metacognitive strategies is dependent on the situation and that particular situations require the use of particular strategies" (Wilson & Bai, 2010, p. 272).

Returning to a more straightforward definition that distinguishes cognition from metacognition, Livingston (2003) simply states, "Knowledge is considered to be metacognitive if it is actively used in a strategic manner to ensure that a goal is met" (p.

4). While the lines between cognition and metacognition can blur at times, students actively and strategically thinking to achieve learning goals is the ideal. Helping students become aware of what this looks like for them so that they can monitor and adjust for increased success will only encourage critical thinking. In this way, engagement in metacognition will encourage engagement in cognition.

Metacognition and Self-Regulation

Whether understood as interchangeable or hierarchical concepts (Hofer & Sinatra, 2010), metacognition and self-regulation are closely connected within the construct of executive functioning. One common understanding of self-regulation places metacognition in a subordinate position along with motivation and behavior as contributors to students becoming "active participants in their own learning process" (Zimmerman & Martinez-Pons, 1988, p. 284):

> In terms of metacognitive processes, self-regulated learners plan, organize, self-instruct, and self-evaluate at various stages during the acquisition process. From a motivational vantage, self-regulated learners perceive themselves as self-efficacious, autonomous, and intrinsically motivated. In terms of behavior, self-regulated learners select, structure, and even create social and physical environments that optimize acquisition. (Zimmerman & Martinez-Pons, 1988, p. 284)

In this construct, metacognition contributes to active learning as "a means of moderating performance" (Hofer & Sinatra, 2010, p. 115), as the conscious strategies to monitor success. No matter the conceptualization, though, the emphasis on the environment's role

remains a demarcation between metacognition and self-regulation, with metacognition researchers focusing on the mind "as the initiator or trigger for subsequent judgments or evaluations" (Dinsmore et al., 2008, p. 405) and self-regulation researchers focusing on learners' surrounding environments as the stimuli for their "awareness and their regulatory responses" (Dinsmore et al., 2008, p. 405). Whether teachers see the catalyst for conscious and intentional thinking coming from within or from outside of the learner, teachers can still design "strategic classrooms" (Meltzer et al., 2007, p. 166) that help students build skillsets to help them tactically and flexibly navigate cognitive challenges.

Critical Thinking

Ultimately, critical thinking centers on educated decision making; it is "reasonable reflective thinking focused on deciding what to believe or do" (Ennis, 2018, p. 166). The American Philosophical Association's *The Delphi Report* identifies six critical-thinking skills—"(1) interpretation, (2) analysis, (3) evaluation, (4) inference, (5) explanation and (6) self-regulation" (Facione, 1990, p. 8)—that allow a person to have "purposeful" (Facione, 1990, p. 3) judgment. The report also speaks to how the "ideal" (Facione, 1990, p. 3) critical thinker's attitudes include reason, prudence, open-mindedness, fair-mindedness, awareness of personal biases, willingness to reconsider, and precision (Facione, 1990). Such cognitive dispositions, in addition to cognitive skills, are "essential for a person to reach sound judgments" (Ku & Ho, 2010, p. 254). Psychological considerations of critical thinking focus on the transferability of "discrete skills or mental operations and dispositions" (Abrami et al., 2008, p. 1103). Critical thinking is goal-oriented and strategic, requiring "an active control of one's own thinking

processes for well-justified conclusions" (Ku & Ho, 2010, p. 251). Such control necessitates knowledge and awareness of thinking—metacognition. Ultimately, critical thinking "involves cognitive, dispositional, and metacognitive components" (Ku & Ho, 2010, p. 254). Ku and Ho (2010) directly connect metacognition to critical thinking: "In sum, a critical thinker is one who is in charge of his thinking processes, while metacognitive strategies enable such control to take place" (p. 254). Metacognition and critical thinking are inseparable. Teachers supporting students in growing their metacognitive strategies only empower students to become independent and responsible thinkers capable of navigating complexity.

Rationale for Research

Evidence That Metacognition Is Teachable

Since Flavell's coining of the term "metacognition" in the 1970s (Lai, 2011), research on metacognition has ranged from understanding its parts and parameters to understanding it in practice. Lai (2011) documented how researchers since the late 1980s have offered evidence that metacognition can be taught to advance student learning. Cross and Paris's (1988) study utilized the Informed Strategies for Learning (ISL) curriculum intervention with 171 third- and fifth-graders to connect metacognition with reading comprehension. Their data revealed "group instruction can be used to inform children about reading strategies and, more important, that children can be convinced to use these strategies on their own" (Cross & Paris, 1988, p. 140). Gaining declarative, procedural, and conditional reading knowledge, the students demonstrated "increased performance on strategic reading tasks" (Cross & Paris, 1988, p. 140), pointing to their

learning of metacognitive skills in planning, monitoring/regulation, and evaluation (Cross & Paris, 1988).

Also focusing on metacognition and reading, Haller et al. (1988) conducted a meta-analysis of 20 studies that included 1,553 students. Haller et al. (1988) found that, with a mean effect size of 0.71, the "average effect of metacognitive instruction on reading comprehension is substantial" (p. 8) but that this instruction needs to last for more than 10 minutes per lesson in order to be effective. Most impactful for seventh- and eighth-graders (Haller et al., 1998), the teaching of the metacognitive skills of "awareness of textual inconsistency and the use of self-questioning as both a monitoring and a regulating strategy were most effective" (Haller et al., 1998, p. 5). The most effective strategy for teaching metacognition was reinforcement (Haller et al., 1988).

Hennessey (1999) studied an instructional program (Project META) for 170 first- through sixth-grade science students over the course of three years. Focus was placed on "making students' science conceptions visible" (Lai, 2011, p. 23) through "poster productions" and "conceptual models (in the form of diagrams, three-dimensional physical models, or concept maps)" (Hennessey, 1999, p. 4). The data supported four claims:

> First, metacognition is within the capabilities of young (school age) children. Second, children's metacognitive ability is multifaceted in nature, it can be probed and teased apart. Third, changes in metacognitive sophistication can be gained by actively engaging in the process. Fourth, changes in metacognitive ability and

> conceptual understanding may be more closely linked to the individual student's epistemological stance. (Hennessey, 1999, p. 1)

Making thinking visible, one way of externalizing thinking, not only holds the students accountable for their thinking, but it also facilitates teachers' abilities to respond to that thinking.

Kramarski and Mevarech (2003) researched 384 mathematics students in eighth grade. They studied four instructional approaches: individualized without metacognition instruction, cooperative without metacognition, individualized with metacognition, and cooperative with metacognition (Kramarski & Mevarech, 2003). Their data showed that

> students who were exposed to the metacognitive training in either cooperative or individualized settings significantly outperformed the other students on graph interpretation (total scores), fluency and flexibility of correct explanations, use of logical-formal arguments to justify their reasoning, and transfer tasks (graph construction). In addition, the metacognitive groups attained higher levels of domain-specific metacognitive knowledge than the non-metacognitive groups. (Kramarski & Mevarech, 2003, p. 300)

Kramarski and Mevarech (2003) encouraged designing learning conditions around cooperation and metacognition "at all grade levels and for all mathematical topics" (p. 305). Students given such opportunities in learning can find more success with actively using their knowledge, making their knowledge more useful, in a sense, through flexibility and transferability.

Dignath et al. (2008) conducted a meta-analysis of 48 studies researching the teaching of self-regulated learning strategies in grades one through six. They calculated the mean effect size for approaches connected to cognition, metacognition, and motivation (Dignath et al., 2008). Two of the three strategy groupings with the greatest mean effect sizes included metacognition (metacognition and motivation at 0.97 and metacognition and cognition at 0.81) (Dignath et al., 2008). While the teaching of various solely metacognitive strategies across the studies resulted in a mean effect size of 0.54, teaching metacognition in planning and evaluation offered a mean effect size of 1.46, and teaching metacognition in planning and monitoring offered a mean effect size of 1.50 (Dignath et al., 2008). Metacognition strategies embedded in student production create more authentic opportunities for students to engage in thinking about their thinking as they plan, monitor, and evaluate.

In Dignath and Büttner's (2008) meta-analysis of 49 studies conducted in primary schools and 35 studies conducted in secondary schools, they calculated separate weighted mean effect sizes of 0.68 and 0.71, respectively, with the highest for primary being in motivation in mathematics and the highest for secondary being in reading and writing strategies. This may be the case for secondary students because they experience more automaticity with reading and writing, freeing up "capacity for metacognitive processes" (Dignath & Büttner, 2008, p. 254). Dignath and Büttner (2008) concluded that self-regulated learning can be effectively taught across a student's continuum from primary to secondary school. While primary teachers should focus on strategies that encourage and motivate, especially in mathematics, secondary teachers should employ strategies that

"build on the strategic repertoire that students have already acquired by then" (Dignath & Büttner, 2008, p. 258). Teachers need to give students time to "practice and automate strategy use in order to facilitate transfer to other learning situations" (Dignath & Büttner, 2008, p. 258), and they should harness the potential of "metacognitive reflection" (Dignath & Büttner, 2008, p. 258). Building automaticity in metacognition not only lightens the cognitive load on students, making it more likely to occur; it also supports knowledge transfer, making learning more versatile and useable.

Researched Strategies to Teach Metacognition

Lai's (2011) literature review also identified the broad teaching strategies that researchers have studied and found effective. These include explicitly teaching metacognition, providing prompting checklists or questions as scaffolding, integrating cooperative learning, making thinking visible, and modeling thinking verbally (Lai, 2011). Cross and Paris (1988) encouraged this explicit instruction (including feedback) because it allows students to "become apprentices to the teacher and receive support when skills are fragile or partially developed" (p. 141). Hennessey (1999) asserted that "even in the best constructivist learning environment metacognition does not simply happen, it must be explicitly promoted" (p. 21). Schraw et al. (2006) directed teachers' intentional instruction to strategies for enhancing cognition, metacognition, and motivation. This explicit approach holds true for inquiry-based learning, as well, as teachers should "facilitate student thinking through scaffolded instruction and explicit reflective thinking" (Schraw et al., 2006, p. 118). Many researchers, including Cross and Paris (1988) and Kramarski and Mevarech (2003), stressed the importance of sharing

with students “how to use strategies, when to use them, and why they are beneficial” in order to build student motivation, independence, and strategy (Lai, 2011, p. 23).

One way to explicitly scaffold strategic metacognitive thinking in students is to provide guiding questions or statements that prompt awareness and reflection. Schraw (1998) encouraged supplying students with such prompts in the form of a “regulatory checklist” (p. 120) divided into planning, monitoring, and evaluating to help students “implement a systematic regulatory sequence that helps them control their performance” (p. 120). Kramarski and Mevarech (2003) offered students during-task questions in three categories: comprehension, strategy, and connection:

> The comprehension questions were designed to prompt students to reflect on a problem before solving it. . . . The strategic questions were designed to prompt students to consider which strategies were appropriate for solving or completing a given problem or task and for what reasons. . . . The connection questions were designed to prompt students to focus on similarities and differences between the immediate problem or task and problems or tasks that they had already completed successfully. (p. 286)

Likely “rooted in Piagetian and Vygotskyian traditions that emphasize the value of social interactions for promoting cognitive development” (Lai, 2011, p. 25), many researchers recommended cooperative learning to build metacognitive skills. Looking at Geil and Moshman’s 1994 study, Schraw and Moshman’s (1995) review of metacognitive theories pointed to how the “discussion of one’s metacognitive conceptions with others may help clarify those conceptions and improve complex

problem solving" (p. 364). Hennessey's (1999) intervention sought to "engage/promote metacognitive discourse among the learners" as a means to "create conceptual conflict or dissatisfaction with the learners' current ideas/beliefs" (p. 5). Kramarski and Mevarech (2003) saw more cogent written explanations of mathematical thinking from students who participated in groups than those who worked alone. Kuhn and Dean (2004) indirectly spoke to the potential of cooperative learning in metacognition by addressing the importance of metacognitive discourse. Referencing Vygotksy's and Piaget's ideas on interiorization, Kuhn and Dean (2004) described growing student efficacy that comes with such social interaction:

> If students participate in discourse where they are frequently asked, "How do you know?" or "What makes you say that?" they become more likely to pose such questions to themselves. Eventually, we hope, they will interiorize the structure of argument as a framework for much of their own individual thinking. They will think in terms of issues or claims, with facts summoned in their service, rather than the reverse—storing up facts with the idea that some conclusion may emerge from them. (p. 270)

Schraw et al.'s (2006) review of research pointed toward the promise of carefully structured peer learning: "Students of similar achievement levels may be more effective than teacher–student pairs because the former are able to discuss strategies in the novice's zone of proximal development" (p. 120). Schraw et al. (2006), along with Kramarski and Mevarech (2003), found that explicitly teaching collaboration optimized cooperative learning (Lai, 2011).

Externalizing thinking through student and teacher visual and verbal expression can help make metacognition more concrete as it offers clarity in accuracies and errors. Hennessey (1999) and Schraw et al. (2006) recommended the construction and refining of concept maps as a way to support the change in misconceptions. Schraw (1998), Kramarski and Mevarech (2003), and Martinez (2006) also encouraged teacher modeling of metacognition through thinking out loud. Martinez (2006) asserted that this is key during problem solving because the teacher's "verbalizations can be a powerful source of cognitive processing that can be internalized by students" (p. 699). Martinez (2006) recommended "making thinking audible" (p. 699) within peer dynamics, as well. Zohar and Barzilai (2013) spoke to another approach to encouraging the verbalization of thinking when they referenced Tishman and Perkins's (1997) idea of "the language of thinking" (p. 368). This language can be divided up into three categories of function: epistemic stance, intellectual process, and intellectual product (Tishman & Perkins, 1997). Not only does this language help structure discourse on thinking; it provides access and direction to thinking:

> Although thinking involves much more than we can say, we would have far less access to that "more" without the language of thinking. Another idea from aesthetics emphasizes that language commonly has a pointing function. The use of language in the presence of a work of art does not substitute for the work but cues us to see or hear things we would otherwise miss. In classrooms or offices, seminars or senates, far from standing between us and our thinking, the language of thinking helps us discern more clearly and deeply what we are doing, where we

> are going, and where we might better go when we think. (Tishman & Perkins, 1997, p. 374)

Externalizing thinking by operationalizing, both visually and verbally, this "language of thinking" (Tishman & Perkins, 1997, p. 368) will encourage and facilitate much-needed metacognitive dialogue between students and teachers. If this approach can be streamlined and built into assessments, then assessments and associated feedback become stronger tools to engage students in metacognition.

A meta-analysis of 684 quasi- or true-experimental studies by Abrami et al. (2015) set out to study "a synthesis of effective strategies" (p. 276) for teaching critical thinking (CT). Their review of empirical evidence revealed that "a variety of CT skills (both generic and content specific) and dispositions can develop in students through instruction at all educational levels and across all disciplinary areas using a number of effective strategies" (Abrami et al., 2015, pp. 301-302). Two approaches to critical-thinking instruction appeared most effective: teachers posing questions to the entire class or to small groups (dialogue) and teachers exposing students to "authentic or situated problems and examples" (even via roleplaying) (Abrami et al., 2015, p. 302). When one-on-one teacher mentoring was added so that all three intervention types were at play, even greater impact was achieved (Abrami et al., 2015). These findings align with Ennis's (2018) views that critical thinking is best taught through a problem orientation (problem-based learning) and the explicit labeling of thinking. Such a mentoring approach can be integrated into the classroom with more frequency and fluidity through

assessments that require student production to promote cognitive and metacognitive feedback.

Zohar and Barzilai (2013) simply captured these various broad strategies that support explicit teaching of metacognition as "metacognitive cues and prompts in the course of instruction" (p. 146). While this might sound rather straightforward, the difficulties arise with building enough teacher efficacy in strategy use to where teachers will actually allot time for metacognitive instruction and with assessing student engagement in and application of metacognition during their learning.

Challenges with Assessing Metacognition in the Classroom

Assessing metacognition in the classroom is challenging because of its complexity. In addition to considering cognitive knowledge (declarative, procedural, and conditional) and cognitive regulation (planning, monitoring/regulating, and evaluating) (Lai, 2011), teachers need to account for the "affective and motivational states" (Lai, 2011, p. 27) of their students because these, too, impact metacognition. The research tied to metacognitive assessments that may offer teachers guidance has largely been conducted outside of the classroom:

> Furthermore, because metacognition is not a skill that is traditionally assessed regularly in school as part of the normal curriculum, many of these assessments have come from experimental studies where the skills are practiced in a lab environment that is somewhat artificial or contrived, in the sense that it is not connected to school learning. (Lai, 2011, p. 28)

While students can complete questionnaires or surveys tied to their learning enterprises, this can become tedious and thus disengaging and inauthentic. While students can think out loud as they complete an endeavor, this may "not capture implicit cognitive processes" (Lai, 2011, p. 27). While teachers can rate student engagement in metacognition using highly structured scales, this can distract and disconnect. Perry (1998) and Kramarski and Mevarech (2003) pointed to well-designed tasks themselves as ripe territory to assess metacognition. Perry's (1998) observations in elementary school classrooms aligned with previous studies' findings at the middle through college levels that "writing activities, particularly when they engage students in all aspects of the writing process (planning, drafting, editing, and revising), present rich contexts for observing SRL [self-regulated learning]" (p. 716). Kramarski and Mevarech (2003) recommended learning endeavors include "complex situations that present quantitative information in different contexts, allow multiple representations, or afford students opportunities to resolve mathematical conflicts" (p. 302). Such well-designed tasks take teacher expertise and care, but PD that supports the design of metacognitive assessments can offer teachers designated opportunities to create, refine, share, and reflect.

Research Needed to Close the Theory-Practice Gap

While rich data pointing to the benefits of integrating metacognition into the classroom have been gleaned over multiple decades, researchers have only more recently begun studying teachers' pedagogies and practices relative to metacognition. With less research comes less direction for PD for both pre-service and in-service teachers. Zohar

and Barzilai's (2013) review of research pointed to the work of Georghiades (2004) and Thomas (2012) to demonstrate this underdeveloped arena:

> Apparently, the application of metacognition in the classroom is an extremely powerful mode of teaching, indicating that it is very important for teachers to be able to use it appropriately. Yet, the scarcity of studies in this area, described by Georghiades and Thomas, leaves us with serious questions: What do teachers need to know and to be able to do in order to apply metacognition successfully in the classroom? Do teachers usually possess the pertinent knowledge? What sort of PD processes can help teachers develop the necessary knowledge? (p. 127)

As Zohar and Barzilai (2013) identified the knowledge teachers need to competently integrate metacognition into their classroom, the focus of PD becomes more comprehensive and fundamental than just offering strategies. Teachers must employ strategies with "general theoretical knowledge about metacognition" and "personal ability to practice metacognitive thinking with respect to classroom activities" (Zohar & Barzilai, 2013, p. 128). Teachers have to become comfortable with approaching learning more strategically at a metacognitive level before they can help students do the same. They also have to be able to use a "language of thinking" (Tishman & Perkins, 1997, p. 368) to both model for and engage students (Zohar & Barzilai, 2013). As teachers increasingly approach classroom endeavors through a metacognitive design lens of plan, regulate, and reflect, the endeavors themselves increase the potential for student metacognitive growth. When teachers are "able to skillfully think about planning, monitoring, controlling and evaluating the performance of that particular thinking

strategy during classroom activities" (Zohar & Barzilai, 2013, p. 128), they are able to communicate their design strategies as they engage students in theirs.

In Georghiades's (2004) review of research with a focus on metacognition in science instruction, he described a "theory-practice gap" (p. 379) resulting from the literature on metacognition that offers "extensive academic elaboration on the mechanisms of metacognitive thinking" with "rare attempts to bring this inside ordinary classrooms" (p. 379). Georghiades (2004) posited that "the notion of metacognition is largely unknown to the average science teacher" (p. 379) and that those who do possess some knowledge of it lack the resources for classroom implementation. Research in pedagogy and practice could both guide PD to equip teachers with some of these resources and bring attention to the need for more:

> The conduct of research on the use and training of metacognition in "natural contexts" (Davidson et al., 1998) is one way of taking a step forward. Until such changes are brought about, the practice of metacognitive thinking in science education will rely heavily on the initiative of small groups of teachers, who will have to invent both the resources and the time for such engagement. (Georghiades, 2004, p. 379)

Zohar's (2006) study of 14 secondary science teachers participating in the Thinking in Science Classroom PD course echoed this same concern for the lack of research on teacher pedagogy and practice that could support quality PD:

> Previous studies have not examined directly issues such as the types of knowledge teachers need for applying MSK [metastrategic knowledge] in the course of

> instruction, the feasibility of developing such knowledge in professional development courses, the characteristics of such potential developments, and the nature of professional development courses in this area. (p. 342)

Among the study's findings, Zohar (2006) concluded that most of the teachers entered the PD with little knowledge of metacognition's role in the classroom but that they gained "considerable" (p. 365) knowledge in thinking-skills awareness and identity via the course. These findings confirmed the findings from Zohar's previous work in 1999 and 2004 that "teachers' initial MSK is lacking and is unsatisfactory for sound teaching of higher order thinking skills" (Zohar, 2006, p. 365).

Thomas (2012) addressed the same missed opportunities in research: "In other words, whilst there are few who question the importance of metacognition, the recognition of this importance is not reflected in teachers' or teacher educators' practices" (p. 132). Thomas (2012) called for expanded research on teaching metacognition in order to "enable increased effectiveness of professional development activities that aim to help teachers to develop higher-order thinking and metacognition in science learning environments" (p. 142). Teachers have to be equipped to engage their content, instruction, assessment, and feedback through metacognition before they can support students in maturing as metacognitive thinkers. The requisite explicitness of metacognition integration in the classroom demands intentionality and direction.

Wilson and Bai's (2010) study of 105 education graduate students focused on teacher knowledge of metacognition, pedagogical stance relative to metacognition, and understanding of what teaching metacognition means. They created the Teachers'

Metacognition Scale (TMS) containing 20 Likert-scale questions to ask about "modeling/demonstration of thinking processes, opportunities for practicing thinking processes, students sharing thinking processes, questioning strategies, providing feedback/debriefing practices, grouping practices, and the use of active discussions" (Wilson & Bai, 2010, p. 274). While this study looked at teacher mindsets tied to metacognition by asking them to rate practices, researchers did not observe actual teacher practice or even ask participants to report their own practices (Wilson & Bai, 2010). While this study moved toward the classroom, the teacher, and the operationalization of teaching metacognition, the "theory-practice gap" that Georghiades identified in 2004 still exists. Wilson and Bai (2010) found a "discrepancy between what the participants know they should do and his/her practice" (p. 286). Considering causes for this gap, Wilson and Bai (2010) pointed to teachers feeling trapped by prescriptive curricula and overwhelmed by the breadth of their content. Since the participants demonstrated possessing knowledge of necessary practice in teaching metacognition and valuing endeavors that support students in becoming more metacognitive, Wilson and Bai (2010) realized the need for PD and graduate studies to focus more on specific strategies that promote metacognition in the classroom.

Designing PD to Help Close the Gap

To support teachers in their teaching of critical thinking and metacognition, PD must move away from the isolated, "short-term workshops" (Wei et al., 2010, p. 1) approach that became even more prevalent during No Child Left Behind (Darling-

Hammond et al., 2017). Looking at 35 studies on PD from 1989 to 2017, Darling-Hammond et al. (2017) concluded that effective PD:

1. Is content focused
2. Incorporates active learning utilizing adult learning theory
3. Supports collaboration, typically in job-embedded contexts
4. Uses models and modeling of effective practice
5. Provides coaching and expert support
6. Offers opportunities for feedback and reflection
7. Is of sustained duration. (p. 4)

PD that comes alongside teachers as they design, give, and reflect upon their assessments can accomplish much of this, changing teacher beliefs and practices for sustained efforts toward student-learning improvements.

In the relative void of research that exists on effective PD tied to teaching metacognition, guidance can come from research and proposals on integrating critical thinking across curricula and offering cognitive feedback that students can digest and use. Ennis (2018) clearly identified both the dispositions and abilities of critical thinkers. Such guideposts can help design PD geared toward teachers engaging students in higher-order thinking. When teachers can take the nebulous-but-ubiquitous phrase "critical thinking" and identify what it specifically looks like through its parts, they can better design instruction and assessment to engage students in it. Building upon the critical-thinking skills and attitudes identified in *The Delphi Report* (1990), Ennis (2018) listed 12 dispositions of "ideal critical thinkers" (p. 167), asserting that they tend to:

1. Seek and offer clear statements of the conclusion or question
2. Seek and offer clear reasons, and be clear about their relationships with each other and the conclusion
3. Try to be well-informed
4. Use credible sources and observations, and usually mention them
5. Take into account the total situation
6. Keep in mind the basic concern in the context
7. Be alert for alternatives
8. Be open minded
9. Take a position and change a position when the evidence and reasons are sufficient
10. Seek as much precision as the nature of the subject admits
11. Seek the truth when it makes sense to do so, and more broadly, try to "get it right" to the extent possible or feasible
12. Employ their critical thinking abilities and dispositions. (p. 167)

Ennis (2018) also classified abilities under the categories of Basic Clarification, Bases for a Decision, Inference, Advanced Clarification, and Communication/Persuasion (see Figure 5).

Figure 5

Critical-Thinking Abilities

Basic Clarification
• Focus on a question • Analyze arguments • Ask and answer questions of clarification and/or challenge • Understand and use basic graphics
Basis for a Decision
• Judge the credibility of a source • Observe and judge observation reports • Use existing knowledge
Inference
• Deduce and judge deductions • Induce and judge inductions • Make and judge value judgments
Advanced Clarification
• Define terms and judge definitions • Handle equivocation appropriately • Attribute and judge unstated assumptions • Think suppositionally • Deal with fallacy labels • Be aware of and check the quality of their own thinking • Deal with things in an orderly manner
Communication/Persuasion
• Employ rhetorical strategies

Note. Content is from Ennis, 2018.

These skills, attitudes/dispositions, and abilities point teachers very specifically to the types of endeavors and feedback they should be engaging students in to promote higher-order thinking.

Quality feedback on student thinking and creation is encouraged and facilitated by student assessments that strategically set up students to think critically as they produce

within a “problem-oriented activity” (Ennis, 2018, p. 171). When the assessments also promote structured student communication of their thinking and comprehension, teacher feedback becomes more pertinent and targeted. In this way, the assessment becomes a well-crafted conduit for dialogue around critical thinking and metacognition because both teachers and students can “label it” (Ennis, 2018, p. 170). Hattie and Yates (2014) pointed teachers to three simple-but-powerful formative questions to guide cognitive feedback: “Where is the student going?” “What progress has been made?” and “What is the next step?” (pp. 48-49). While feedback must be timely (promoted by an established conduit of dialogue using conventions) in order to be useful, “timely” does not mean immediate:

> In essence, poorly timed external feedback may subtract from the opportunity to engage in self-corrective personal feedback. This aspect becomes more pertinent when feedback is targeted upon lower level activities that fail to relate well to more advanced product-oriented goals harboured within the recipient's mind. (Hattie & Yates, 2014, p. 52)

So not only do teachers have to consider the competency and autonomy of each student as they offer feedback to allow for student self-regulation; they have to ensure they offer feedback at appropriate levels of sophistication demanded by the endeavor. Such a perspective adds useful traction to the concept of timely and targeted feedback. Brookhart (2019) discussed the meaning communicated to the students and the mode the teacher takes within cognitive feedback:

- What does my work show about my learning? (Descriptive comments; performance-level descriptions in rubrics)
- What do I need to understand that my work doesn't yet show? (Expository comments)
- What next steps might I take in my learning? (Expository comments explaining next steps, and sometimes argumentative comments taking a position about the work and supporting it). (p. 74)

An assessment that designs for strategic student production requiring critical thinking and for structured student communication of that thinking only expedites and focuses such "expository comments" (Brookhart, 2019, p. 74), making it more likely to happen with greater effect.

Ben-David and Orion's (2013) study of 44 elementary school science teachers (with one to more than 25 years of experience) as they participated in a 28-hour PD training program revealed opportunity for growth in pedagogy tied to metacognition if the PD is "constructive" (p. 3186), allowing teachers to engage metacognition "as learner and teacher, reflect on their metacognitive learning and teaching experiences, and construct a deep and practical meaning for the term 'MC' [metacognition]" (p. 3186). Ben-David and Orion's (2013) research pointed to a PD model that "floods teachers' initial knowledge and beliefs" (p. 3186) about metacognition and then "deals with them" (p. 3186). Ben-David and Orion's (2013) study also revealed two "barriers" (p. 3186) to integrating metacognition into the classroom: a dearth of useful learning materials and the lack of "close, supportive in-classroom guidance" (p. 3186). These two barriers start to be

dismantled with action PD that supports teachers in the design of assessments requiring production for critical thinking and facilitating metacognitive discourse. Such a PD model that is built around assessment design contributes to the needed learning materials by promoting backwards instructional design and supports teachers' explicit practices in the classroom, especially as they focus on quality cognitive feedback.

Spruce and Bol's (2015) study of 10 elementary and middle school teachers with at least five years of experience pointed to two opportunities upon which well-designed PD on metacognitive instruction can capitalize. First, it can help teachers realize the "gaps in their SRL [self-regulated learning] knowledge and classroom instruction" (Spruce & Bol, 2015, p. 270). Second, it can support teachers in how to "imbed explicit strategy instruction for SRL into their content area" (Spruce & Bol, 2015, p. 270), specifically emphasizing skills for "goal setting for a task and evaluation after a learning event" (Spruce & Bol, 2015, p. 270). Assessments that demand students use critical thinking to design within confines increase opportunities for teachers to model and scaffold student goal setting. Assessments that ask students to engage in labeling, classifying, and diagraming their thinking within their creative responses bolster students' evaluation of their own work through an accessible dialogue between teacher and learner.

Braund and Soleas's (2019) two-phase study of 43 pre-service and 45 in-service teachers focused on teacher beliefs and self-reported strategies connected to classroom metacognition. In addition to the first-phase questionnaires, Braund and Soleas's (2019) interviews of six pre-service and five in-service teachers illuminated a difference within a

commonality tied to teachers' PD needs concerning metacognition: Both groups found it challenging to integrate metacognition without outside support, but they valued two different PD approaches to help remove some of the challenges. Where the pre-service teachers were looking for broader instruction and guidance to develop their pedagogy, the in-service teachers were looking for specific, practical support to facilitate implementation: "Pre-service teachers preferred 'professional development courses' and 'workshops' rather than more concrete resources. In-service teachers overwhelmingly preferred concrete resources like 'books,' 'sharing activities,' and 'course profiles,' all supplemented by 'a supportive administration.'" (Braund & Soleas, 2019, p. 115). Designing PD around specific assessment design within a structured framework can meet both needs. While pre-service teachers hone their professional understanding and position themselves within teaching metacognition through purposeful creation, in-service teachers use focused and synthesized resources as they develop resources that both inform and aid in their actual teaching of metacognition. Focusing on assessment design geared toward student production, critical thinking, and metacognitive discourse is one way to make PD more "concrete" (Braund & Soleas, 2019, p. 115), thus relieving some frustration and time-consumption (Braund & Soleas, 2019).

Teaching Critical Thinking without Compromising Subject Content

Ennis (2018) made a case based on research from as far back as 1981 for integrating explicit teaching of critical thinking with subject content. Ennis (2018) posited that combining the two "seems to provide increased use of, reinforcement of, and retention of critical thinking" (p. 177). Ennis (2018) also pointed to control-group studies

that “suggest that subject matter will at least not suffer when critical thinking is mixed or infused and might well improve” (p. 178). If taking time to integrate overt critical-thinking instruction actually supports students’ higher-order processing without compromising subject-area content, teachers’ arguments against such practice become weaker. If such instruction may also improve content retention and application, these arguments become counterproductive.

Winocur’s (1981) study looked at 312 females and 418 males in seventh through ninth grade who were identified by their schools as needing remediation in reading. The experimental group received supplemental instruction in critical thinking using the Ennis model (1962) that identifies 12 aspects connected to “judging statements” (Winocur, 1981, p. 86). Winocur’s (1981) research found that even though “40 percent of the instructional time of all treatment groups was devoted to alternative learning activities, the reading scores of these students matched, and in some cases exceeded, those of the control groups receiving instruction in basic skills exclusively” (p. 185). Considering the treatment groups’ comparable success with that of the control groups’ and how much time in the treatment groups was given over to applying critical-thinking skills to gaining reading skills, engaging students in higher-order thinking appears to offer promise as a means to grow all students, even those labeled as needing remediation.

Lumpkin’s (1990) control-group study looked at 35 fifth graders and 45 sixth graders with a focus on social studies. The experimental group received instruction integrating critical thinking over five weeks with content-retention testing taking place two weeks following (Lumpkin, 1990). While Lumpkin’s (1990) results showed no

significant differences in critical thinking for the fifth- and sixth-grade groups and no significant differences in content abilities for the fifth graders, the sixth-grade treatment group did perform considerably better than the sixth-grade control group when assessed on content abilities. While the time and effort dedicated to instructing critical thinking did not show any improved results concerning higher-order thinking, as it was measured, this focus might have helped with students gaining content knowledge; it surely did not interfere.

Solon's (2007) study looked at 51 community college students, 25 in the experimental group and 26 in the control group. The experimental group received "a moderate infusion of generic critical thinking material—approximately 10 hours of class time activity and an additional 20 hours of homework exercises" (Solon, 2007, p. 98). Solon (2007) found "no significant differences in course content learning" between the control and experimental groups, suggesting that "a moderate generic critical thinking infusion" should not "lead to a significant cost in subject matter learning" (p. 103). With some attention to critical thinking not compromising gains in content knowledge, the possible benefits could be worth teachers exploring and designing critical-thinking integration.

Teachers hesitant to include the explicit teaching of critical thinking or metacognition due to concerns over lost instructional time should consider how teaching content and thinking combined can actually help students engage and retain the subject content. Teachers should be encouraged to explore such integration, seeing that subject content can coexist uncompromised and that students can grow as thinkers and learners

beyond the confines of the content. Such an approach to instruction can benefit all students, whether needing remediation or enrichment, by both developing their basic skills within the content and transferable skills between the content. The possibilities are worth exploring considering that teaching critical thinking does not come at the expense of teaching subject matter.

Significance of Race, Rurality, and Poverty

Before looking at how teaching metacognition through student production in South Carolina schools can open up access to "student-centered, higher-order curricula and pedagogies that encourage deep learning" (Gorski, 2018, p. 112)—often more available to wealthier students (Gorski, 2018), considering the context of race, rurality, and poverty in South Carolina and around the study site reveals the pertinence and urgency of such instructional efforts: In 2019, 20% of children in SC lived in poverty, down from a most recent high of 28% in 2011 (The Annie E. Casey Foundation, 2020b). The national childhood poverty rate in 2019 was 17% (The Annie E. Casey Foundation, 2020a). Black children and Hispanic children in SC experienced poverty at the highest rates, at 35% and 33%, respectively (The Annie E. Casey Foundation, 2020b). White children in SC (at 10%) experienced poverty at half the rate of the entire state (The Annie E. Casey Foundation, 2020b). The six counties (all rural) with the highest childhood poverty rates sat near or above 40% (The Annie E. Casey Foundation, 2021; United States Department of Agriculture, 2000). Four of those six counties were among the seven SC counties with the highest percentage of Black residents (57% to 73%) (United States Census Bureau, 2019).

All of these data show just how many South Carolina children (215,000 in poverty with almost half being Black) (The Annie E. Casey Foundation, 2020b) have struggles placed upon them and barriers placed in front of them that distance them from learning. This reality appears even harsher when looking at the South Carolina Department of Education's (SCDE) (2021c) estimate that over 61.9% of students were identified as students in poverty for the 2020-2021 school year. The research site's district identified 60.5% of its 2020-2021 students as living in poverty (SCDE, 2021b), and the research site identified 37% (SCDE, 2021a).

These data also put real numbers to the intersectionality of race, rurality, and poverty in SC. A further look into this intersectionality provides evidence warranting concerted, intentional, and immediate response. According to the *Why Rural Matters 2018-2019* report,

> More than one in five of the state's nearly 120,000 rural students live in poverty [ranking sixth], and households in the average rural school district earn barely twice the poverty threshold. South Carolina's rural districts have some of the nation's highest rates of enrollment for students of color. (Showalter et al., 2019, p. 133)

Data included in the report also pointed to "among the lowest in the U.S." scores on standardized mathematics and reading tests. Gaps in performance between SC's rural and non-rural students and between those living in poverty and those outside of poverty were "larger than in nearly all other states" (Showalter et al., 2019, p. 133).

One way to prepare SC students for post-secondary success is to improve teacher quality through instructional practices that transcend content and get students thinking and using knowledge. While readily accessible data reveal formal qualifications or benchmarks (years of experience, degrees held, certification status) as proxies for teacher quality, numbers tied to quality teacher pedagogy are understandably missing. Looking at data from the SCDE's *2011-2012 Educator Equity Profile*, 5.3% of teachers were in their first year; schools in the highest quartile for poverty and for minority populations staffed first-years teachers at considerably higher rates, 7% and 7.6%, respectively. Statewide, 1% of teachers taught without certification or licensure (SCDE, 2012). While the rate was similar for high-poverty schools, the rate almost doubled for schools in the highest quartile for minority populations, sitting at 1.7% (SCDE, 2012). Just under 3% of SC classes were taught by teachers not highly qualified, but those rates increased for classrooms in schools with high poverty and minority populations, 4% and 5.2%, respectively (SCDE, 2012). The starkest contrast arises when comparing not-highly-qualified rates between schools in the highest quartile and lowest quartile for minority student populations: 5.2% versus 1.6% (SCDE, 2012). While these data tell of formalized barriers to equitable access to education in SC, they also point to ample opportunities to come alongside newer and less-experienced teachers with real-time PD focused on metacognition before they become beholden to their teaching habits.

Students facing instability at home and in their communities need stability of opportunities at school. According to Fine et al. (2016), "systemic disinvestment in opportunities and material conditions" and "chronic disruptions of living/learning and

relational wellbeing" (p. 500) connected all-too-directly to race, rurality, and poverty create "precarity" (p. 500) for SC students in and out of school. While SC educators may not be able to directly influence larger systems of inequity in the country or in the state, SC teachers can refuse to "reproduce" (Gorski, 2018, p. 3) lack of access to opportunity in public schools. Two mindsets in the classroom must be confronted, though: lowered expectations and a preoccupation with mere remediation:

> Concomitant with deficit thinking is low-level, basic skills curricula aimed at remediating students' deficiencies (Oakes, 2005). This is the most serious consequence of deficit thinking: it leads to instructional practices that diminish student learning by limiting students' access to the rich learning opportunities routinely afforded to students in affluent, high-achieving schools and classrooms. Students targeted by these practices learn less and learn more slowly because of the scope and pace of the remedial curricula to which they are subjected. (Dudley-Marling, 2015, p. 7)

While this pedagogical "targeting" of the most precariously situated students is not necessarily intentionally malicious or dismissive, it can be just as damaging through a misguided, uninformed desire to help those seen as deficient. Meeting students where they are, even remediation, does not have to neglect higher-order learning, though. With thoughtful learning endeavors that require planning, production, and evaluation, all students can utilize metacognition to access more critical thinking. Unfortunately, teachers designing then implementing curricula to "take a metacognitive approach to instruction, emphasize higher order thinking skills, teach basic skills in meaningful

contexts, and use a range of formative assessment tools" (Kennedy, 2010, p. 384) is the exception to the rule, especially for students struggling with literacy and poverty (Kennedy, 2010).

A prioritizing of metacognition through production as a pathway to higher-order thinking in the classroom will not only improve learning but, in doing so, could keep students with motivations to drop out from quitting school altogether. According to Lee and Burkam (2001), "regardless of students' own academic background and school performance, schools with . . . more challenging courses, fewer remedial or non-academic courses hold students in school" (p. 24). While encouraging and supporting higher-order thinking through metacognition "will never radically change the system of persistent inequality in education" for "dark students" (Love, 2019, p. 92) who face accumulating historical, economic, sociopolitical, and moral "education debt" (Ladson-Billings, 2006, p. 5), it is a real step toward refusing to reproduce inequity in the classroom and toward giving students what is owed to them, whether students lack access to educational opportunity due to race, poverty, or rurality.

Helping build quality instruction with teachers in their classrooms is one way to improve access to quality education for all, not just students with access to more resources due to money, race, or location. As teachers focus more on equity in their classrooms through higher-order thinking, they can empower students to contextualize their learning in their communities and societies, a pathway for metacognition that grows student agency. Students in "precarity" (Fine et al., 2016, p. 500), just like those in societal stability, "yearn for opportunities to be respected, recognized and educated, to

dive into critical histories, create opportunities for and with their communities and to mobilize for educational justice" (Fine et al., 2016, p. 510). Students empowered by their learning seek out opportunities to learn and take action.

With a focus on learning awareness comes the opportunity to promote equity in the classroom and social justice beyond. As students become more critical in their thinking, they learn how to see complexity. They move beyond just gleaning new information to discern factual truth to realizing "the social, historical, and political *meaning* given to those facts" (Sensoy & DiAngelo, 2017, pp. 23-24). Teachers can support students holding up knowledge to the motivations behind its production, validation, and circulation (Sensoy & DiAngelo, 2017) and reconciling this new knowledge with who they are and how they see the world. Such an awareness can promote students becoming agents of change that confront unjust dominating ideology (Sensoy & DiAngelo, 2017). They can become wiser consumers of knowledge as they decide what to "accept and reproduce" (Sensoy & DiAngelo, 2017, p. 29). Teachers can help students engage information through questioning: Who produced this? Why was this produced? Why is this valued in society? As students become more confident in questioning bias, ideology, and motivation, they become more confident in who they are and how they learn. This could promote application of this understanding to productive action. Thinking and learning about thinking and learning can build character and citizenship in students so that they have a stronger commitment to their own growth and the wellbeing of others (Fullan & Quinn, 2016). As students learn by contextualizing their learning through what their communities and societies offer, require, prioritize, and

value, teachers learn to step even further away from deficit ideology by seeing marginalized students and their communities as possessing "multi-layered, nuanced, deep, and complex" (Milner, 2020, p. 26) assets to acknowledge in their students and in their curricula. Looking beyond the school, "*society offers a real curriculum site* that must be taught if we have a fighting chance at helping all students deal with and counter the effects of racism and other manifestations of hate" (Milner, 2020, p. 15). Teachers who actively renounce a deficit ideology in their classrooms by tapping into their students' communities empower their students as they ground learning in immediate, real contexts.

Improvement Science Approach

At the heart of improvement science is its iterative quality that aims "to accelerate learning-by-doing" (Carnegie Foundation for the Advancement of Teaching, n.d.). Improvement science is therefore a "user-centered and problem-specific approach" (Bryk et al., 2015, p. 26). It focuses on the practical with the goal of measuring improvement (Bryk et al., 2015). Such a recursive and adaptive approach urges starting small and designing "rapid tests of change" (Bryk et al., 2015, p. 120), accommodated by the Plan-Do-Study-Act (PDSA) cycle. This specificity should lead to findings that are conducive to scaling. Since improvement science demands intentional design and study that will hopefully inform scaling, the specific target should be a "high-leverage target" (Bryk et al., 2015, p. 66). Along with specificity and scaling comes the need for consistency and operationalization. Complex endeavors operationalized provide reliability and ensure "that the process can work under a variety of conditions and that quality outcomes will

typically ensue" (Bryk et al., 2015, p. 51). Improvement science values the recursively refining focus on the complexities within the small scale in order to better inform larger, subsequent actions for change.

My research intervention, grounded in improvement science, focused on implementing PD that built a common language and understanding around a Metacognitive Framework for Assessment Design (see Figure 7) so that it could be used to inform teaching, promote feedback, and build student agency. This focus aligned with a growing instructional need within the research site. For the 2021-2022 school year, the principal tasked one of the instructional coaches with helping faculty members reflect on their formative-assessment practices. The principal saw a disconnect between daily grades and summative assessment scores. In too many cases, smaller grades recorded between the larger summative assessments were suggesting to some parents/guardians and students a mastery of the content until summative-assessment scores contradicted that. The principal worried that too many "assessments" were being treated as completion, participation, or compliance grades and that students were not getting the cognitive feedback they needed to master the content before summative assessments arrived. In the charge to design PD around quality formative assessments, the principal posed the following questions for the faculty and instructional coaches to investigate: How do we use formative assessments? What are school requirements for formative assessments? What do good formative assessments look like? How does the feedback we provide on formative assessments help students grow and perform better on summative assessments?

My ultimate goal through this intervention was to embed PD as fluidly as possible, minimizing the teacher burden and promoting their engagement. Such an approach helps in three ways:

1. It increases the likelihood of open-mindedness by showing respect for the teacher's time.
2. It encourages application by being grounded in what the teacher is actually doing.
3. It promotes confidence by providing a standard work process that reduces "the stress and cognitive overload associated with carrying out complex tasks" (Bryk et al., 2015, p. 48).

Lessening the cognitive demands on teachers while building their confidence, competence, and excitement in designing assessments for metacognitive discourse should also free them up to focus intentionally on metacognitive backward design in their classrooms moving forward past these interventions.

Within the 90 days of Semester 1 during the 2022-2023 school year, I completed three PDSA cycles—three "rapid tests of change" (Bryk et al., 2015, p. 120)—that resulted in three assessments—"high-leverage target[s]" (Bryk et al., 2015, p. 66) as opportunities for quality cognitive feedback—produced by each teacher participant (see Figure 6). Before and after these three cycles unfolded, however, I collected data using two instruments: (1) a survey on teacher comfort levels with metacognition and its inclusion in the classroom (see Appendix B) and (2) the Academic-Feedback, Thinking, and Problem-Solving domains of the South Carolina Teaching Standards 4.0 Rubric

(SCDE, 2021d) (see Appendix C). I created and disseminated the survey, and the assistant superintendent of instructional services for the research site's district scored samples of student work using the pared-down SC 4.0 Rubric (SCDE, 2021d). The first survey was my first formal communication with research participants, and the last survey finalized our recorded communication. The assistant superintendent scored student work that was produced before the first assessment-design sessions and student work that was produced in response to the third-cycle design sessions. Gaining an understanding, through the survey, of where my teacher participants stood pedagogically before versus after the PD intervention could suggest if their newly learned practices will persist since a change in beliefs should promote a change in practice. After all, my goal was to move beyond just growing teacher participants' knowledge of metacognition to supporting their more consistent classroom integration of it:

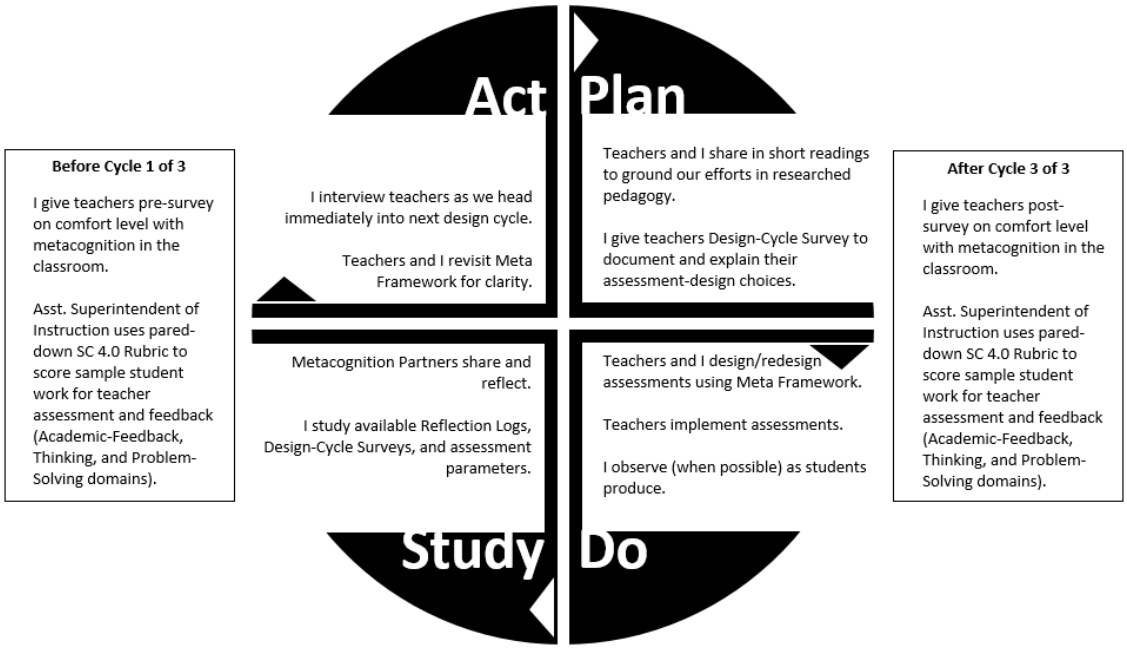
> Teachers' beliefs and practices are related (e.g., Hoy et al., 2005; Lombaerts et al., 2009; Pajares, 1992). If teachers are uncomfortable with metacognition or have a lack of understanding, then they would be less likely to effectively integrate it into their classrooms. By increasing our understanding of pre- and in-service teachers' beliefs about students' abilities to be metacognitive and their understanding of the concept, we can adapt professional development opportunities to the needs of both teaching populations (Ben-David & Orion, 2013; Spruce & Bol, 2015; Wilson & Bai, 2010; Zohar, 2006). (Braund & Soleas, 2019, p. 108)

While the survey helped provide the pedagogical context, the scored teacher assessments through student-work samples provided reference points for how my PD intervention impacted teacher participants' assessments and feedback.

Within these bookends of data, each of the three PDSA cycles focused on teacher-participant preparation, production, and reflection. I provided focused literature, pertinent modeling, and personalized feedback as teachers not only designed their assessments but integrated instructional practices into their classrooms to prepare students to successfully engage these assessments. I had to strike a balance between directing participants to produce within the confines of the PD approach (to operationalize our endeavors) and affording them the necessary autonomy to authentically design (to promote engagement and implementation).

Figure 6

Plan-Do-Study-Act Diagram



Plan

Each planning phase consisted of two enterprises: studying a brief text of research and responding to the Design-Cycle Survey (see Appendix D). We shared in focused, short readings (no more than four pages) to ground our work in research and best practices because "pedagogy matters" (Abrami et al., 2008, p. 1121) with teaching metacognition and critical thinking. A stage 1 meta-analysis (Abrami et al., 2008) of instructional practices impacting student critical thinking found that the greatest affects resulted from a combination of preparatory training and changed explicit teaching practices. The content of the three texts focused on (1) critical thinking cognitive skills and sub-skills, (2) making thinking audible and visible and providing a problem orientation, and (3) cognitive feedback. The survey I created to be given during the planning phases focused on individual teacher assessment needs, practices, and understandings (see Appendix D). This feedback both informed the later design sessions and helped me monitor teacher pedagogy.

Do

This phase of each cycle focused on actual assessment design or redesign and included implementation and, whenever possible, observation. The Metacognitive Framework for Assessment Design (see Figure 7) and The Bridge: Supporting Annotations of Awareness (see Figure 8) offered direction to each teacher participant but ensured that the intervention was specific to the user and the problem (Bryk et al., 2015). The direction offered through this framework supported both initial design and measurement of improvement (Bryk et al., 2015). This framework functioned as the

foundational tool for my focused PD interventions, helping the teacher participants externalize both their and their students' thinking through specific assessments. The framework required teachers to prepare and construct space for student Annotations of Awareness within production-based assessments as the means to operationalize "the language of thinking" (Tishman & Perkins, 1997, p. 368) and pave the way for metacognitive discourse between students and teacher. These Annotations of Awareness were moments in an assessment where students used agreed-upon, classroom-level conventions—shorthand, even—to label, categorize, diagram, explain, or contextualize their thinking and production. This framework also required teacher participants to provide their own acknowledgements of awareness during the Plan, Do, and Act phases, specifically through the Design-Cycle Surveys (see Appendix D) and the Interview Protocol (see Appendix F), so that they had to explain their rationales for the choices they made in designing their assessments. Mirroring the desired teacher-student assessment dynamic, this PD approach promoted metacognitive dialogue between the teacher participants and me while offering documentation of teacher growth.

Figure 7

Metacognitive Framework for Assessment Design

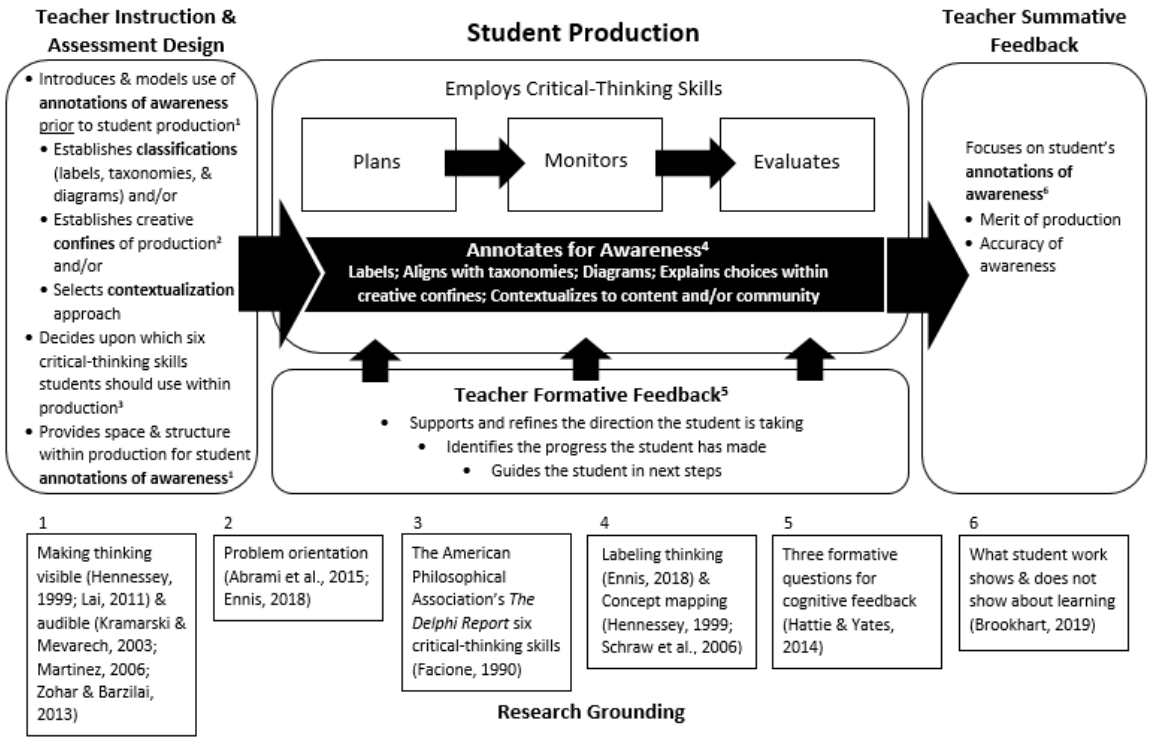
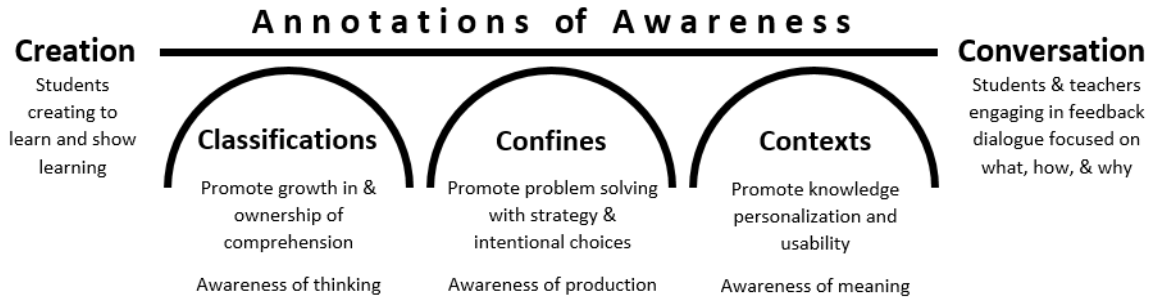


Figure 8

The Bridge: Supporting Annotations of Awareness



Once the teachers finalized their assessments, they used them in the classroom, and I observed, if possible, and scripted class time surrounding many of these assessments as students produced and teachers offered verbal feedback. My scripting was analyzed for trends.

Designing assessments within such an "investigative stance" (Kennedy, 2010, p. 384) allowed the participant teachers and me to collaborate "to discover solutions" (Kennedy, 2010, p. 384) through real-time PD that valued the teachers' autonomy and creativity (Kennedy, 2010), and such a small-scale approach lent itself to the iterative process of PDSA. The Metacognitive Framework for Assessment Design ultimately offered a meeting place for teachers to build capacity, promoting sustainable improvement (Fullan & Quinn, 2016). Building this capacity through such an intentional and structured framework aimed to provide common knowledge and skills and educate through accomplishing the work (Fullan & Quinn, 2016).

Study

After assessments had been given, teacher reflection occurred via Metacognition Partnerships. An English teacher partnered with a fellow English teacher, and a social studies teacher partnered with a fellow social studies teacher to discuss the assessment design, implementation, and impact using a structured reflection log (see Appendix E). These assigned partnerships (based on planning periods) allowed for divergent thought and promoted the consideration of varied perspectives. Since a goal was "getting quality results under a variety of conditions" (Bryk et al., 2015, p. 35), even through implementation at only the one study site, I identified the class in each teacher's schedule

that we would focus on in the study in order to obtain a fuller range of classes—from those supporting struggling learners to honors/Advanced Placement (AP) courses—across the study and within the partnerships. That way, strategies could be compared across ability levels in addition to across content areas.

I reflected by studying all available Design-Cycle Surveys and Reflection Logs (some design sessions took place before surveys had been submitted and partners had met so as to maintain pacing while meeting the needs of the teachers and accommodating their schedules) and reviewing the assessment parameters the teacher participants and I had discussed in the assessment-design sessions. These data helped me focus my interview protocol (see Appendix F), prompt focused teacher reflection, and guide my support as we immediately headed into the next design cycle.

Act

The interviews and design sessions were actually combined to minimize burden on the teachers. In addition to their surveys and logs, we discussed their verbal and written feedback content and quality, focusing on how timely, intentional, specific, and immediately pertinent and digestible it was. This focus on the feedback generated through the assessments was important because, even though this assessment piece fundamentally helps students grow in cognition and metacognition, it often gets neglected. Even though effective feedback, according to Hattie's (2009) meta-analyses, has a .73 effect size, "feedback from teachers is indexed in terms of only several seconds per day" (Hattie & Yates, 2014, p. 46). The assessments designed during these three

cycles moved more toward promoting this much-needed cognitive feedback that engages students in dialogue around planning, monitoring, and evaluation.

As we moved through the design cycles, participants and I sought refinements and clarifications. We revisited protocols to maximize ease, usefulness, and meaning. We also revisited the Metacognitive Framework (see Figure 7) and The Bridge (see Figure 8) to promote comprehension and usability. The parameters of each subsequent design session responded to the emerging needs of the teachers through my intentional support in the backwards design of their assessments. We focused on what skillsets they specifically wanted to assess and how to refine their Annotations-of-Awareness approaches to promote accessible rigor while collecting the data they needed to offer meaningful cognitive and metacognitive feedback to support student mastery with increasing cognitive demands.

Conclusion

A focus on supporting teachers with overtly and meaningfully integrating metacognitive and cognitive feedback into their classrooms promotes equity through high expectations for learning, no matter the student. It facilitates application of knowledge and "transfer of learning" (Pintrich, 2002, p. 222) beyond the specific content and classroom. It builds confidence and agency in both the students and teachers. My "user-centered and problem-specific" (Bryk et al., 2015, p. 26) research interventions focused on what the teacher has the most control over: instructional design and feedback. My interventions operationalized some of the more complex teaching endeavors while offering freedom of creativity. They offered strategies and promoted specific feedback

for teacher growth while giving teachers a framework to engage their students in deeper learning and critical thinking. In high school, especially, teachers can neglect supporting learning awareness because of the complexity of the content itself. Since "thinking about the mental processes a novice learner needs to comprehend the subject-area material is not a natural activity" (Joseph, 2009, p. 100) for many secondary educators or students, intentionally supporting the explicit teaching of metacognition will only help. Teachers are continually encouraged and want to prepare their students for the cognitive and character demands of the 21st century but often find little practical support in achieving this:

> For the last quarter century, education has been giving superficial lip service to 21st century skills without much concerted action or impact. The energy has been invested in describing sets of skills without much robust implementation or effective ways to measure them. (Fullan & Quinn, 2016, p. 83)

Hopefully, this Metacognitive Framework for Assessment Design will provide motivation and traction for this important work. With specific strategies and feedback, teachers can build confidence and competence in helping students better think about their thinking.

This research offers great promise for the school through building teacher capacity for integrating metacognition into the classrooms, focusing on practical assessment design/redesign for immediate impact, and aiming toward subsequent backwards design of instruction. After working with English and social studies teachers, these interventions can expand to the other content areas. There is also promise in

moving toward closing the opportunity gap in South Carolina schools by improving teaching quality, by promoting higher-order thinking through creation, and by encouraging confrontation with social justice. Grounding learning and design in community and societal contexts can empower students to think independently and act courageously. Speaking specifically to artistic creation, Love (2019) asserted how "art that inspires for a better world is rooted in intense design, research, and musings for justice" (pp. 99-100). In terms of research significance, this study can contribute to closing the divide between theory and practice when it comes to metacognition. To date, much of the metacognition-education research focuses on the theoretical or on broad strategies, preventing accessible classroom implementation. The topic remains abstract, and this research could make it more digestible for educators. At a policy level, SC could use this study to guide the integration of metacognition instruction into the state teacher induction program.

Through my research I wanted to expose the simplicity in the complexity of designing for metacognition. Yes, production opportunities must be skillfully designed and executed, but they do not have to demand great resource allocation. For example, while project-based learning can be a route to higher-order, more relevant learning, the scope of production does not always need to be that grand. Small moments of production where students are using parameters in which to design can also afford opportunities for planning, monitoring, regulating, and evaluating. Students can be problem-solving, contextualizing knowledge, and mapping out their thinking through endeavors occupying minutes or hours, not necessarily days, weeks, or months. This realization offers great

freedom for teachers, thus increasing the likelihood that they will engage their students in higher-order thinking through metacognition. Production in the classroom, in and of itself, is not sufficient; these endeavors of creation need to be intentionally designed with metacognitive dialogue in focus. Designing for metacognition cannot just be an afterthought; it must use domain-specific content to transcend the content.

In addition to building teacher-participant comfort through embedded, real-time PD focused on assessment design, the change idea of Metacognition Partnerships built in expanded perspective by partnering teachers for collaboration. The two teachers compared their interventions—planning, monitoring, and evaluation—to both offer more support beyond me and to demonstrate the transferability of these assessment practices and understandings, a desired outcome of building metacognition. In this way, the teacher learning modeled the desired student learning. Outside of the teaching workday, I did ask participating teachers to engage a few short, targeted readings to offer pedagogical grounding.

My three cycles of PD interventions utilized the Metacognitive Framework for Assessment Design (see Figure 7) and The Bridge (see Figure 8) to help teachers encourage students to design responses to their learning using confines, classifications, and contextualization. Providing thoughtful confines for student production establishes a "problem-oriented activity" (Ennis, 2018, p. 171) that encourages student discretion, problem-solving, and creativity by adding complexity to the arrival at the goal. Developing systems of classification, or taxonomies, for domain-specific content knowledge, cognitive skills, and metacognitive skills allows students to use that language

when evaluating their products and communicating their thinking. Students contextualizing their products in the meaning of the broader content or their communities makes the learning more authentic and promotes agency. While the study's resulting teacher-designed assessments offered concrete tools to help teachers integrate metacognition in the immediate, the assessments also served as reference points to promote future backwards instructional design that considers how teacher delivery and student discovery of the content (Content Engagement primary driver) can be structured to allow for more explicit instruction in metacognition.

CHAPTER TWO

METHODS

Research Site

The research site was a traditional public high school in South Carolina. This school was classified as suburban: large (National Center for Education Statistics [NCES], 2020a) in a suburb: large district (NCES, 2020b) serving a student population that was, according to 2021 district data, 76.7% White and from households with a median income of just over $67,700 (NCES, 2019). In 2019, the district's county Black population sat at 7.2%, well below the 27%-average for the state (United States Census Bureau, 2019), and the poverty rate for children sat at 15.5% (The Annie E. Casey Foundation, 2021). During the 2021-2022 school year, this school served around 1200 students (76% White, 8% Black, 7% Hispanic/Latinx, 6% multiracial, and 3% Asian). With 37% of students identified as "pupils in poverty" for the 2020-2021 school year (SCDE, 2021a), school data showed 3% as homeless and 28% as qualifying for free or reduced lunch. Seventeen English Language Learners (ELL) received accommodations; 76 diploma-seeking students had Individualized Educational Plans (IEPs); 17 on-campus non-diploma-seeking students had IEPs; and 94 students had 504s. According to district data, close to 400 students took 850 AP exams in the spring of 2020, and that number continued to grow with close to 1000 AP exams taken spring 2021. While 80% scored C or better on the 2021 English 2 End-of-Course Exam (EOC), 57% scored that well on the 2021 US History EOC. These scores were considerably higher than those from the other high schools in the district (English 2 average of 63% and US History average of 35%).

The 2021 School Report Card showed 79% of graduating students as college or career ready with 77% of the prior year's graduates pursuing post-secondary education in the Fall of 2020 (SCDE, 2021a). In 2020 37% of the school's graduates were eligible for Legislative Incentive for Future Excellence (LIFE) or Palmetto Fellows scholarships (SCDE, 2021a), and 32% completed programs in Career and Technical Education (SCDE, 2021a). The school's 2020 School Report Card identified that 80% of the school's teachers held advanced degrees (SCDE, 2020). In 2020 six teachers in core-content areas were classified as "inexperienced" (SCDE, 2021a), and only one core-content teacher taught outside of their certified area (SCDE, 2021a). Based on a three-year average, 90% of the faculty had returned from the previous year (SCDE, 2021a). At the time of my study, the school employed 12 English teachers and 10 social studies teachers.

My research site offered convenience, but this did not compromise my research. While this site did save me time and effort, it was not "at the expense of information and credibility" (Creswell & Poth, 2018, p. 159). The struggles that teachers face with integrating metacognition into their classrooms to promote critical thinking through student production are more universal than site specific, and these struggles exist when teaching students at all levels of cognitive ability and engagement, from struggling learners to honors and AP students. Just because this school typically has had higher standardized test scores than the other district high schools did not mean room for growth in improving transferable critical thinking beyond the content areas was too small. These teacher struggles are also not unique to teacher or student gender or race. Implementing

PDSA cycles urged my starting small and local before considering scaling. Focusing on high school English and social studies teachers pulled from my instructional and content-area strengths and helped me establish more immediate credibility among my research participants. Refining the Metacognition Framework (see Figure 7) through the work of these teachers and my expertise will allow for more-confident expansion of this PD approach to mathematics and science instruction. Because of my relationship with the school, I had ample access to data, classrooms, and administration. While this site offered me a "natural setting" (Creswell & Poth, 2018, p. 43) for the gathering of "up-close information" (Creswell & Poth, 2018, p. 43), it also provided the familiarity between participants and me that promoted a more organic and authentic process of "emergent design" (Creswell & Poth, 2018, p. 44) where the developing Metacognitive Framework (see Figure 7) evolved to meet participants' needs without being stymied by my vision. This way, the framework, specifically through The Bridge (see Figure 8), responded to the participants' challenges and remained an accessible and practical tool for improving critical thinking in classrooms.

Positionality

I viewed my positionality throughout my action research as an "insider collaborating with other insiders" (Perry et al., 2020, p. 112). I was within the system of the research site's district working with teaching and administrative peers. I depended upon my research participants to help me check my biases and identify my blind spots. When I positioned myself in this research, I had to acknowledge how my personal identity could shape my perceptions and impact my working with research participants.

Five of eight teacher participants were like me: White from middle-class backgrounds who attended and found success in public schools. While the other three participants were also White, they described different educational experiences prior to entering college: one male was from a middle-class family and underachieved in public schools; one male identified as being raised in a "lower working-class family" and "barely" graduating from public high school; and one female was a successful student in both Catholic elementary and middle schools and public high school. Three of the participants were male (two English and one social studies), and five were female (four English and one social studies). Like me, these teachers worked with a majority White students.

As a veteran educator, I had to be careful not to see myself as the expert with all of the answers. I had to remain open to varied teaching approaches and needs. I had to refrain from judging the more traditional, content-driven teachers and not be blinded to the struggles of the more contemporary, skills-driven teachers. As an educator who grew up not finding reading entertaining and now seeing the equal merit in reading for information, I had to avoid dismissing the teacher who espouses the mission of getting students to love reading. I also had to be mindful that, while metacognition and critical thinking are human endeavors, the placing of value on that knowledge and the prioritizing of gaining knowledge in school are not homogenous.

I found it relatively easy to operate within the culture of the school as I conducted my research because I agreed with many of its policies and approaches and belonged to the majority, but I had to remain vigilant not to take advantage of this ease. I had to

consciously make myself look for the exceptions, for the counter-narratives (Milner, 2007). Since my teacher participants were all White and middle class, this attentiveness to exceptions applied mostly to the students. I could not just focus on how well these metacognitive strategies worked for White students or financially stable students; I had to research their effectiveness with students of lower socioeconomic status, with limited English proficiency, and from varying races and ethnicities. Truly "successful" metacognitive strategies should be somewhat universal in engaging knowledge and understanding but cannot be universal in prescribing the meaning made or the value of that meaning.

When it came to professionalism and integrity, I maintained honesty and fairness in what I did know, but I had to be careful to pursue what I did not know or understand in others' approaches to teaching and learning. I have a tendency to pass quick judgments and dismiss strategies different from the ones I confidently use. With the participants less aligned with my pedagogy, I had to look beyond my pride to internalize and understand their successes.

Research Methods and Design

Overview and Rationale

Conducting my research over 90 days during the Fall Semester of 2022 with three PDSA cycles, I collected mainly qualitative data via surveys, observations and conversations, interviews, reflection logs, and design-session transcripts. Quantitative-data collection bookended my study to ground the qualitative data in more concrete measures more resistant to my biases. I collected quantitative data via Likert-scale

portions of the pre- and post-surveys (see Appendix B) and from assistant-superintendent scores of teacher assessments and feedback (via student-work samples). The assistant superintendent of instructional services for the research site's district scored assessments using a pared-down SC 4.0 Rubric (SCDE, 2021d) (see Appendix C). Research participants were teacher volunteers from the English and social studies departments at the high school, and we focused our efforts on using the Metacognitive Framework for Assessment Design (see Figure 7) and The Bridge: Supporting Annotations of Awareness (see Figure 8) as each teacher developed three assessments that required student critical thinking and promoted metacognitive discourse. These parameters were set with practicality and realistic focus in mind. I was only one researcher, and I needed to facilitate quick and responsive interventions that met the needs of teacher participants already overwhelmed by their professional duties. Because my study focused on teacher experience and perception, the data were more qualitative than quantitative. The focus on teacher growth in confidence and competence, rather than student growth in learning, was partially due to the short time span of my research, unconducive to collecting sufficient quantitative or qualitative data from numerous student products.

Participant Recruitment

With the approval of the school district and principal, I sent an email to all English and social studies teachers at the study site inviting them to join my research (see Appendix A). I clearly stated that participation was voluntary for as long as they chose to continue and was not connected to any formal school- or district-level evaluation. My invitation included the parameters of the study, identifying their commitments and the

end products (three assessments) they would design. Participants were asked to complete all surveys, share student work, participate in interviews, meet for three assessment-design sessions, open their classrooms for observations, and meet with a partner teacher to reflect. To ensure participants received the support they would need from me, I limited participation to eight teachers. An even number within English and within social studies allowed for content-specific Metacognition Partnerships, integral to my research design. The eight volunteers taught a variety of instructional levels (struggling learners, College Prep, and AP/honors) and included a variety of teacher-experience levels (from zero to over 20 years). While diversity was not achieved with race/ethnicity (largely due to the limits of the school's teacher demographics—one Black core-content teacher, two Black non-core-content teachers, two Hispanic non-core-content teachers, and one German non-core-content teacher), gender diversity was achieved with three males (two English and one social studies) and five females (four English and one social studies).

Methods of Data Collection

As part of the mixed-methods design of my single instrumental (Creswell & Poth, 2018) exploratory case study, I collected quantitative data through a self-created pre- and post-survey adapted from Wilson and Bai's (2010) Teachers' Metacognition Scale (see Appendix B) and pared-down portions of the SC Teaching Standards 4.0 Rubric (SCDE, 2021d) (see Appendix C); I collected qualitative data through that same survey plus a self-created Design-Cycle Survey (see Appendix D), Metacognition Partnership reflections (see Appendix E), semi-structured interviews (see Appendix F), design-session audio recordings, observation scripts, and student-work samples. This

quantitative and qualitative data helped me both arrive at a "general understanding" (Stake, 1995, p. 3) and glean more specific, "in-depth understanding" (Creswell & Poth, 2018, p. 96).

Bookending my three PDSA cycles, I collected quantitative data through two instruments: the pre- and post-survey concerning participants' comfort levels with metacognition (see Appendix B) and the pre- and post-scoring (by assistant superintendent of instructional services) of teacher-participant assessments and feedback using a pared-down portion of the SC 4.0 Rubric (SCDE, 2021d) (see Appendix C). I disseminated the survey as a Google Form, and the assistant superintendent recorded scores with comments in a Google-Sheet version of the rubric.

During each of the three PDSA cycles, I collected qualitative data through Design-Cycle Surveys (Google Form) focused on teacher assessment intent and approach (see Appendix D), Metacognition Partnership Reflection Logs (Google Docs) (see Appendix E), audio recordings of the teacher interviews (see Appendix F) and assessment-design sessions (so that I could focus on supporting the participants), my hardcopy scripting of observations (subsequently typed), and student-work samples. The recorded design sessions and teacher interviews were transcribed prior to coding. I saved my data to my district Google Drive and a local hard drive, naming files with participant pseudonyms. Any hardcopy data, such as student-work samples, were scanned and uploaded to my Google Drive and local hard drive, as well.

Figure 9

Data-Collection Rationale

Required Knowledge to Answer Research Question	Data Type	Data Source	Notes
Participant teachers' perceptions of their comfort in integrating metacognition using Annotations of Awareness as the bridge between student production and teacher feedback	Surveys, observations, interviews, design-session notes, reflection logs	Researcher-created surveys, researcher-scripted classroom observations, transcripts from semi-structured participant interviews, transcripts from assessment-design sessions, participant-completed Metacognition Partnership Reflection Logs	+Be sure to monitor teacher comfort level with Design-Cycle Surveys. +Be sure to tailor interviews based on data previously collected. +Be sure to encourage teachers to share their assessment-design cycle experiences aloud as they complete the Reflection Log.
Impact on student production of assessment design utilizing Annotations of Awareness	Observations, student-work samples	Researcher-scripted classroom observations, student-produced work in response to assessment requirements	Be sure teachers are holding students accountable for actually using Annotations of Awareness.
Impact on student production of teacher formative and summative feedback through Annotations of Awareness	Observations, student-work samples	Researcher-scripted classroom observations, student-produced work in response to assessment requirements	+Be sure that observations occur as students are producing in order to observe teacher's verbal formative feedback. +Be sure to encourage written summative feedback through the actual student's Annotations of Awareness.
Asst. superintendent of instruction's perceptions of participants' competence in integrating metacognition to impact student production	Student-work samples scoring	Pared-down South Carolina Teaching Standards 4.0 Rubric (Academic Feedback, Thinking, and Problem Solving)	Be sure to encourage comments from assistant superintendent to contextualize scores.

Methods of Data Analysis

With my limited quantitative data, I documented, using two-way tables, movement with the Likert-scale responses on the pre and post surveys that bookended my study in order to measure my interventions' impact on teacher knowledge and perception of metacognition in the classroom. With only eight study participants, my sample size did

not warrant any statistical-significance test. On these surveys, as Wilson and Bai (2010) did, I used a four-point Likert scale (from 1 = strongly disagree/low to 4 = strongly agree/high) (see Appendix B) (Creighton, 2007). I created the first four items to focus on teacher comfort levels with integrating metacognition in the classroom. The following 20 items from the Teachers' Metacognition Scale (Wilson and Bai, 2010) presented hypothetical scenarios across four factors. Items one through five focused on the pedagogical factor; items six through nine focused on the conditional; items 10 through 13 focused on the declarative; and items 14 through 20 focused on the procedural (Wilson & Bai, 2010). I also documented changes between the pre- and post-assistant-superintendent-scoring of teacher assessments in each of three SC 4.0 Rubric (SCDE, 2021d) domains (Academic Feedback, Thinking, and Problem Solving) (see Appendix C) to measure impact on teacher competence (see Figure 26).

With my more exhaustive and complex qualitative data, I completed two cycles of inductive coding (Miles et al., 2018) to identify prevailing themes. My analysis was an interplay of "categorical aggregation" and "direct interpretation" (Creswell & Poth, 2018, p. 206).

First Cycle of Coding

During my first cycle, I used "descriptive coding" (Miles et al., 2018, p. 74). Each code was a short phrase with the intent of "essence-capturing" (Miles et al., 2018, p. 72) to document how participants engaged the study's process and my support. These codes spoke to process coding in that the gerunds addressed "conceptual action" (Miles et al., 2018, p. 75). This was only appropriate since teachers, no matter their years of

experience, are becoming more refined professionals as they mature their craft, including assessment design. My coding not only broke down the data into digestible, smaller categories; it also substantiated my coding as I coded across sources (Creswell & Poth, 2018). To maintain "lean coding" (Creswell & Poth, 2018, p. 190), I only added a new code if the data could not be contained by my existing codes.

Reliability

To ensure reliability as I "retrieve[d]," "assemble[d]," and "condense[d]" my data (Miles et al., 2018, p. 73), I focused on the cleanness of that data and the fidelity of my coding. I checked transcripts to minimize mistakes and remained true to my codes' well-defined parameters (Creswell & Creswell, 2018). My cycle-one codebook, which concretely "articulate[d] the distinctive boundaries for each code" (Creswell & Poth, 2018, p. 190), functioned as the organized depository for my qualitative data, largely direct quotations.

Second Cycle of Coding

During my second cycle of coding, I moved to the more "interpretive act" (Miles et al., 2018, p. 90) of "pattern coding" (Miles et al., 2018, p. 86) to look for themes that both transcended manners of participant engagement in my study's process and repeatedly appeared across my cycle-one codes. (In actuality, I started recording in more nebulous form some of these themes as I was cleaning up transcripts and populating my cycle-one codebook.) These themes ultimately took the form of paradoxes to capture dialectic relationships offering "a richer understanding of reality" (Hasan & Kazlauskas, 2014, p. 10). I populated my cycle-two codebook with data from my cycle-one codebook

after creating a framework matrix that identified data moments by theme. Ultimately, these themes offered "more meaningful and parsimonious units of analysis" (Miles et al., 2018, p. 86) to facilitate my meaningful interpretation of the data.

My second coding cycle also included the development of a concept map (see Figure 27), or "network" (Miles et al., 2018, p. 111), to synthesize my data at a fundamental level. I designed my concept map using activity theory's (my theoretical framework discussed next) triangle diagram of collective activity system developed by Engeström (1987) (see Figure 10), and this allowed me to show the integral role Annotations of Awareness play in student production grounded in critical thinking and metacognition.

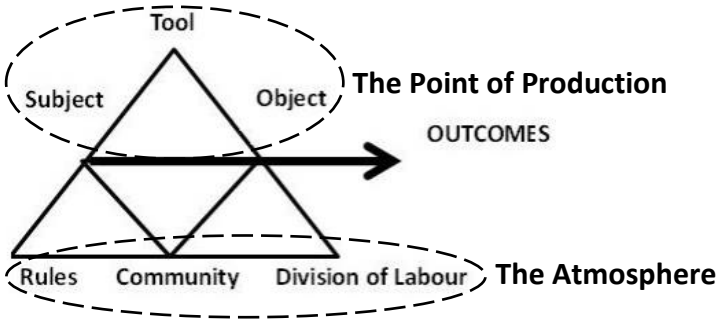
Theoretical Framework

Since my research was grounded in thoughtful production—me producing and refining a Metacognitive Framework for Assessment Design (see Figure 7), teachers producing assessments to foster cognitive and metacognitive discourse, and students producing responses to learning and thinking that required communication of their learning and thinking, I grounded my action and my data analysis in a theory that focuses on conscious production. As a sociocultural "lens through which designers can analyze human activity systems" that "focuses on the interaction of human activity and consciousness within its relevant environmental context" (Jonassen & Rohrer-Murphy, 1999, p. 61), activity theory helped guide my iterative research design, my coding, and my findings. Grounded in the philosophies of Kant and Hegel, as well as Marx and Engels, and in the psychology of Vygotsky, Leontiev, and Luria (Jonassen & Rohrer-

Murphy, 1999), activity theory "posits that conscious learning emerges from activity (performance), not as a precursor to it" (Jonassen & Rohrer-Murphy, 1999, p. 62). This consciousness becomes the fertile ground for engaging (both teachers and students) in the metacognitive skills of planning, monitoring, and evaluating. As teachers produce assessments and students produce responses, a metacognitive dialogue can commence. Activity theory takes an activity and identifies its fundamental components localized at what I have called The Point of Production (Vygotsky's and Leontiev's models) (Hasan & Kazlauskas, 2014): the subject (the person or group producing), the object (the intended product), the tools (anything employed for "transformation"), and the actions/operations ("goal-directed" efforts to achieve the object) (Jonassen & Rohrer-Murphy, 1999, pp. 62-63). Also present, as what I have termed The Atmosphere or context of the production (Engeström's model) (Hasan & Kazlauskas, 2014), are the components of the community (the people with a claim to ownership of the object), the rules (explicit and implicit culture), and division of labor ("horizontal division of tasks" and "vertical division of power and status") (Mak & Lee, 2014, p. 75) (see Figure 10).

Figure 10

Adaptation of Engeström's Collective Activity System from 1987



Note. This graphic is adapted from Hasan & Kazlauskas, 2014.

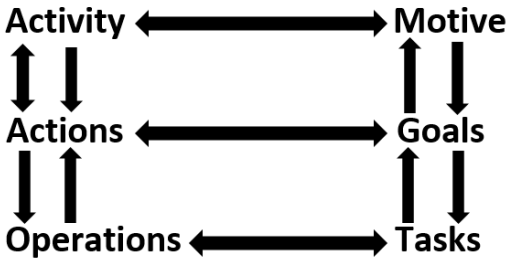
These localized efforts to accomplish the object can be considered through a dynamic continuum (see Figure 11):

> Activity (e.g., designing instructional materials) is the performance of conscious actions and consists of chains of actions (such as needs assessment, objective writing, drawing graphics, shooting video, etc.). Actions are chains of operations (e.g., camera operations, spreadsheet entries, telephone calls). All operations are actions when they are first performed because they require conscious effort to perform. With practice and internalization, activities collapse into actions and eventually into operations, as they become more automatic, requiring less conscious effort. The reverse dynamic is also possible: operations can be disrupted and become actions. (Jonassen & Rohrer-Murphy, 1999, p. 63)

My research, through defining the Metacognitive Framework for Assessment Design (an object for me and a tool for participating teachers), sought to operationalize steps toward such automaticity so that teachers and students found engaging in metacognition more accessible. The question that guided the development of this Framework and the teachers' efforts was "How can the assessments we design offer the students tools to produce with metacognition and teachers the tools to offer metacognitive feedback?" In this Metacognitive Framework, the Annotations of Awareness became the students' tool for thoughtful production and the teachers' tool for feedback.

Figure 11

Leontiev's Activity Hierarchy from 1981



Note. This graphic is from Hasan & Kazlauskas, 2014.

Specifically looking at instructional design, tradition assumes that "knowledge (both as an object and outcome of instructional design) can be transferred and acquired by learners" (Jonassen & Rohrer-Murphy, 1999, p. 64). Activity theory, however, assumes that "knowledge is socially constructed based on the intentionality, history, culture, and tool mediation used in the process" (Jonassen & Rohrer-Murphy, 1999, p. 64). The construction process, the social endeavor, of learning must therefore intentionally integrate opportunities for discourse on thinking if instruction is to promote confidence and competence in critical thinking through metacognition. If such endeavors are built around students producing and crafting well beyond recalling through overly contrived and narrow questions—processes of knowledge construction instead of "knowledge transmission" (Jonassen & Rohrer-Murphy, 1999, p. 64), such opportunities become more authentic and claimable. Presupposing intentional production, the three metacognitive skills (planning, monitoring, and evaluating) align with activity theory's definition of consciousness:

> Consciousness is not a set of discrete, disembodied acts (design, decision making, classifying, remembering) as conceived by traditional conceptions of learning. Rather, consciousness is the result of everyday practice. The conscious process of meaning making for any actor or group of actors in the network emerges from activity or the personal reflection on activity. (Jonassen & Rohrer-Murphy, 1999, p. 64)

Activities where students create using their knowledge for the purpose of gaining knowledge offer the requisite planning, monitoring, and evaluating opportunities for metacognition to occur.

My awareness of another aspect of activity theory, contradiction, offered me opportunity to react to teacher-participant needs organically yet with structure. Contradictions arise from "the multiple perspectives of the participants or multivoicedness inherent in the activity systems" (Mak & Lee, 2014, p. 75). If not careful, I could have only looked at these tensions as "disturbances" instead of "sources of change and development" (Mak & Lee, 2014, p. 75). Viewing my action research as an activity system itself, a tension existed between teachers wanting to support independent and transferable critical thinking but finding it difficult to do so. The objects became intentionally designed assessments that asked students to produce, that facilitated teachers supplying effective feedback, and that promoted metacognitive discourse. Once my participants started working on designing or redesigning assessments, they developed intentions of their own:

> According to activity theory, intentions emerge from contradictions that individuals perceive in their environment, such as differences between what they believe they need to know in order to accomplish a goal and what they do, in fact, know at any point in time. Their intentions, however, can exist only in the context of the intended activity. (Jonassen & Rohrer-Murphy, 1999, p. 65)

Whether I was the subject designing my research, my teacher participants were the subjects crafting their assessments, or their students were the subjects producing artifacts of their thinking, such contradictions that arose and were responded to by iterative design became the actual moments for metacognition. When the subjects and the surrounding community prepared to support them can engage in overt conversations about planning, monitoring, and evaluating, critical thinking skills will grow.

Validity and Trustworthiness Measures

To help evaluate the accuracy of my findings and to help build confidence among my readers in that accuracy, I used multiple procedures (Creswell & Creswell, 2018). I triangulated between the interviews and design sessions, the observations and conversations, the reflection logs, the surveys, and student-work samples, looking for "corroborating evidence" (Creswell & Poth, 2018, p. 260) and building "coherent justification" (Creswell & Creswell, 2018, p. 200) for my emerging themes. I also used member checking with the participants to assess "how well the ongoing data analysis represent[d] their experience" (Hays & Singh, 2011, p. 206). This entailed sharing with the teachers specific transcribed moments and my interpretations of them. To avoid ignoring divergent perspectives or shoehorning perspectives into already established

coding, I judiciously expanded my coding to allow for multiple perspectives and held my themes up against antithetical positions shared. I remained mindful as I triangulated data of "disconfirming evidence" (Creswell & Poth, 2018, p. 261) because it often highlights "points of intrigue" (Creswell & Poth, 2018, p. 261) that warrant further investigation.

Limitations of the Study Design

While my research sought to fill some of the gaps in metacognition research, specifically focusing on practical classroom application, it was limited by the small number of teacher participants and one research site. Both of these limitations stemmed from the need for a realistic approach to research conducted by only one scholarly practitioner (Perry et al., 2020) within the limitations of a 90-day (semester-long) PDSA methodology. The small number of participants from only one site ensured I offered enough support to their efforts while also collecting substantial data from each of them, but this did limit the diversity of the teachers in terms of race/ethnicity, educational background (five earned their teaching degrees from the same university), and teaching experience (seven had taught mostly in the research site's district or the neighboring district with similar demographics). The use of only one research site did simplify my access to data and ensure ample knowledge of the site's complex inner workings, but it limited student diversity in terms of race/ethnicity, educational experiences (most previously attended only a handful of schools), and living environments (rural and suburban). The focus on only English and social studies classrooms allowed me to pull from the comfort of my professional expertise, but it did limit the variety of instructional dynamics studied, offering no direct data to fill the gap in research on metacognition

application in the science or mathematics classroom. My focus on secondary instruction was guided by both my experience as an educator at the secondary level and my desire to understand better how to integrate metacognition within content-heavy curricula that often promote recall with limited application and design.

CHAPTER THREE

FINDINGS

Summary of Findings

Through two cycles of qualitative-data analysis and the comparison of quantitative data pre and post study, the usefulness of the Metacognition Framework and its dependence on Annotations of Awareness were tested and validated. As my eight teacher participants navigated this study seeking clarity and comfort in the Framework's concepts and processes, they arrived at "answers" speaking to their pedagogies and practices. As they designed or redesigned their assessments, they leveraged already-present classifications and developed creative confines to increase both the demands on student critical thinking and the quality of teacher feedback. As they grew in awareness of their professional preferences, they grew more enthusiastic about improving their assessment strategies while maintaining their autonomy. As they modified expectations to ensure student engagement and completion, they promoted accessible rigor. As they grew to see the necessity in having students include Annotations of Awareness, they held students accountable while helping students see this integral step as more than just compliance. As they pushed themselves to try new assessment-design strategies, they missed some opportunities to capitalize on the power of annotations, but they recognized this upon reflection and through practice.

During my second coding cycle, themes emerged around paradoxes, a fitting way to classify my data since my theoretical framework of activity theory finds meaning in "inevitably generated" (Mak & Lee, 2014, p. 75) contradictions and tensions. These six

themes captured the more transcendent concepts of my study, moving beyond how participants and I engaged the study's process and one another. The most prevalent theme of *Finding Clarity through Abstraction* spoke to the heart of the Metacognition Framework and the methods teachers can use to support and promote critical thinking through both concretization and abstraction. *Moving Backwards to Move Forwards* placed the assessment at the center of instructional design with teachers integrating pathways for student thinking as they identified the thinking targets. *Giving More Feedback to Give Less* documented how teachers increased their formative feedback as students produced and how teachers could/should utilize the shorthand of the annotations to compose their written summative feedback. With the theme *Slowing Down to Speed Up*, some participants realized both the benefits and costs of building in time for metacognition. Within *Focusing on the Discrete for Transfer*, teacher participants found potential in how Annotations of Awareness can promote both student-thinking transfer from the micro to the macro and teacher-assessment-design transfer across curricula. The last of my six transcendent themes, *Students Guiding the Teachers*, focused on cognitive load. The annotations increased the cognitive load on the students but decreased the cognitive load on the teachers as both students and teachers established an agreed-upon language for fostering feedback.

My quantitative data collected pre and post study took three forms: Likert-scale teacher self-assessments on comfort and confidence with teaching metacognition, Likert-scale responses to metacognitive scenarios, and SC Teaching Standards 4.0 Rubric (SCDE, 2021d) scores on teacher assessments (scored by the assistant superintendent of

instructional services for the research site's district). The four pre- and post-survey data points focusing on levels of teacher confidence with integrating metacognition into their classrooms revealed improved confidence on average. Question 1, dealing with perceptions of time and space for metacognition, revealed an increase from the average of 3.5 to 4. Question 2, dealing with metacognitive strategies, showed an increase from the average of 1.88 to 3.25. Question 3, focusing on designing product-based assessments, revealed an increase from the average of 2.63 to 3.63. Question 4, focusing on integrating metacognition into the classroom, showed an increase from the average of 2.88 to 3.5. When comparing the pre- and post-survey Likert-scale data focusing on participant perceptions of teacher and student metacognitive practices, ratings on the four-point scale minimally increased and decreased, but the five items that most directly aligned to my action research (two from the declarative category and three from the procedural category) revealed high rating levels post study, all at 3 and 4. Pre- and post-study assessment scores in Thinking and Problem Solving revealed maintenance of rigor with two veteran teachers; growth in rigor with one veteran teacher, one newer teacher, and one first-year teacher; and some points of divergence with scores for three teachers. All but two teacher participants' scores for Academic Feedback (written) dropped from pre- to post-study scoring.

Qualitative Data Analysis

First Coding Cycle

Qualitative data collected before my action research, during the three PDSA cycles, and after the study pointed to teacher participants (a) seeking clarity and comfort,

(b) designing for thinking, (c) growing in awareness, (d) positioning for improvement, (e) modifying for priorities, (f) holding students accountable for the process, and (g) missing some opportunities. These seven thematic categories fundamentally captured the teacher participants' engagement in the process and their interactions with me.

Seeking Clarity and Comfort

As we entered the study, questions arose, and comfort levels increased as the participants wrapped their heads around Annotations of Awareness and the three approaches of classifications, confines, and contexts that provide ripe opportunities for these annotations. Some had to arrive at the realization that student annotations can move beyond marking up texts of study to marking up student production. Sophie (pseudonyms used), a newer English teacher, asked during her second assessment-design session, "So with the annotations, so there's annotating the text and then annotating your own work?" Some had to grow to appreciate the structured and brief nature of these annotations to promote more timely and more focused feedback. As a veteran English teacher who had already found comfort in asking students to make meaning through classification and justification, Richard's interest was piqued during his first design session by the idea of students simply identifying before decoding the one most meaningful word (a creative confine) in their quoted evidence. As we looked at his analysis chart organized around a series of thematic concepts, he realized how he could easily modify it to include this step: "It's just adding an addendum here, quote that four or five, and then space, and it's circle the most important word in the quote."

Some had to realize how to harness the power of their already existing classification systems to move beyond recall. Claire, a first-year social studies teacher, already had categories for the types of challenges arising from different shapes of states, so I encouraged her to design her assessment to promote student interpretation over regurgitation:

> . . . they're going to know that with an elongated state these are three to five common issues that arise, right? . . . how do you make that first column something more than just listing the problems that typically arise with the elongated state? . . . You could give them a couple of quick scenarios that present the actual problem. And then they have to decide, "Oh, this is a problem of capital location" or "This is a problem of transporting goods." And then they move into the solution column. Because if you're not careful, and maybe I'm misinterpreting this, if they get an elongated state and they know these are the three problems, that's just going to be what they list, right? . . . So I wonder if we can maximize that first column.

Some participants started to see the potential in creative confines—not minimum requirements—as they gained understanding around annotations. Lucy, a newer English teacher, agreed to use the titles of student essays as a place to promote thematic thinking. After circling the most meaningful words in both their quoted evidence and commentary, students would be asked to find a connection between the circles to craft their titles using a technique of repetition. As we discussed this approach during her first design session,

she asked, “So now, what specifically is the difference between the annotations of awareness and the . . .?” I responded,

> So the annotations of awareness are where they're actually marking something that they did. So their creating the title is them doing creative confines or classification; them labeling their title with the technique is an annotation. . . . Or you could argue that their title is an annotation, too; you could. . . . The annotations are the things they write down in shorthand.

And while only a few teacher participants looked to contexts for promoting critical thinking, many arrived at some understanding of this as we discussed possibilities. As Sophie and I were discussing, during her third design session, a final assessment for her English class, we considered ways to connect literary devices to themes to personal community experiences as a way to ground literary analysis in real life:

> Think about it. Recontextualize this excerpt for your community. . . . But you could choose a moment or two that’s rich with at least three of the different concepts and then say, “Okay, I want you to use this as a mastery-text jumping-off point; I want you to recontextualize this moment in your [name] community, in your [name] community, in your [name] community, in your neighborhood.” And then they have to decide, “Okay, well, this passage is about excess and green light, so here's,” and then they annotate for the green light and the excess.

Sophie responded with both excitement and caution as we moved more into specifics:

> In their own writing? After they've already looked at the other? I think that could work, and I think it'd be easy to kind of latch on to literary devices because those are already going to be in many of those rich thematic . . . .

I offered a thinking-out-loud of how the student could self-question to arrive at a quality response: "Okay, in *The Great Gatsby*, he wants Daisy, so he has flowers for her, and it's over the top. Right? So what do I want? And if I wanted that, how can I use excess to influence me getting that?" Sophie started designing backwards to produce an assessment that ensured such quality: "The only thing is that I feel like we would have to provide that question with that amount of clarity, rather than just saying . . . ." Such questions and dialogue for building clarity and comfort with the concepts that undergirded this study helped the teacher participants build confidence that manifested in more cognitively demanding assessments.

This seeking of clarity and comfort transcended the foundational conceptual parameters of the study to include reflection and discussion on fundamentals of pedagogy and practice. Early on, participants posed questions about whether or not they were "correct" in their approaches and if they were actually promoting metacognition. Alex, a veteran social studies teacher, shared a discomfort both he and his fellow social studies teacher, Claire, had as they finished cycle one: ". . . we were just kind of worried that we were getting what was going on. Like, in other words, are we really, when we do what we're doing, are we hitting this metacognition?" Even though this appeared to be a doubt about the particular practices promoted in this study, such a question revealed discomfort with what metacognition can actually look like in the classroom.

Sometimes questions were asked almost as if seeking permission. During her second design session, as Lucy expressed concern over an assessment possibly becoming too narrow in focus, she was actually expressing uncertainty about assessing with rigor, how to balance a desire to "cover more" and have students do "more" with demanding inescapable critical thinking: "And so you don't think that would be too, like, that I'm not scoping in too much if we just focus on one pattern?" During her third design session, she asked if she should add a confine to an essay assessment: "Are there any confines that I need to add here?" My response returned her to backwards design that questioned, instead, what she wanted her students to produce to show their thinking and then explain their thinking:

> I mean, this might seem kind of cliché, because we talked about it before, but maybe in their title . . . . Because think about it; a title is already a confine. So you could confine it even more, to really hold them accountable to make some deeper meaning, right?

Instead of thinking about what we could add, we discussed what we could use to deliver students' products to the desired destination.

Soon after Anna, a veteran English teacher, completed her first Metacognition Partnership Reflection Log, she and I had a discussion about feedback that not only offered promise for more useful and utilized feedback but also for assessment designs that scaffold for success. Anna earnestly shared, "I don't know how to give good feedback; I usually just ask questions." As I thought about how to respond to such a pivotal question, the premise of my study was tested. Annotations of Awareness

withstood and helped us arrive at the realization that an assessment built around annotations can help teachers' feedback bridge the gap between offering questions (sometimes not enough feedback) and modeling (sometimes too much feedback). The established classifications, in this case for paraphrasing (using own words/synonyms, adding words, reorganizing words), not only informed the students in how they could achieve a quality product but also directed Anna and her partner teacher in how they could offer personalized and focused feedback.

During his third design session, Harrison, a veteran English teacher, asked that we focus on redesigning an assessment that did not prompt students to produce at the level he expected when compared to a similar assessment given in another one of his classes:

> I'm kind of confused because I feel like they're very similar assignments. And I gave examples with both assignments. You don't see it on the printout for *One Good Mama Bone*, but I've got a PowerPoint that went through and showed them samples. So I, like I said, showed them samples. They both have rubrics; they both, I feel, clearly defined what I'm looking for. But yet, I got two very different sets of results.

After comparing the two assignments, we realized that the one with more thoughtful student production resided more in the abstract realms of symbolism and theme to arrive at a visual and that the other integrated the visual component much more concretely without demanding creative decisions from the students. Even though his confusion arose from feeling like he had set both assignments up for success by modeling and detailing expectations, he found clarity when he understood that the assignments themselves were

designed with different demands on critical thinking connected to the visual component. As teacher participants navigated this study seeking clarity and comfort in its concepts and processes, they found more fundamental "answers" to their individual pedagogies and practices as they relate to assessment design and feedback.

Designing for Thinking

This first-coding-cycle theme captured the largest percentage of the qualitative data yet presented the most consistency of discourse. Most of the data within this theme focused on using classifications to give students entry points into how to critically think in accomplishing their products, and most teacher participants arrived at their design sessions with classifications available for use. Alex shared at the start of the study that he wanted to use the five historical thinking skills delineated in SC's Social Studies College- and Career-Ready Standards (comparison, causation, periodization, context, and continuities and changes) (SCDE, 2019) to build into his teaching more sustained critical thinking: "And the idea was to try to find within a historical quote a place where they're relying on a thinking skill, or they're referencing a thinking skill." As the study progressed, though, he also started to explore how to use classification to help students think within more discrete arenas, such as political-cartoon analysis. After discussing his students' struggles with decoding a recently presented cartoon, we stopped to design backwards by identifying how political cartoons are created, arriving at two fundamental techniques of symbolism and hyperbole. As an approach to help him support his students in this realm of primary-source analysis, I offered,

> So imagine they just looked at symbolism and distortion. And those are the two classifications, because you don't want to put too much on them and it's not a course in political cartoons. But if you say, “Hey, these are two devices that are often used: exaggeration and symbolism,” then that gives that student two entry points into making meaning. And then they can label, they can say, “Hey, I've just made meaning through this symbol” or “I've made meaning through this exaggeration.”

Such movement between fundamental classifications used throughout a curriculum and more immediate classifications used in isolated moments occurred throughout my study.

While classifications were at hand and ready to use quickly at most design sessions, creative confines that create a “problem-oriented activity” (Ennis, 2018, p. 171) required more time and exploration to integrate authentically and purposefully into some teacher-participants’ assessments. A common (because of its versatility) confine we explored was the word limit. This ranged from asking students to justify their choices in just four words to asking students to circle the most important word in their meaning making. Molly, a veteran English teacher, decided to harness the power of this confine as her students annotated what they viewed as successful moments in their essays to justify their analysis of quoted evidence. To introduce this approach to Molly, I offered,

> So I'm wondering if . . . in the moments they think they did the best in, if they were able to circle the word or the phrase, and limit it, the one to three words in that quoted evidence that really helped [them] analyze it the best, and then literally draw a connection between that one or three words and the one word to

> three words they have in their analysis that shows that connection. . . . So they're, they're literally connecting the dots.

This idea of word-limit confines also appeared in some design sessions as we discussed the underutilized power of the title. In his first design session for his Life Philosophy essay assignment, Harrison already had the two classifications of how and why (How will you pursue what you say is important? and Why is this important to you?) to move his students beyond just identifying the four values most important to them, but he wanted his students to arrive at a more comprehensive understanding of what they had written as they composed their conclusion paragraphs. As a means to use a confine to promote more complex thought through the interplay of conclusion and title, I suggested,

> So I would say either, if you want to make it a little more heavy with the cognitive load, can your title capture some type of commonality shared between these four values? . . . Or do you give them the confines of the title can't be more than three words, and they're really looking precisely at their word choice? And then they're quick annotation could be a justification for their word choice. Why did, if your title can only be two words, or one word, why, why is this word important? That's almost bridging the gap; that's almost getting to the commonality piece, but it's not so daunting, right?

This approach was not far removed from when Lucy asked her students to circle key words and connect the dots in the title. Confines establish a problem orientation (Ennis, 2018) by asking students to prioritize and use discretion as they produce to meet the challenge, but confines also can promote annotations to succinctly show student

motivations and understandings, making these moments ripe for cognitive and metacognitive feedback.

As my eight teacher participants designed their assessments for student thinking, they also realized they were designing for teacher feedback, feedback both during and post student production. As the annotations held students accountable for communicating their thinking, annotations also held teachers accountable for the thoughtfulness of their feedback, especially during student production. As Lucy reflected on the execution of her previous two assessment designs, she appreciated how student annotations facilitated her giving feedback as students were actually thinking:

> And I've found, too, (and I think we've talked about this, especially for CP [College Prep] kiddos) honestly, after the production, it's a little too late. Like they need the feedback then and there in the process versus after the end. . . . So that's why to me, I think this is so valuable, too. It's just because the process is an action. And so I'm really about it's not just Annotations of Awareness but Annotations of Action.

With this pursuit of formative feedback as students are producing, the commitment to quality of—not quantity of—cognitive feedback on the final products must remain, though, because such moments are still opportunities to teach. As Richard and I were reviewing a student-work sample, we stopped on a moment where the analysis behind an apt connection between the teacher-provided theme of "the necessity for justice" and the student-selected quotation including the word "conscience" fell short of its potential. The student's choice of quotation revealed potentially deeper thinking than

her explanation did. Richard and I talked about how he could use this student's practice of composing an equation (word from quotation = meaning) to model for her the realized potential of what she selected. I offered,

> And so I think what you've set up for them sets you up for very quick feedback, to point out either through modeling or just using the same annotation process to point out these really strong ideas. . . . So that would be my encouragement: How can you take and harness what they're already doing and then use the same process yourself in response to what they did?

In response, Richard acknowledged two important realities resulting from his redesigned assessment: He had given a good amount of feedback as students produced, and he had missed an opportunity for focused and brief feedback post production: "And I think that was also probably me not being as diligent as I should have been in the feedback process because I've already given her about five pieces of feedback now." As teachers design assessments that allow for Annotations for Awareness, they are not only designing for high-but-achievable cognitive demands; they are designing for timely, personalized, and focused feedback.

Growing Awareness and Positioning for Improvement

These two first-coding-cycle themes are distinguishable but interconnected. The teachers' growing awareness of their professional selves and the possibilities for assessment design energized them and encouraged them to take risks and commit time to improve their assessment practices. When they realized how designing for annotations promotes more student success with critical thinking, teachers excitedly looked for

implementation opportunities. Upon reflection before her third design session, Claire was able to see how so many of her assessments had been focused more on recall, but she also realized the need to ground this upcoming assessment in real-world contexts:

> So typically in this class, quizzes have been very much just straight vocab, just to see if they're on track with that, except for the quiz that I did for the first design cycle. So for this one, what I'm going to try to do is not focus on just do [they] know what this word means but do they understand what this looks like in the real world, because this is economic stuff.

Claire set this caliber of assessment as a priority for this unit, and she felt more empowered to pursue higher student cognitive demands because she had seen the results from her first-design-cycle assessment.

As teachers pursued Annotations of Awareness, they also grew in awareness of their personal preferences, of approaches they would more likely use again because it fit within their professional comfort zones. Where one teacher embedded the annotations into preexisting charts, others preferred students marking up their final products. Lucy shared how she can tolerate this type of controlled mess in her students' final submissions: ". . . I want their final essays to be color coded; that's easier for me to see their thinking. . . ." Because of the versatility of Annotations of Awareness, despite their specificity of teacher guidance for the student, teachers realized the autonomy they maintained as they improved their assessments and feedback.

Teacher participants' positioning for improvement mainly appeared in the form of enthusiasm to try something new with their assessments. This enthusiasm remained

throughout the study because the Annotations of Awareness approach guided without prescribing, respected their autonomy, improved their students' production, and offered speed—speed in design and speed in feedback. Anna, who toward the beginning of the study felt uncertain about her feedback strategies, experienced opportunities to offer quality feedback that built her confidence and improved student learning: "Yes, it gave me even the confines, or words, to tell them exactly like to specifically tell them what to work on." As Anna experienced the quality of student work improve and her feedback becoming more specific and focused, Harrison, a teacher comfortable with providing feedback through rubrics and post-production comments, found himself giving personalized cognitive feedback more quickly in class and on the final drafts:

> I felt that it allowed me to give really effective feedback because they had, you know, highlighted and pointed out exactly where I needed to spend my time. . . . But by and large, I didn't have to look for the information; I could hone in on what we're really focused on. And I think it made an effective use of my time.

When teachers found that they could incorporate strategies to improve their effectiveness and efficiency while actually designing and implementing their instruction without taxing their time and comfort, they needed little persuasion to be energized for change.

Modifying for Priorities

This first-coding-cycle theme arose periodically as I both observed teachers teach and worked with them in their design sessions. These modifications took basically two forms: lowering the number (not weight) of student cognitive demands and establishing levels of demands for student production. When teachers lowered the number, they were

monitoring and adjusting to students' abilities, logistics of time, and students' needs without sacrificing critical thinking. Alex found that most of his students had already found success with certain historical thinking skills, and he wanted his students to focus on the more challenging ones:

> So they have trouble doing the periodization one. . . . And that's what I have not been very good about. I tell them, "I want you to locate a point in the text that you see one historical thinking skill," but they go bonkers with the thing, and they find and you see down here, "Oh, I find this one here; I find this one here."

In order to support their thinking in the arenas his students were avoiding or falling short in and to better provide them with, as Alex said, "some really good, focused feedback," he modified his assessment by simply crossing out the skills they had mastered so they could focus on the others without "too much going on."

While Lucy lowered the number of demands for students who were absent the previous day by holding them accountable for deeper thinking with one less approach, she also delineated levels of demand to accommodate the variety of her students' abilities by offering three tiers of thinking in a thesis. When teachers leveled demands, they were seeking opportunities to support their students in each one's Zone of Proximal Development and to promote metacognition as students and teachers conferenced to decide how best to seek challenge.

Sophie encountered this scenario as she and I were designing an assessment that had more obvious categories of evidence along with categories just as rich but less obvious. She wanted to encourage her students to move beyond the conspicuous category

of improper forensic science and challenge themselves as they looked for evidence within two more categories, so I suggested,

> And I think, and part of the metacognition is you let them know that the more obvious [categories] are going to be misidentification and misconduct, but those others [categories] are there. So just be aware as you move forward and choose your other two. If you want more of a challenge, if you want to do a little bit of investigation by yourself on your own time, those are some avenues.

Such modifications within critical-thinking endeavors allowed teachers to prioritize rigor without overwhelming students or lowering cognitive demands. This is important because products that students can never successfully complete are products that never fully demonstrate their cognition/metacognition and never engage a comprehensive feedback loop between student and teacher.

Holding Students Accountable for the Process and Premise

This first-coding-cycle theme appeared mostly in conversations and observations outside of the design sessions. With annotations being new for most teachers and students, such a step could seem additional and maybe even superfluous without the understanding that this is the conduit for metacognitive discourse. Without the annotations, both teachers and students would find less comfort and opportunity to engage in the feedback loop tied to metacognition. Sophie was the first teacher to bring this dynamic to my attention. She spoke of how some of her students did not include the annotations but did complete the assignment. The annotations are integral to having quicker conversations during and post production, and this promise of speed increases the

likelihood of occurrence so more students get more feedback. Later in the study, Richard, with self-satisfaction, shared how three of his students in one class “didn’t like” the annotating confine of the equation (word or short phrase = big idea) because of discomfort but how one student returned to speak with him only “two minutes later,” sharing “‘did not come from wealth’ = egalitarian.”

In one of Molly’s classes, some of her students did not yet comprehend the purpose in drawing arrows between the most important words in quoted evidence and the most important words in their analysis. One student asked her, “Just draw an arrow? Or explain?” Molly responded, “Just draw an arrow.” A few minutes later another student asked a peer, “Just draw a line?” and followed up saying, “I’ll just draw arrows all over the place.” This student at this moment failed to see how he was avoiding engagement in metacognition and instead operating under compliance to satisfy the teacher’s demands. The following day, I shared with Molly my observation that some of her students really wanted to justify their arrows. She concurred with this and with my assertion that "The analysis they circled is the justification.” Encouraging and expecting students to engage in the actual annotating can face some challenges when students only see this as an extra step, when they do not see the thinking that it shows, when they are working in only compliance mode, and when they face discomfort in trying to execute what looks so simple. That discomfort, though, is the moment where students grow and teachers directly witness it. Activity theory identifies these moments as “contradictions,” as “sources of change and development” (Mak & Lee, 2014, p. 75).

Missing Opportunities

The last first-coding-cycle theme sounds harsh but is necessary to capture some of the understandings that both the participants and I gained through the study. When considering missed opportunities, I am talking about improvement, not mistakes, and these opportunities for improvement mainly appeared as occasions for teachers to model and to optimize feedback. As a first-year teacher, Claire soon realized the need for modeling with intentionality to increase the likelihood of students authentically meeting expectations and thus maximizing the potential in each endeavor—potential for student cognition and metacognition and potential for cognitive and metacognitive discourse. Reflecting on her first design cycle, we discussed both modeling the endeavor before the students produce and modeling the annotations in her feedback. Claire expressed concern that some of the students who did well might have just showed the ability to "memorize the important words and then regurgitate those." As an approach for her to model thinking without doing all the thinking for her students, I offered,

> Something that you could do . . . is next time give them as an extra layer, have them choose an identity and place it and justify one that you did not model with them. . . . But it's one of those things where you really, for the kids [who] really pay attention and get the modeling, it's just a way to see are [they] really getting it.

Focusing on her feedback with her first assessment, I shared how her written feedback could also model thinking within the set confines:

> And so what I would suggest is when you say that, maybe even model for him what you would have said within the confines so not only are you helping him build his content knowledge but then post the experience you've modeled for him how to do it . . . but I might have even gone back and just circled the five most important words in your feedback.

Veteran teachers also realized missed opportunities for feedback. Alex shared, during his second design session,

> See that, that is something I need to do with these guys. I, we have been doing it, discussing it as a group, have some kids come up and mark it and annotate it, and then I sort of collect them and look at them. I need to have that . . . one-on-one interaction with them.

We looked to placing confines on which historical thinking skills the students could use in order to prepare him for focused feedback. During his second design session, Harrison reflected on how the confines of the title helped some students "encapsulate more of the spirit of the assignment" but how some students' content did not live up to their titles:

> But I think when I use this again . . . I'll make sure I build in a day that I can conference with them individually and one-on-one because, like you said, I got a lot of the whys . . . but not how . . . . And so even though I told them (it was written in the instructions; it was written in the in the assignment itself) that's what I want [them] to do, several students . . . fell short in that explaining how they were going to achieve that or how they were going to ensure that that philosophy remain part of their lives going forward. So yeah, I think maybe it just

needed me to interact with them a little bit more and have some more one-on-one to push that.

Moments where teachers reflect and realize how they can improve are moments to respect by acknowledging them, not hiding them out of embarrassment or conceit. No learning endeavor can be neatly perfect. As I mentioned with teachers holding students accountable for annotations, activity theory asserts that learning takes place through "disturbances" (Mak & Lee, 2014, p. 75).

Second Coding Cycle

During my second cycle of coding, six themes, capturing the more transcendent concepts in my study, emerged as they resided across the seven first-coding-cycle themes. These six themes hold most meaning when explored through paradoxes as they speak to realizations of thoughtful simplicity to achieve complexity in thought. My Metacognitive Framework built upon Annotations of Awareness aimed to use simplicity to arrive at complexity, so this only seems fitting. Activity theory, too, looks to dialectic relationships (where a concept and its opposite coexist) to arrive at "a richer understanding of reality" (Hasan & Kazlauskas, 2014, p. 10). As I analyzed the data across the first-coding-cycle themes, I identified (a) *Finding Clarity through Abstraction*, (b) *Moving Backwards to Move Forwards*, (c) *Giving More Feedback to Give Less*, (d) *Slowing Down to Speed Up*, (e) *Focusing on the Discrete for Transfer*, and (f) *Students Guiding the Teachers*.

Finding Clarity through Abstraction

As the most prevalent theme throughout my study, *Finding Clarity through Abstraction* focused on the interplay between thinking concretely and thinking abstractly. Sometimes the abstract had to be made more concrete with classifications, and sometimes the more concrete had to be made more abstract with confines. Either direction, the goal was clarity of student critical thinking. The concept of making the abstract, the unfamiliar, the less automatic a more digestible process makes obvious sense, and many teacher participants used the Metacognitive Framework to achieve this. The concept of making the concrete, the familiar, the more automatic a more abstract process could make many pause, but many participants in my study did just that to promote student critical thinking.

Structuring for Clarity in the Abstract.

As teacher participants engaged the Metacognition Framework and its Annotations of Awareness, they started to realize the power of classifications. Utilizing already-existing classifications or newly identifying them, the teachers were able to demystify processes that they wanted their students to master. Early in the study, Anna and Sophie, co-teaching in one English class, were working with their students on quality paraphrasing as a fundamental step toward conducting research. By identifying three ways people can summarize, they were able both to help their students produce quality summaries with awareness and provide specific feedback as students summarized. As I was working with Sophie during her second design session, I wanted to encourage the path she and Anna were taking:

> I like this! . . . you've given them three things that they can do to make it a paraphrase. And then you can now assess them on those criteria, versus just a good paraphrase, because now you've told them what a good paraphrase can be. And now you can measure it against those three things. So classifications give them a chance to do things well but then gives you a chance to give really quick feedback on if they did it well.

As students produced using classifications and then annotated for them, they were able to share their work with their teacher, essentially saying, “Not only do I know what I'm doing, but I know what I did.”

Later in the study during Anna’s third design session, we returned to classifications as a method to support and promote quality student work as they compared an original text with a contemporary, young adult rewrite. I encouraged her to revisit her strategies for helping students paraphrase as they moved from reading comprehension into heavier critical thinking:

> I wonder if there's even a way to help them access the way the text made it contemporary, like you go ahead and give them kind of classifications like humor, younger character, if you give them some inroads into what this guy was thinking in terms to make it contemporary and accessible. Then it's much easier for them to make the meaning.

Anna quickly agreed, saying, “Yes. And just to have the language for it, I think. Because if you just say, ‘What is the impact?’ or ‘How's it changed?’ they don’t know.”

Using classifications for clarity in complex thinking endeavors also promotes students monitoring, regulating, and evaluating their work as they produce. During her second design session, Lucy reflected on how holding her students accountable for annotating their work facilitated peer editing:

> And, too, when they're doing workshopping, they're able to easily . . . , they're able to look at another piece, person's work and be like, "Oh, that's wrong. That's right." Because sometimes even when you try to get kids to workshop, they don't even know what they're supposed to be looking for.

Structuring Abstraction for Clarity.

Where annotations built around classifications can remove the abstract and mysterious, confines can healthily abstract to encourage problem solving. Oftentimes when students are asked to analyze at a more complex level through a more familiar lens, they neglect the deeper thinking because of that familiarity with the process. This often appears as students struggle to analyze versus summarize their selected evidence. Having an impromptu conversation with one teacher about analysis versus summary, this conundrum became clear within the scope of my study. I realized and shared with the teacher that asking students to select the most meaningful word or short phrase in the quotation they selected and then asking them to analyze only that "abstracts the process and jars them out of comfort of summary—can't summarize a word or phrase."

This idea of disrupting what students have grown accustomed to in writing appeared multiple times throughout the study. Molly, during her second design session, wanted to fine tune her process for written feedback once her students had written a

series of essays. As we were looking for ways to speed up and focus her feedback post student production, we arrived at students annotating their perceived strongest moments of analysis. Exploring the annotations for this, we returned to the struggles of analysis and decided to embed abstraction through confines of annotation. As Molly enthusiastically agreed to try this approach, I shared my experiences using such annotations:

> I just find myself when they're able to circle, abstract it down to the words or the phrases and not hide behind words . . . and say, out of all these words, "Some of these are transition words. Some of these are the heart of the quotation. And this is the heart of me decoding that heart. And does that work? Do you see that connection?" I just think that will help them to realize, "Oh, wait, I've said a lot of stuff that doesn't really . . . ."

Disruption through confines appeared in a third design session when Richard decided to formalize the equation-annotation approach (quoted word = meaning) one of his students used earlier in the study. As he worked to add it to a reading log focused on conflicts in a novel, he jumped ahead of the equation, much like students want to do, but returned to it, realizing the clarity of thinking and cognitive load this demands within such a familiar quotation-analysis process:

> But and what I've usually asked them to do in the past is "Okay, you identified your key quotation; now why is this a key quotation? What is it developing? Character, plot, or theme? And then just give your commentary to explain how." So what I've done just now is added the steps that we put into that *Macbeth*

> assignment of sentence-level-identification work. “Okay, what are the key words in this quote?” If for example, if this was “You call an assembly Ralph. We got to decide what to do,” and say the focus is authoritarianism versus democracy . . . “assembly,” “We decide.” “Okay, why are these the key quotes?” “The assemblies have been democratic because of group debates and then votes, so everyone has a voice in the decision.” . . . “How has it dealt with the focus?” Well, okay, I kind of already did that there.

At this point, I returned to the intention of the equation confine requiring students to keep both sides of the equation brief: “That’s what I was wondering if like in that column before the last, if they did something as simple as ‘we’ equals ‘decide’ equals ‘assemble’ equals.” Richard realized, “That’d be better. . . . I went too far.”

Much like classifications promote self-monitoring, confines encourage self-regulation. During Lucy’s second design session, she reflected on how her strategy of having students circle the most important word in each quotation and analytical sentence before crafting their titles and returning to their theses helped them realize how their initial claims did not align with their analyses: “Yes. And they also, I even had students after circling, go, ‘Wait, but my title now doesn't actually reflect what my analysis is. So I need to go back and change my claim.’ Like they would realize . . . .”

During Harrison’s third design session, the concrete and the abstract, the classification and the confine converged. I made the suggestion that since having such clear classifications of characterization (e.g.: instincts, intellect, beliefs, conflicts, weaknesses) helped students break apart with some depth and nuance their characters of

study maybe he could ask students to look for moments of evidence offering two categories of character analysis in order to encourage more complexity of thought:

> . . . maybe another thing to think about is, can some of these be combined? And can you push them to find a piece of evidence that showcases both things in one quotation? Maybe you add that confine. Like, "Here's an assignment that has eleven [categories of characterization]; for two of your pieces of evidence, I want you to find within two to three sentences something that shows two of them," . . . to add a little more . . . complexity to their quotation selection, you know? "Where do you see in this character both the instinctual and the intellectual in competition with one another . . . or the emotional and the intellectual?"

Where Harrison's concrete classifications helped students approach character analysis more comprehensively, confines could force abstraction to help students find more complexity in their characters.

Moving Backwards to Move Forwards

This second-coding-cycle theme, along with *Giving More Feedback to Give Less*, was the second most prevalent. While backwards design is nothing new to education, this study revealed that the Metacognitive Framework necessitates this intentionality because it starts and ends with the assessment. Teachers have to embed classifications, confines, and/or contexts both to promote quality products and quality Annotations of Awareness. As teachers define the desired final product, they must become aware of what makes the product one of quality and then work backwards to give their students entry points to arrive there. While rubrics often delineate what components need to be included or

broadly state indicators of success, they often do not show students specific thinking pathways or establish processes for achieving that success.

Sometimes this notion of backwards design comes into conflict with the new teacher's reality of just surviving all the demands of teaching while just stepping into instructional design. Claire, a first-year teacher, shared during her third design session how she had already made the study guide but not the quiz. As we were discussing the design of this assessment, I encouraged her to let the quiz inform her teaching:

> So as you work through that, think about tomorrow. Once you have that quiz finalized in your head, that's how you're backwards designing, and you're like, "Okay, I need to make sure we hit this concept again, or I'll make sure I phrase things in a way that kind of undergirds where I want them to be able to go."

Sophie, with less than five years of teaching experience, found herself in a relatively better position during this study to think about her established assessment-design practices. As she reflected with her Metacognition Partner, Lucy, she realized that she more naturally/instinctually sees the big picture of her assessments and neglects to identify the pieces or the steps that will support her students successfully arriving there: "Like, my planning process sometimes gets overtaken by, the idea gets ahead of the process, and so I'm already at the final stage." At the end of my study, Sophie shared in her post survey,

> I have been able to strengthen assessments and build in deeper levels of thinking with existing assessments by using the Annotations of Awareness. Simple grammar quizzes were improved by giving students the tools to identify mistakes,

correct them, and accurately explain why they did what they did. I appreciate the math-like approach to problem solving.

Along with backwards design comes the necessity for teachers at all experience levels to be bluntly honest with themselves and their students about what they want students to master. When teacher participants acknowledged this, they designed assessments and instruction to achieve just that. As I was working with Lucy during her second design session, I shared with her my appreciation for her willingness to be honest with her assessments and her integration of annotations:

> And what I found interesting is you [and Anna] approach it from the angle of what is the specific thing that you want to work with them on. Yeah, they were working on paraphrase, so instead of hiding from it and trying to make it something more than that, how can we build the annotations around that? If you want them to build in more creativity with their title and become more competent in connecting their evidence to their analysis, you build in the annotations. You don't want it to be inauthentic by adding an extra layer of something fancy; you want it to meet the assessment where it is.

Repeatedly during design sessions, I posed some variation of the question "What do you want them to be able to do well?" With that specificity of focus, we were able to add classifications, confines, and/or contexts to help students achieve that goal. As Lucy and I refined her third assessment, I held her accountable: "Let's design backwards. What do you want to see in their title? And then we can just design a confine to help get them there, to hold themselves accountable, because that's the idea." As Sophie and I designed

her third assessment, I encouraged her to build off of what her co-teacher, Anna, was asking their students to master as they studied a novel:

> So be thinking about, what else do you want them to get from their study of *Jake Reinvented*? You know, if she's going to focus on the literary devices and hold them accountable for their learning tied to that, what's another arena of learning you want them to get from it? Is this an opportunity for them to contextualize with their own life or their own society?

Sometimes the question became more of "Where do you think you're going to want to spend most of your in-class feedback time?" This was exactly the question I asked Lucy during her third design session. She wanted to spend more time on supporting students in their analysis of quoted evidence. She had been consistently focusing their efforts on selecting and explaining quotations that reveal meaning through the classifications of how and why, but her students still needed more support. I suggested that she use confines in conjunction with classifications as students annotated their quoted evidence for how and why. She had already asked them to draw arrows between their analysis and their theses, so drawing arrows between their analysis and the moments in their quotations that revealed how and why, according to Lucy, "would be a natural next step."

With backwards design comes the opportunity to clearly direct students down the paths you want them to explore without the static of superfluous tasks or the ability to select an easier path. As Sophie considered how to use confines to promote her students looking for evidence across classifications, some more obvious than others, she expressed

concerns that some of her students might just write from their memory and avoid conscious paraphrasing of evidence: “But I need to find a way to require that they are pulling from outside stuff because most people are just getting to writing because they have it all in their head.” I reminded her that the confines of everyone having to use evidence from the most obvious classification and then from two additional, less-obvious categories should help prevent this because students would have to return to the evidence to be able to annotate their work.

Sometimes the rubric can clearly state priorities in an assessment, but the assessment itself can get in the way. For his third design session, Harrison wanted help understanding why a recent assessment produced quality evidence selection but very little creativity in thought and expression. After talking through the assessment and looking at student work, we arrived at an agreement that the visual component intended to promote creativity was included more as an afterthought than as an integral part of the assignment. When I first mentioned this possibility, Harrison pointed to his rubric: "And that is entirely possible. That is, however, I go back to the rubric. They knew how they were going to be evaluated." As we discussed further, he honestly connected the requirements of the assessment to his students’ realizations of them:

> I also like what you said at the beginning that I'm wondering if perhaps there was so much information to focus on with the character autopsy that they spent the bulk of their time focusing on finding passages and finding quotes for each of those so many components that the graphics became an afterthought.

Backwards design is vernacular in teacher verbiage, but the optimization of this approach is not as common in teacher practice. The Metacognitive Framework with coinciding Annotations of Awareness urged teachers to meticulously design backwards with minimal demands on their time. Molly reflected in her post survey,

> I already knew that it was important to "begin with the end in mind," but this has reminded me of the varied ways in which I can do that. Shaping students' thinking in order to master skills demands an intentional, sequential approach toward the end goal.

Giving More Feedback to Give Less

Closely related to *Moving Backwards to Move Forwards*, this prevalent theme revealed how the Metacognitive Framework, built to support thoughtful student production, relieved teachers of time-consuming written feedback post production as it facilitated and demanded more in-production feedback. Early in the study during their first design sessions, both Anna and Lucy could appreciate how annotations promote more focused feedback. As we discussed responding to quick annotations quickly in class, Anna saw how “It focuses the moment. It focuses the class time.” As Lucy reflected on her tendency to want to address everything from content to grammar in students’ polished work, she could see how annotations that focus her students on specific arenas of cognition and metacognition could focus her feedback on the agreed-upon priorities. Anna admitted, “I don't know, necessarily what the most important, like, what's the priority . . . because writing is such a complex . . . skill.”

Less time-consuming feedback post production was possible for two reasons: Annotations of Awareness encouraged verbal feedback all throughout student production, and they allowed for teachers to use shorthand in providing written feedback on final products. During Harrison's second design session, I discussed with him how verbal formative feedback is crucial to student growth and how it must be promoted through ease of entering into academic discourse with students:

> And it goes back to students only get seconds of personalized feedback, cognitive feedback, a week, and that's because it can be so hard. So we have to create structures to make it easier. . . . And your comment to them as they work is just as valid as a comment once they turn in the final.

He replied with "More so . . . because oftentimes they don't even look at the comments." Not only did Lucy start to see how the Metacognitive Framework facilitated in-class feedback and relieved some pressure on her for written feedback; she also started to realize the need for, as I phrased it during one design session, a "feedback loop where both the student and the teacher are talking at the same level of awareness":

> And the evaluation was done all along, so the final grading was so easy, comparatively to looking at a six-page document than it has been in the past, because we've been evaluating this whole time. I'm alright, check, check, check and then really just looking at the last final paragraph, and because it was color coded, I can already see if they were on the right track or not and then just made one little comment.

This concept of creating a more equal playing field where both students and teachers understood and agreed upon what quality thinking looks like as students were actually producing actually supported students producing and learning at optimal levels. Students and teachers entering cognitive and metacognitive discourse with shared confidence and comfort lightened the cognitive load on the teacher, resulting in a higher frequency of this dialogue occurring and in the students benefiting from it. During Harrison's third design session, he agreed with my assertion that we need to design more intentionally for what we want to see in students' work:

> . . . little tiny tweaks that take what's already good [in an assessment] and just make [students] be a little more thoughtful and intentional and build skill sets and give you what you want, because it's much easier to engage a student in feedback when they're producing at the level you want them to produce.

Another way Annotations of Awareness can promote more written feedback while using fewer words is through the agreed-upon language of the shorthand inherent in the annotations. Teachers can harness that power to model, ask questions, and offer reminders with minimal pen strokes. This idea arose while I was working with Richard during his second design session:

> And so I think what you've set up for them sets you up for very quick feedback, to point out either through modeling or just using the same annotation process to point out these really strong ideas that might take ten times as many words or that might seem like it's coming out of the blue if you just plopped it in at the end of what they did. So that would be my encouragement. How can you take and

> harness what they're already doing and then use the same process yourself in response to what they did?

When both verbal and written feedback can be shared more quickly and more briefly, both students and teachers might engage more in the feedback loop. When the feedback uses agreed-upon language that carries clarity of meaning, feedback uttered may be less likely to fall on ignoring or distracted ears.

Slowing Down to Speed Up

This second-coding-cycle theme, like the last two, was not as prevalent, but it appeared enough to warrant sharing. As I worked with participants throughout their design sessions, some spoke of making more effort to slow down for the students to authentically think. During her second design session, Anna shared how she and her partner teacher, Sophie, were realizing that more repetitions in practicing a skillset did not necessarily equate with increased student mastery:

> And that's been a big goal for us that we've noticed. We feel like we practice so much, but then we don't slow it down enough that they really had to think about each little step. So the final will be on a computer, a Google-based assignment, but we're making them do a lot paper/pencil because I think that's where the transfer happens in terms of paraphrasing instead of copying and pasting. . . . It slows them down. . . . they're really good at completing a task but [not necessarily] completing it correctly. They think, "Well, I've done all my work."

The idea of intentionally slowing down to hold students accountable for their thinking also arose as Harrison and I were discussing one student's powerful title that captured the

thematic thread of "stumbling into happiness" in his personal essay. When we held the title up to the essay, though, the essay was not nearly as thoughtful as its title. I prompted Harrison to reflect on the students editing process:

> Because I noticed, when I was looking at that second one that scored lower, it seems like he had some trouble with either the hows or the whys, right? So walk me through because the title speaks to an awareness. And it's like his analysis fell short of that awareness. And so he, if he had explored the idea [of allowing for accidental happiness] . . . do you remember anything about him in terms of through the editing process, getting that, how he would make that a priority?

If the student had slowed down after creating his title to better align his essay with such a strong expression, he could have produced an essay of greater insight. In a process as complex as writing, students need multiple moments of deceleration prompted by Annotations of Awareness in order to plan, monitor, and evaluate their work.

Not all teacher participants spoke of slowing down in completely fond terms, though. Richard continued throughout the study to consider the pros and cons as he tried to find his comfort level:

> What I've noticed about this dimension. And I like it. But it really slows us down. If somebody ever told me I had to cover more texts, this would have to go. And I don't think it should. The balancing act then is the guys over here who will deliberately make slapdash meaning. It's good enough to match English 4 standards, but they're not expending much mental effort in doing it . . . . Meanwhile, [student name] will be over there, and [student name] will be over

there taking their time and just killing themselves and really thinking about and turning in something that would get an A in CP. But it takes them twice as long.

Within this pedagogical debate, he was balancing covering content and promoting critical thinking, along with classroom management. If pressed to have students read more texts, which undermines his pedagogy of developing skillsets through engaging texts, he feared he would have to speed up and neglect metacognition.

Focusing on the Discrete for Transfer

While a less-prevalent theme emerging from my second coding cycle, *Focusing on the Discrete for Transfer* merits attention because of the import of both developing thinkers who can transfer their understandings and equipping teachers with instructional strategies that can be used throughout a curriculum and across courses. The versatility of the Metacognition Framework offers specific guidance to approaches without limiting application. During Lucy's second design session, I asked her if the time burden of her reexamining her writing instruction was worth the effort. She replied with emphatic positivity:

> Oh, gosh, yes! And I wouldn't even think it as a burden because it's just solid teaching. And I always want to be solid. So I would rather do something more meaningful, that's worthy of the time, than just be like, "Here's an essay; go!" because I think a lot of writing teachers don't know where to start because it's such an extensive process. And especially for struggling writers, like, less is more. And I think this one thing I've found that I've even been using with the honors section is paring it down. I don't have to give them this immense literary analysis.

> At the end of the day, the smaller chunks of the writing instruction [are] going to go a lot further.

In her response, she spoke directly to both transfer dynamics that appeared in my study: students thoroughly mastering skillsets at the micro level in order to find more agency at the macro level and teachers finding comfort, confidence, and merit in a metacognitive strategy that they were eager to use again in one class and across their courses.

Alex and Anna, in their post-surveys, also spoke of their excitement in continuing to use metacognitive strategies they developed during this study. Alex responded, "I can now help students develop understandings that they can apply across several different activities and assessments." Anna reported, "It is something that I plan to implement into all of my classes. I want to use Annotations of Awareness as part of the Poetry Prose Chart. It may be step one before the charting." During Richard's third design session, he shared how he planned to use next year in his advanced classes the equation confine he had used with struggling learners:

> The big jump for most Lang [AP Language and Composition] kids to get over is to wrap their heads around the difference between a warrant and what I call a category of evidence. . . . "Okay, why? Elaborate on the warrant? Okay, where's your evidence from the packet? And now explain how the evidence illustrates the warrant." You know, if they do one of these [a synthesis-essay organizer utilizing the equation confine], they should be able to write at least a 4 in the second draft. What I can do next year is add a step here. "What were the key words in this evidence?" And you see how you could adapt this for a close reading on the

> Question 2 of what is the rhetorical move in this chunk of the text: clarification, contrasts, exemplification, rebuttal, concession. “Okay, what’s your quote? What's the rhetorical move? Now identify the key meaning-making words in the quote. Now, do the quick equals; now make the meaning.” I can work what I'm doing . . . this year into those debriefing organizers next year to help them sharpen how they're working with the quotes they select.

While the idea of focusing on the discrete to build mastery before supporting transfer into a different content area never arose due to the nature of each secondary-teacher participant teaching within only one discipline, encouraging and practicing the transcendent metacognitive skills of planning, monitoring for regulation, and evaluating should only promote such transfer.

Students Guiding the Teachers

The sixth theme that emerged from my second coding cycle dealt at some level with role reversals where students possessed the agency to guide the feedback loop. In some ways, Annotations of Awareness are moments where students are providing their own feedback for the teacher to verify. During Lucy’s second design session, I shared with her the benefits of having students annotate their work even in their final drafts:

> Annotations aren't just for getting to the final product. So in their final product, they annotate, and that's one more way that you can quickly, so then your comments just become comments on their annotations versus everything. . . . They've kind of done the feedback for you. You're just validating.

When teachers saw students providing their own feedback through structured annotations, they could assess both the student thinking that produced the work and the students' awareness of that thinking, and both of those discourses are powerful and necessary to support independent thinkers.

Another benefit of annotations is that they helped orient the teacher more quickly to the feedback needs of their students. Molly and I were discussing the challenges of giving personalized feedback in the moment as you move from student to student, and I commiserated,

> . . . like, when a person gives you an essay and says, "Read. What do you think of this?" you have to get the lay of the land. You have to orient yourself. And then it becomes ten times as long of an endeavor. If you'd just had some orientating-type devices set in, then you'd know what to look for, right? . . . The student's done some of the work for you at that point.

Molly saw such potential in annotations, specifically within her offering feedback as students peer edited: "Right. Yeah, that's what I love about this. . . . But I'm often not able to say you're on the right track with your feedback because I have no idea." In that same conversation, we acknowledged the students' agency in being able to direct the feedback loop.

Harrison also addressed this dynamic of the student guiding the teacher as he reflected on his cycle-two assessment:

> I felt that it allowed me to give really effective feedback because they had highlighted and pointed out exactly where I needed to spend my time. So I didn't

have to look for information. I didn't; well, I still had to do it in a couple of cases. But by and large, I didn't have to look for the information; I could hone in on what we're really focused on. And I think it made an effective use of my time.

Sometimes teachers struggle to give control over to students, but this relinquishing of total authority only helped students think more critically and receive more quality cognitive/metacognitive feedback while teachers lightened their cognitive load.

Quantitative Data Analysis

Bookending my three PDSA cycles that produced a wealth of qualitative data, my pre and post surveys offered some quantitative data less susceptible to my possible biases. These data were collected through questioning/prompting that offered responses on a four-point Likert scale (from 1 = strongly disagree/low to 4 = strongly agree/high) (Creighton, 2007). A majority of the Likert-scale questions (20 out of 24) were borrowed from Wilson & Bai's (2010) Teachers' Metacognition Scale that measures the interrelationship between teachers' metacognitive understandings, pedagogies, and practices. I added four questions that asked teacher participants to self-assess their levels of confidence with integrating metacognition into their classrooms.

Pre- and Post-Survey Data

When comparing the quantitative pre-survey data to the post-survey data focusing on levels of teacher confidence with integrating metacognition into their classrooms, all four self-assessment items resulted in either improved or static levels (see Appendix G). When prompted, "Select your level of agreement with the following statement: 'There is enough time/space in my curriculum to embed explicit teaching of critical thinking and

metacognition,'" 50% of the participants increased their Likert-scale rating from 3 to 4; the other half remained at 4 (see Figure 12). This mindset of there being enough time and space only encourages teachers to start and continue making efforts to integrate more critical thinking and metacognition into their instruction. This mindset may also be related to the pedagogical stance that critical thinking and metacognition are integral parts of teaching. The fact that the Metacognition Framework can enhance assessment design for both critical thinking and metacognition without requiring complete retooling of assessment approaches may have also contributed to the four teacher participants' increasing their level from 3 to 4.

Figure 12

Enough Time/Space in the Curriculum for Metacognition

		Post-Survey Rating			
		1	2	3	4
Pre-Survey Rating	1	-	-	-	-
	2	-	-	-	-
	3	-	-	-	4
	4	-	-	-	4

The question that resulted in the largest percentage of participants raising their ratings asked, "How would you rate your level of knowledge of metacognitive strategies?" Six out of eight teachers (75%) rated themselves higher after the study (see Figure 13). One teacher, Alex, moved his rating from 1 to 4. Three teachers increased their ratings by two (two from 2 to 4 and one from 1 to 3), and two increased their ratings by one (2 to 3). The two participants who reported no change rated themselves 3 and 2 respectively on the pre- and post-surveys. Strategies are the conduit between intentions

and practices, so teachers feeling more knowledgeable about specific metacognitive strategies only increases the odds that they will use them.

Figure 13

Knowledge of Metacognitive Strategies

		Post-Survey Rating			
		1	2	3	4
Pre-Survey Rating	1	-	-	1	1
	2	-	1	2	2
	3	-	-	1	-
	4	-	-	-	-

Five of eight teachers (62.5%) assessed themselves as more confident post study when asked, “How would you rate your confidence level with designing product-based assessments that promote higher-order thinking beyond recall/answering questions?” (see Figure 14). Three teachers increased their ratings by two, and two increased their ratings by one. Two of the three who did not record any growth in confidence rated themselves at the highest level of 4 before the study began, leaving only one teacher who self-reported room to grow, Sophie, remaining at 3. All teachers rated their confidence at 3 or 4 in the post-survey. Teacher confidence in any instructional arena can urge investigation, creativity, and perseverance in pursuing higher quality teaching, so increased confidence on product-based assessments promotes students having more opportunities to plan, monitor for regulation, and evaluate as they produce to learn and demonstrate learning.

Figure 14

Confidence with Designing Product-Based Assessments

		Post-Survey Rating			
		1	2	3	4
Pre-Survey Rating	1	-	-	1	-
	2	-	-	1	2
	3	-	-	1	1
	4	-	-	-	2

The question resulting in the smallest percentage of participants reporting increased confidence asked, "How would you rate your confidence level with integrating metacognition into your classroom?" Only three teachers increased their ratings (two by two and one by one), but the other five remained at the already higher levels of 3 and 4 (three at 3 and two at 4) (see Figure 15). With the mindset that metacognition can fit into their instruction, knowledge of specific strategies to follow through on that mindset, and increased confidence in the specific realm of product-based assessment design, teachers' confidence in integrating metacognition across their instruction should grow.

Figure 15

Confidence with Integrating Metacognition

		Post-Survey Rating			
		1	2	3	4
Pre-Survey Rating	1	-	-	1	-
	2	-	-	-	1
	3	-	-	3	1
	4	-	-	-	2

When comparing the pre- and post-survey Likert-scale data focusing on participant perceptions of teacher and student practices as they relate to metacognitive demands on students, ratings on the four-point scale minimally increased and decreased.

The 20 items taken from the second part of Wilson and Bai's (2010) Teachers' Metacognition Scale offered 20 "hypothetical constructs" (p. 276) organized around the categories of pedagogical knowledge (how to teach metacognition) (five items), conditional knowledge (when to use strategies) (four items), declarative knowledge (knowledge of definitions of strategies or making students aware of them) (four items), and procedural knowledge (how to use strategies to provide assessments requiring student application of strategies) (seven items). The percentage of responses that included any changes was only 38.75% with 66.13% being increases. In addition, four of the 21 (19.05%) decreases were desirable because three out of the four conditional items spoke to behaviors that could possibly neglect, minimize, stifle, or overshadow student metacognition in an attempt to promote it. For example, the conditional item that had the highest percentage of decreased ratings stated, "You are evaluating students' metacognitive processing. Rate the level of metacognitive thinking if they are asked to complete an essay that describes the events of Sherman's March on Atlanta including who, what, where, when and why" (Wilson & Bai, 2010, p. 275) (see Figure 16). Besides the why requirement hiding among the others, students could easily focus on summary and neglect analysis. Because of how these three conditional items were phrased, the percentage of desired changes rose to 72.58%.

Figure 16

Metacognition Required for Sherman's March on Atlanta Historical Essay

		Post-Survey Rating			
		1	2	3	4
Pre-Survey Rating	1	2	1	-	-
	2	1	3	-	-
	3	-	1	-	-
	4	-	-	-	-

The category with the largest percentage of movement in ratings from pre to post study was the pedagogical with 22 of the 40 (55%) responses showing movement (59% increasing and 41% decreasing). The pedagogical item that showed the highest percentage of participants decreasing their ratings stated, "You are evaluating students' metacognitive processing. Rate the level of metacognitive thinking if they are aware of the reasoning involved in completing a Venn diagram" (Wilson & Bai, 2010, p. 275); four of the eight (50%) teachers lowered by one their perceived level of student metacognitive demand, and only one teacher increased his rating (by one) (see Figure 17). The possible reason for this data might be because these four teacher participants perceived a relatively easy cognitive load when completing a Venn diagram compared to more complex products. While this approach to classifying thinking is inherently metacognitive, it is introduced early in students' educations, so high school teachers might deem this too elementary. The cognitive load of a Venn diagram, however, can increase as the concepts of what are being compared become more nuanced and subtle. In fact, Lucy and I discussed, during her second design session, using Venn diagrams within Venn diagrams to compare patterns in myths. I suggested,

> Okay, so when I look at this comparing and contrasting (tell me if I'm totally off base), is it possible—and I know this sounds really simple but using the Venn diagram—could they, within the overlapping circles, identify by category the patterns that they both shared? . . . So I think, for me, if I'm thinking about a class with a lot of variety of ability, this [Venn diagram] might be a way to get them focusing on the patterns that are similar and different versus the content that's similar.

Figure 17

Metacognitive Awareness with Using a Venn Diagram

		Post-Survey Rating			
		1	2	3	4
Pre-Survey Rating	1	-	-	-	-
	2	-	-	1	-
	3	-	1	2	-
	4	-	-	3	1

The two of the five pedagogical items showing the highest percentage of participants increasing their ratings focused on students allocating thinking to logistics and planning. Half of the teachers increased their ratings on both items (see Figure 18 and Figure 19).

Figure 18

Students Planning the Logistics of Final Product before Developing Models

		Post-Survey Rating			
		1	2	3	4
Pre-Survey Rating	1	1	-	-	-
	2	-	2	1	-
	3	-	1	-	3
	4	-	-	-	-

Figure 19

Students' Abilities to Describe the How and Why behind Their Plans

		Post-Survey Rating			
		1	2	3	4
Pre-Survey Rating	1	-	-	-	-
	2	-	-		1
	3	-		1	3
	4	-	-	1	2

The four items each tied to declarative knowledge and conditional knowledge revealed the same percentage of changed ratings (34.38%). The declarative, which started with higher ratings, revealed a more positive change in mindset among participants with nine out of the 11 changed responses increasing. The conditional items, with understandably lower initial and resulting ratings, revealed almost an even split between increased and decreased ratings post study (six responses increasing and five decreasing, each by one level).

The seven procedural items revealed the smallest percentage of movement with 18 out of 56 responses (32.14%) changing by one level from pre to post survey. Thirteen changes were an increase, and five were a decrease. The procedural item with the highest percentage of teachers increasing their ratings (equal to the highest percentage of 50% recorded in two other items across the 20 Likert-scale items) stated, "When teaching students to use metacognitive thinking strategies, the teacher should allow students to generate questions regarding content" (Wilson & Bai, 2010, p. 275) (see Figure 20). Questioning is fundamental to both critical thinking and metacognition. Questioning is where students locate themselves relative to the content and task at hand. Questioning arises from self-evaluation of what is known and what is unknown. When students share

questions aloud, they are externalizing their thinking and creating opportunities for teachers to come alongside them to model thinking.

Figure 20

Students Generating Questions Regarding Content

		Post-Survey Rating			
		1	2	3	4
Pre-Survey Rating	1	-	-	-	-
	2	-	-	-	-
	3	-	-	1	4
	4	-	-	1	2

With my study focusing on embedded PD that shared metacognitive strategies tied to annotating classifications, confines, and contexts, five items from the 20 "hypothetical constructs" (Wilson & Bai, 2010, p. 276) most directly aligned to my action research with two from the declarative category (knowing what the strategies are) and three from the procedural category (knowing how to use those strategies) (see Appendix H). After all, "teachers set up assignments based on their understanding of the definitions of metacognitive strategies (declarative) and how to teach students to be metacognitive (pedagogical)" (Wilson & Bai, 2010, p. 283). Procedural knowledge is inextricably connected to both declarative and pedagogical knowledge, as procedural "significantly influence[s]" the declarative and the pedagogical (Wilson & Bai, 2010, p. 283).

In response to the declarative item stating, "When teaching students to use metacognitive thinking strategies, the teacher should increase their awareness of the strategy and understanding of its power by relating it to specific task objectives" (Wilson & Bai, 2010, p. 275), the only three teachers who initially reported having room to more

strongly agree ended up increasing their Likert-scale rating from 3 to 4, placing all eight (100%) participants at 4 (see Figure 21). The ultimate goal of the Metacognition Framework is to help teachers help students position their metacognitive knowledge within specific tasks aimed at completing a final product.

Figure 21

Relating Metacognitive Thinking to Specific Task Objectives

		Post-Survey Rating			
		1	2	3	4
Pre-Survey Rating	1	-	-	-	-
	2	-	-	-	1
	3	-	-	-	2
	4	-	-	-	5

The other closely aligned declarative item stated, “When teaching students to use metacognitive thinking strategies, the teacher should explain the mental processes used to answer inferential questions” (Wilson & Bai, 2010, p. 275), and six of eight (75%) teachers responded in the post-survey with a 4 (see Figure 22). Four of those participants entered the study with a 4, and two increased their rating from 3 to 4. One increased her rating from 2 to 3, and one decreased his rating from 4 to 3. Much of the teacher’s role in the Metacognitive Framework is delineating, communicating, demonstrating, and supporting entry points via classifications into critical thinking, so explaining “mental processes” (Wilson & Bai, 2010, p. 275) is unavoidable.

Figure 22

Explaining Mental Processes in Answering Inferential Questions

		Post-Survey Rating			
		1	2	3	4
Pre-Survey Rating	1	-	-	-	-
	2	-	-	1	-
	3	-	-	-	2
	4	-	-	1	4

In response to the procedural item stating, "When teaching students to use metacognitive thinking strategies, the teacher should provide problem-solving activities for students" (Wilson & Bai, 2010, p. 275), two teachers started and ended at 4; two started and ended at 3; three raised their ratings by one level (two from 3 to 4 and one from 2 to 3); and one lowered her rating from 4 to 3 (see Figure 23). Since another component of the Metacognitive Framework is the teacher creating a "problem-oriented activity" (Ennis, 2018, p. 171) within an assessment through creative confines, English and social studies teachers should consider how "problem-solving activities" (Wilson & Bai, 2010, p. 275) are useful in all content areas, not just mathematics and science.

Figure 23

Providing Problem-Solving Activities

		Post-Survey Rating			
		1	2	3	4
Pre-Survey Rating	1	-	-	-	-
	2	-	-	1	-
	3	-	-	2	2
	4	-	-	1	2

The other two closely aligned procedural items both dealt with sharing and explaining thinking. For the item stating, "When teaching students to use metacognitive

thinking strategies, the teacher should allow students to share their thinking" (Wilson & Bai, 2010, p. 275), five teachers entered and exited the study rating this at 4; two participants increased their ratings from 3 to 4; and one remained at 3 (see Figure 24).

Figure 24

Students Sharing Their Thinking

		Post-Survey Rating			
		1	2	3	4
Pre-Survey Rating	1	-	-	-	-
	2	-	-	-	-
	3	-	-	1	2
	4	-	-	-	5

Responding to the item stating, "When teaching students to use metacognitive thinking strategies, the teacher should ask students to explain how they came up with their answers" (Wilson & Bai, 2010, p. 275), six teachers began and ended with 4; one teacher increased her rating from 3 to 4; and one remained at 3 (see Figure 25).

Figure 25

Students Explaining Their Answers

		Post-Survey Rating			
		1	2	3	4
Pre-Survey Rating	1	-	-	-	-
	2	-	-	-	-
	3	-	-	1	1
	4	-	-	-	6

While a peer-collaboration component is not specified but could be accommodated easily in the Metacognition Framework, the components of students sharing with and explaining to teachers their thinking are foundational. Teachers integrate Annotations of Awareness for the sole purpose of externalizing student thinking.

Pre- and Post-Study Assessment-Design Scoring

As a means to "measure" the embedded PD's impact on teacher participants' assessments while removing me from the process, the assistant superintendent of instructional services for the research site's district used a pared-down version of the SC Teaching Standards 4.0 Rubric (SCDE, 2021d) (see Appendix C) to score the pre- and post-study assessments on Written Feedback, Thinking, and Problem Solving. When comparing the pre and post scores, both Molly and Richard started with 3s and 4s and remained there (see Figure 26). The assistant superintendent's comments on their Thinking domains focused on their assessments requiring a "deeper level of thinking" where students had to "draw conclusions" as they "dissect the text" to formulate conclusions and inferences and supply evidence. Under Problem Solving, she commented on how their assessments required students to "categorize and draw conclusions" as they "identify relevant information to generate ideas."

Harrison and Claire improved, scoring 4s on Thinking and Problem Solving with their post-study assessments (see Figure 26). Claire, a first-year teacher, moved from 2 to 4 in both domains. Although their two assessments were vastly different in specific task requirements, both required students to employ various types of thinking. Harrison's assessment, a more creative-response, asked students to research, analyze, and design. The assistant superintendent specifically acknowledged under Problem Solving how students had to categorize to develop their products. When she spoke to the overall approach of Claire's assessment, she commented, "While it includes the amount of activities to be awarded a 4 on the rubric, it is still a standard test. The student does not

have to demonstrate understanding through non-written processes; no creation is asked of the student." Claire's assessment did require "explanations, drawing conclusions, sorting, predicting outcomes, and identifying relevant information."

As partner teachers, Anna and Sophie submitted one pre-study assessment, but they submitted separate post-study assessments. While Anna did not score higher on her post-study assessment in Thinking or Problem Solving, Sophie moved to 3 from 2.5 for Thinking and to 3 from 2 for Problem Solving (see Figure 26). Under Anna's Thinking domain, the assistant superintendent commented, "This work does not require students to expand on their thinking in ways that would make them go from DOK [depth of knowledge] 1 to a higher DOK level; it does not allow for much creativity or generation." While admittedly Anna's assessment did not require practical, creative, or research-based thinking and only resided in the one thinking type of analysis, thus eliminating many opportunities for metacognition, it did reside heavily within critical thinking. Her assessment asked students to compare two texts and explain, identifying moments through categories of specific approaches authors use to contemporizing a text. It also asked students to evaluate on a scale the degree of change present and then justify their choices. With this brief assessment, Anna employed three of six critical-thinking skills: analysis, evaluation, and explanation. When you consider the Problem-Solving domain, Anna employed three approaches, not one: categorization, identifying relevant information, and drawing conclusions. Just because this shorter assessment did not require such a comprehensive product in response does not mean it did "not require students to expand on their thinking" in a more focused burst of thought. In fact, this brief

assessment demonstrated how a quick discussion prompt can become more cognitively demanding. This is important because students need more and more-frequent opportunities with heavy cognitive lifting, and larger projects that accomplish this either take up more class time or require students to dedicate more time outside of school. This raises concerns about equity in access to rigor because, if that access is not provided during the school day with teacher support, some students may not engage in deeper levels of critical thinking. While Lucy was addressing more specifically the idea of equity in grading, her sentiments shared during her second design session echo the concern for equity in access to rigor during class instruction:

> And I actually think, too, I'm really, one of my interests right now is equity and grading, and our whole system is very inequitable. But I feel like this process is way more equitable and allows for more equity in grading in and of itself because I'm grading the process, not just the result. And so I think seeing, and for them there was that feeling of "Oh, I just wrote an essay."

Sophie's increased score in Thinking and Problem Solving occurred because of how her assessment blended analysis with creation. The assistant superintendent commented, "The student had to identify relevant and irrelevant information in analyzing the dialogue and then had to generate ideas through scene creation; this was also creating and designing."

Lucy remained at a 3 for Thinking and moved from a 3 to a 2 in Problem Solving (see Figure 26). Looking more closely at her Problem-Solving domain score, though, Lucy's assessment, an argumentative essay, employed four problem-solving types, not

one, as the assistant superintendent recorded: categorization (annotating evidence and analysis for how and why, thesis fact and opinion, and effective components of an essay), drawing conclusions (argument made in thesis), identifying relevant information (evidence selection), and creating/designing (composing an argument). You could also argue a 4 for Thinking because of the heavy metacognitive load tied to the multiple tiers of annotation and because three types of thinking were required: analytical, creative, and research-based. The assistant superintendent's comments for Lucy under the Thinking domain pointed to the cognitive load of the annotations in the outlining process: "This organizer into a mini-essay is a good format for students to outline their thinking and then craft a response that includes analysis, uses research (connecting to text) and makes sure they explain their work."

Alex remained at a 3 for Problem Solving but moved from a 4 to a 3 in Thinking. Similarly to Anna's, Alex's post-study assessment was a brief and focused one that asked students to think analytically (not practically, creatively, or through research). (Although, since students were asked to analyze a primary source for historical meaning, this endeavor was not far removed from research-based thinking.) This assessment asked students to identify only moments of continuities and changes (a creative confine) because they had either avoided that historical thinking skill (SCDE, 2019) or not yet demonstrated mastery of it. They then had to justify their annotations through how and why. With this short assessment, Alex engaged students in at least three of the six critical-thinking skills: interpretation, analysis, and explanation, with ample opportunities for two more: inference and evaluation. Admittedly, Alex could have designed this

assessment to require inference making and evaluation instead of merely leaving room for it. The assistant superintendent's comments addressed how important the categorization through historical thinking skills was to this assignment, identifying it as "the part that would require the most thinking." Initially, without fully understanding Alex's motivation and purpose in eliminating category options, she interpreted this as weakening the rigor of thinking, but when she considered this intentional creative confine, she understood its role in scaffolding for actually more rigor in thinking.

Other than Molly's and Harrison's, the teacher participants' post-study assessments all ended up scoring lower on Written Feedback, most with 1s (see Figure 26). While these drops are drastic and undesirable, they can be explained and prevented. Designing for Annotations of Awareness in the Metacognitive Framework, study participants showed (witnessed during observations and reported during design sessions) an increase in focused, verbal cognitive feedback during the students' production processes. Teachers found themselves being able to more quickly, and thus, more frequently, provide personalized formative feedback in order to support student thinking as they produced. As a result, they found themselves having to offer less written feedback on the final products. This does not diminish the rich potential for focused, written summative feedback, though.

Through the latter parts of my study as participants were submitting student-work samples, I found myself encouraging teachers to provide more specific written feedback. While a check to validate a student's expression of thought is appropriate, there is always room for students to improve. I found myself encouraging teachers to harness the power

of student annotations to respond in like, modeling even more sophisticated thinking or helping students fully realize a thought:

> Great formative feedback is occurring during student production . . . For these last assessments, really use your students' Annotations of Awareness as entry points for your written summative feedback. How can your feedback validate their thinking through their annotations, suggest improvement via modeling annotations, or offer pointed questioning to promote more thinking?

For example, if a teacher is using the confine of the equation approach where a student is making solid meaning from one key word within a longer selected quotation as a way to promote analysis over paraphrase and summary, the teacher, instead of just checking it off, can take the equation provided and fine tune it by offering a more apt decoding of the word or suggest another equation using a more telling word. This type of focused, minimalized written feedback still encourages student growth in critical thinking and metacognition while still requiring relatively less time from teachers than if they were marking up everything across their students' products.

Figure 26

Pre- and Post-Study Assessment-Design Scoring

	Pre-Study Rubric Scores			Post-Study Rubric Scores		
	Written Feedback	Thinking	Problem Solving	Written Feedback	Thinking	Problem Solving
Alex	3	4	3	1	3	3
Anna	2	2.5	2	1	2	2
Claire	2	2	2	1	4	4
Harrison	2.5	3	3.5	4	4	4
Lucy	2	3	3	1	3	2
Molly	4	4	4	4	4	3.5
Richard	4	3	3	3	3	3.5
Sophie	2	2.5	2	1	3	3

Through the collection of both qualitative and quantitative data, the benefits of the Metacognition Framework were measured and substantiated. The six paradoxical themes capturing the more transcendent concepts of my research helped reveal how the Framework supports critical thinking and metacognitive discourse in the classroom: (a) *Finding Clarity through Abstraction*, (b) *Moving Backwards to Move Forwards*, (c) *Giving More Feedback to Give Less*, (d) *Slowing Down to Speed Up*, (e) *Focusing on the Discrete for Transfer*, and (f) *Students Guiding the Teachers*. The four pre- and post-survey data points measuring levels of teacher comfort and confidence with classroom integration of metacognition revealed improvement (see Appendix G), and the five items from the Teachers' Metacognition Scale (Wilson & Bai, 2010) that most directly aligned to my research documented high rating levels post study, all at 3 and 4 (see Appendix H). Pre- and post-study assessment scores in the Thinking and Problem-Solving domains of the SC Teaching Standards 4.0 Rubric (SCDE, 2021d) revealed maintenance of or growth in rigor for five teacher participants, while the scores for the other three participants offered guidance on how to hold up the 4.0 Rubric to the realities and priorities of teaching.

CHAPTER FOUR

DISCUSSION

Discussion of Findings

How does embedded PD focusing on assessment design grow teachers' capacities to impact students' critical thinking and metacognition as demonstrated by student production? This study provided enough evidence both to show that embedded assessment PD does grow teachers' capacities to integrate critical thinking and metacognition and to show how this can be achieved. As teachers designed and redesigned assessments using the Metacognition Framework and Annotations of Awareness (see Figure 7 and Figure 8), they grew in comfort and confidence with both the concept of metacognition and the practice of integrating metacognition into their teaching through assessment design.

Pre- and post-survey Likert-scale data revealed this growth, with Claire, the one first-year teacher in my study, self-reporting the greatest gains. The assistant superintendent's scoring pre and post study of teacher participants' assessments for Thinking and Problem Solving on the SC Teaching Standards 4.0 Rubric (SCDE, 2021d) also pointed to more critical thinking required in assessments from multiple teachers, both the newer and the veteran. While the assessment-design-scoring data would have been more telling if the assistant superintendent had scored one assessment per teacher before and after their using the Metacognition Framework, this would have required teachers to only use preexisting assessments and not allowed them to design from scratch, eliminating some opportunities, especially for the newer teachers and the first-time

partner teachers. Even though the assistant superintendent was comparing two completely different assessments per teacher pre and post, instead of the same assessment, her scores and my data collection through design sessions, classroom observations, and student-work samples revealed the Framework did actually encourage more cognitively-demanding assessments to assess the specific skills within the course content.

Also, the assistant superintendent could only measure what she witnessed: the written feedback; she was not privy to the verbal formative feedback I witnessed through observations and teacher participants self-reported during design sessions, reflections, and surveys. In their Metacognition Partnership Reflection Logs, Alex spoke of "more fruitful" discussions with students engaging in "regular analysis of primary documents"; Lucy reflected on being able to "bounce from group to group quickly" due to the "annotation systems set in place"; Harrison addressed experiencing "much more effective" conferencing with students as they "could clearly show" him or not "where they had addressed each of the components of the assessment." Richard's reflections on during-the-production feedback were more dichotomous, though. He spoke of how "most" of his students "found the extra level of cognition . . . a rewarding and engaging challenge" that offered opportunities for his "direct intervention" but also of how both higher-performing students (who "underestimated the demands of the task") and lower-performing students (who "were almost overwhelmed by the metacognitive element") struggled with focused and sustained engagement with these demands: "the main challenge was being able to give real-time feedback as the students were doing their assignment in class while also managing behavior." Teacher participants' gained

practical understanding of metacognition, along with reported better student products and improved formative verbal feedback during production, encouraged many to commit to continuing with Annotations of Awareness not only in the level of classes studied but in their other levels of classes, as well.

When asked, "How has this focus on Annotations of Awareness impacted your assessment-design approach?" teachers responded within three arenas: focus and specificity, explicitness and intentionality, and transferability of strategies. Both Molly and Lucy reflected on how their assessment design had become more focused. Molly responded in her post survey, "This has prompted me to rethink assessments, particularly their length and the ways in which I can tighten them to assess with greater specificity the skills I have taught." Lucy echoed this sentiment, speaking of how her writing assignments had become more "pointed and focused."

Sophie, Claire, and Richard spoke to designing assessments with more awareness of their intentions. Claire reflected in her post survey, "I have been putting more thought into making sure my assessments are actually assessing all the things I want students to master." Richard shared how, even though his summative assessments had been geared toward metacognition, he now saw the importance that he "incorporate metacognitive steps more explicitly in formatives." In her post survey, Sophie reported both growth in intentionality and appreciation for the flexibility in the Metacognition Framework that allowed for the transferability of strategies:

> I have been able to strengthen assessments and build in deeper levels of thinking with existing assessments by using the Annotations of Awareness. Simple

grammar quizzes were improved by giving students the tools to identify mistakes, correct them, and accurately explain why they did what they did. I appreciate the math-like approach to problem solving.

Alex and Anna shared their excitement in being able to take newly learned approaches to assessment design and utilize them in different dynamics as they build in critical thinking and metacognition. Alex reflected, “I can now help students develop understandings that they can apply across several different activities and assessments.” Anna plans to “implement [Annotations of Awareness] into all of [her] classes.”

When asked, “How has this focus on Annotations of Awareness impacted your approach to instruction?” two themes emerged: teachers instructing more efficiently with backwards design and teachers externalizing thinking. While Molly realized that “Shaping students' thinking in order to master skills demands an intentional, sequential approach toward the end goal,” Harrison spoke of how his conferencing with students had become “more stream-lined and specific for the learning objectives.” Sophie, Claire, and Anna all addressed how their teaching had changed to incorporate more sharing and modeling of their thinking. Sophie reflected, “I am much more capable of sharing my own thought process when we have a shared language.” While Claire reported making more effort to model thinking for her students, Anna shared, “I find myself talking through my thinking more.”

When asked, “How has this focus on Annotations of Awareness impacted your feedback approach?” the ideas of offering feedback earlier, providing feedback more

quickly, and sharing feedback with more clarity appeared. Molly spoke to realizing she needed to provide a certain type of feedback earlier in her curriculum:

> I knew that students needed more feedback from me earlier in the course. However, I was surprised to find that one of the redesigned assessments, which required students to explain their thinking on essays written near the end of the course, necessitated significant feedback from me to correct mangled thinking.

Richard's realization of earlier feedback centered on the phases of each assessment: "I just need to give more of it at earlier stages." While Lucy, Alex, and Claire spoke overtly of feedback speed, streamlining, and efficiency, Sophie and Harrison indirectly addressed feedback speed by focusing more on clarity through specificity. Sophie shared, "I love being able to use clear, pointed annotations rather than explaining the same correction or response in five different ways for different students."

When asked, "How has your assessment design and instruction in response to this focus on Annotations of Awareness impacted your students' production?" teachers spoke of increased student self-monitoring, increased student critical thinking, shared and explicit rules of and pathways for engagement, more intentional and focused student work, student work better meeting teacher expectations, and teachers designing with student thinking in mind. Sophie, a newer teacher reported,

> I still think there is room for improvement with my assessment design, as it seemed to be somewhat repetitive for students which led to productions that were rushed. I think the instruction and establishment of shared language through

annotations helped tremendously, though. It forces us to slow down, which is often hard, but it allows for deeper understanding and interesting conversations.

When asked on the post survey, "How has your formative and summative feedback in response to this focus on Annotations of Awareness impacted your students' production?" teacher participants spoke of two improvements: more authentic student engagement in their process/refinement of thinking as they produce and increased speed and focus of teacher feedback. Anna captured improved engagement in thinking when she responded, "I am getting better final products. Students do all the thinking during the drafting process . . . ." The improvements in feedback were captured as Molly spoke of being able to better "'diagnose' issues" in student writing, and Lucy spoke of a "code system" that promoted clarity and brevity of feedback. These two improvements are intertwined as increased critical thinking and metacognition employed during student production increase opportunities for teachers to engage in feedback during student production instead of waiting for post-production written feedback. Students externalizing their thinking through Annotations of Awareness also helps teachers focus in on student needs in the moment to offer brief-but-pointed feedback, requiring less time per student for verbal feedback in class and for written feedback outside of class. Such a "code system" is exactly what empowers a teacher to "diagnose" in a timely fashion. Returning to a transcendent theme that emerged, when teachers have to give less feedback, they can give more feedback. While the assistant superintendent did observe less written summative feedback on the last-cycle assessments than on to the pre-study

assessments, teacher participants, during their design sessions, repeatedly reported providing more and higher-quality verbal formative feedback.

Significance

My findings are significant to secondary teachers at the research site, in the district, and in the state because they reveal how schools and districts can leverage the power of the instructional coach, assistant principal for instruction, or department chair to come alongside teachers, no matter their years of experience, and support them during their actual work of designing and implementing instruction. This embedded, real-time PD model is personalized to teacher needs and produces tangible products to help students grow in cognition and metacognition. This PD support does not judge a teacher's behaviors but instead supports a teacher's efforts. It builds confidence in the teachers as it builds strategies in the teachers' toolkits. While the Metacognition Framework uses Annotations of Awareness (see Figure 7 and Figure 8) to lessen the cognitive load of providing useful, cognitive feedback, it also lessens out-of-class time demands on teachers to provide timely, personalized, and specific feedback. This PD model's benefits lie exactly in providing teachers with what they want to provide their students: support, guidance, and feedback while the actual work is being completed. When feedback is provided during production, it supports learners' growth in metacognitive skills as they actually plan, monitor to regulate, and evaluate their progress/product. My findings also help close the theory-practice gap by putting theory into practice at the actual classroom level through the daily work of the teacher.

Findings through the Theoretical Framework of Activity Theory

Within the theoretical framework of activity theory, where I was the subject and the Metacognitive Framework was the object, I encountered, in addition to the solvable "contradiction" (Mak & Lee, 2014, p. 75) of student final products receiving minimal written feedback, four dynamics that I instinctually wanted to classify as "disturbances" (Mak & Lee, 2014, p. 75) and explain away, change, or ignore. I had to remind myself that data is data and that these disruptions offered "sources of change development" (Mak & Lee, 2014, p. 75) that strengthened my Framework. I recognized the first contradiction as I was working with Richard. He departed from my expectations of how I thought assessments should be designed by wanting to add a column to a preexisting heuristic to promote more intentional analysis. I grew to understand that this in and of itself was not the problem; the problem was that his departure from how I would do something created confusion between us about what we were actually asking the students to do. We both eventually realized we needed that extra column to provide abstraction through a confinement. Initially, I could so clearly see that possibility only in the student composing with pen or pencil an equation in the margin of the text, and Richard believed students would arrive at sentence- and diction-level analysis when simply given the space to do so. I realized that the equation itself (no matter how the space to do this was provided) was the Annotation of Awareness that abstracted the task just enough to promote deeper thinking, and Richard realized he needed to provide this thinking structure in addition to the space.

Some of Molly's experiences surrounding timing also tempted me to see them as "disturbances" (Mak & Lee, 2014, p. 75), but upon reflection, I grew to understand how they actually promote the use of the Framework, instead of discouraging it. During her first assessment, she designed a reading quiz so that it would take less class time for students to complete. While the students still took longer than desired, the quiz's structure sped up her feedback, prompted more student critical thinking, and revealed to her that her students needed more practice with thinking within unexpected confines. Molly shared, in her first Metacognition Partnership Reflection Log,

> Despite the confines created by the assessment, students still took longer than expected—or, I think, needed—on the quiz. Some students felt compelled to go beyond the confines created—probably due to their context: an AP class where high expectations have been set for previous quizzes. I loved the design of the assessment and will replicate that for future quizzes. However, I may make some future quizzes timed to facilitate quick thinking and prevent students from waiting for answers to be delivered like the Ten Commandments from God.

During her second design cycle, Molly was trying to build in student metacognition while promoting more streamlined teacher feedback. While this assessment structure once again failed to offer the quickness for which we were designing, students still engaged in metacognition, giving her the chance to offer focused, although time consuming, feedback on some fundamental student misconceptions, misunderstandings, and misperceptions about their writing. Molly shared,

> I learned that students struggle to see precisely where they break down evidence in their commentary. Some identified commentary as a moment of weakness, failing to see that they did, in fact, analyze the evidence provided. Others identified connections between evidence and commentary as moments of strength when they were not. Because of this, the attempt to reduce the amount of feedback I offered actually increased the amount of feedback needed to correct their misconceptions. Was this a fruitful exercise for the students? Absolutely. But was it time consuming for me? Also yes. I would repeat this exercise but perhaps after the first or second essay in an effort to deal with misconceptions earlier in the course.

A third contradiction appeared with Harrison and Lucy as they were implementing classifications. Harrison described letting students classify their thinking in simultaneous categories with the phrase "made concessions." He saw the validity in this type of coding, but his phrasing suggested something negative. Lucy described the same dynamic as a burden: "I did not like the coding for the actual writing because the elements worked together rather than separate, so the coding was more burdensome than helpful." Instead, I see how this student identification of overlapping classifications actually shows student awareness of their more complex thinking and their use of discretion to show multiplicity and nuance.

Richard shared what could possibly be seen as one of the biggest threats to dissuading teachers from using the Framework, but even this "disturbance" (Mak & Lee, 2014, p. 75) proves the merit of its use. Richard reflected on how in promoting more

formative verbal feedback Annotations of Awareness also inhibited in-production feedback:

> For both cycles, the main challenge was being able to give real-time feedback as the students were doing their assignment in class while also managing behavior. Unfortunately, some of the higher-performing students underestimated the demands of the task, where some of the lower-performing students were almost overwhelmed by the metacognitive element. With the prevailing student response to either extreme being off-task behavior, I was not able to dedicate enough time and energy to just giving process feedback. I think that as students do more and more metacognitive work, the more they will be able to put the demands of the task in perspective, and give it their full attention (for some of the higher flyers) and to see that it is challenging, but well within their skillset (for some of the lower students).

This paradox might cause teachers to pause, but upon consideration, like with Richard, teachers can see how students need practice in annotating in order for this "action" (initially carrying a heavier cognitive load) to become a more automatic "operation" (Hasan & Kazlauskas, 2014, p. 10). As the cultures (rules) of classrooms evolve to include with more frequency externalizing cognition and metacognition through accountable discourse, the students (subjects) will better be able to use the tool of annotations as they produce the artifacts of their learning and thinking (objects). What initially may hinder formative feedback will ultimately facilitate it.

Continuing to look at what I have termed “The Atmosphere” for production, my findings connected to the three components of rules, community, and division of labor (see Figure 27). In activity theory, rules speak to the structure of the culture where production is taking place (Mak & Lee, 2014, p. 75). My findings showed that when teachers designed product-based assessments for accountable cognitive and metacognitive dialogue through an accessible structure, students became more acclimated to it, engaged more authentically in it, and improved their thinking and production through it. Anna spoke to continuing the annotation structure for paraphrasing from cycle one as a way to hold her students accountable for better understanding their research as they selected their evidence later in the course:

> And basically, the paraphrase is showing that they truly understand this information that they're reading, because they don't understand the words that they read but they still write it down as their research. So now we're doing a lot of, I've noticed so much more discussion of, because they're having to really figure out how to understand this information instead of just copying and pasting, which is really what they’re used to doing.

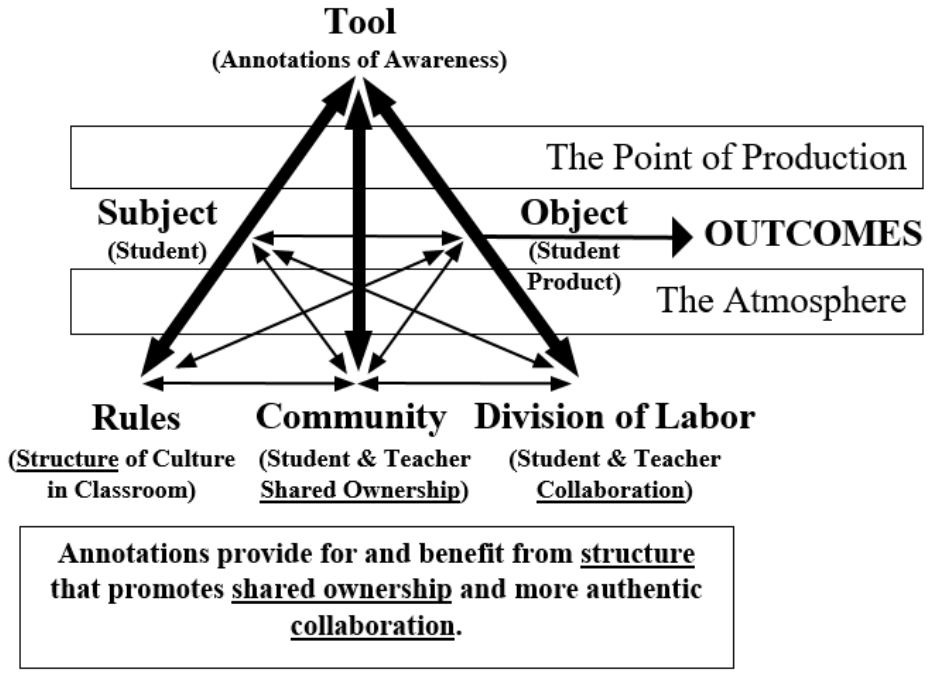
Community speaks to ownership of the object produced (Mak & Lee, 2014, p. 75), and the Framework’s resulting discourse around thinking requires and urges ownership of all three objects at play: the teacher’s assessment, the student’s work, and the student’s thinking. This ownership makes the learning more apparent, authentic, and autonomous. It supplies both the teacher and the student with agency.

Activity theory's division of labor accommodates for both the horizontal (task division) and the vertical (power and status division) (Mak & Lee, 2014, p. 75). My findings speak more to the vertical division of labor through teacher and student agency and establishing a more equal-status structure during academic discourse. Harrison indirectly addressed this when he was reflecting on his second-cycle student conferencing: "I felt that it allowed me to get really effective feedback because they had highlighted and pointed out exactly where I needed to spend my time." This recognition of teacher focus through the annotations also acknowledged that the students directed (within the confines of teacher expectations) him to where they needed feedback. The annotations, this time in the form of color coding, gave them the structure to share this need, giving them more voice in the conferencing. Harrison also made a point to ask students if this color coding helped them monitor and regulate their own work. One student replied, "Yes. I needed to add a sentence about how it made people feel about the song." Another student said, "[The color coding] led me to realize where I could expand and what was my strongest answer." Such metacognitive conversations offer students more agency and thus diminish the status divide between teacher and student. The Metacognitive Framework repeatedly demonstrated how it optimizes the teacher's purview over instructional design, and the structures built around Annotations of Awareness often elevated the student to a more equal collaborator with the teacher when discussing thinking. Teachers took more ownership of and pride in their assessments, and students did the same with their production.

When looking at what I call “The Point of Production” (subject, tool, and object) (see Figure 27), my findings point to how Annotations of Awareness became the tools for both the teachers and the students to socially construct knowledge. In her post survey, Sophie spoke again about the benefits of a “shared language”: “It helps students take ownership over the feedback they're given, too, when it is based on that shared language and not something out of the blue at the end of their writing/work process.” This “shared language” becomes the conduit for the social construction of knowledge, and the more students engage in externalizing their cognition and metacognition, the more it becomes an accessible and ingrained “operation” instead of a daunting, foreign “action” (Hasan & Kazlauskas, 2014, p. 10). This automaticity should promote transfer of cognitive and metacognitive skills across task and content. In response to my findings, my concept map (see Figure 27) emphasizes the two-way mediation (Hasan & Kazlauskas, 2014, p. 10) between the secondary tool (“language, ideas, models”) (Hasan & Kazlauskas, 2014, p. 11) of Annotations of Awareness and the entirety of The Atmosphere for production (rules, community, and division of labor) (Hasan & Kazlauskas, 2014; Mak & Lee, 2014).

Figure 27

Concept Map of Two-Way Mediation between Tool and The Atmosphere



Note. This graphic is adapted from Hasan & Kazlauskas, 2014.

Recommendations

Based on the overwhelmingly positive mindsets, reactions, and results of teacher participants as they worked with intentionality on designing and redesigning assessments, I propose this real-time PD intervention be scaled first within the research site, then across the district, and ultimately across the state. Teachers need this type of personalized and practical support during their workday to fine tune and grow their assessment approaches. They need this because time is limited and because students deserve more rigorous instruction guided by more rigorous assessments. Research-based PD that is immediately implemented to achieve instructional goals more authentically supports teacher learning and directly supports students learning. Students need more exposure to

critical thinking and metacognition as they produce to show their learning, and product-based assessments are accessible paths for teachers to ensure this.

Next Steps for Research Site

Since my study focused only on English and social studies instruction, this research should continue with mathematics and science teachers at the research site. This will help create a continuity of pedagogy across the four content areas that will support teachers as they join the faculty and support students as they learn with higher expectations of critical thinking and metacognition, no matter the core-content area. This will also provide more data that can continue to eat away at the research gap between theory and practice. The meta-analysis conducted by Dignath et al. (2008) revealed that "promoting self-regulated learning raises academic performance more in a well-structured subject than in a rather open field" (p. 120). While integrating self-regulation should be relatively easier in content areas that are "more flexible and open for students' activities" (Dignath et al., 2008, p. 120), such as English, social studies, and science, metacognition in the mathematics classroom could help students move beyond mere procedural knowledge to deeper conceptual understanding, a current focus for both the research site and the site's district as a whole.

Since teacher participants focused mostly on designing and redesigning assessments using classifications and confines, research should continue with how teachers at this research site can tap into the potential of building metacognitive discourse around contexts, especially contextualization within students' multiple layers of society. Such opportunities to find real, personal meaning in learning could help students realize

how they could use their knowledge to effect positive change in their lives and in their communities. Assessment design for student production and annotation grounded in community contexts acknowledges each student's reality outside of the classroom as "a real curriculum site" (Milner, 2020, p. 15) for gleaning new knowledge, understanding present conditions, and seeking improvement. Supporting such student agency through learning demands intentionality from teachers, no matter their subject's content or their school's location.

Proposed Systemic Changes

Based on my findings, I propose that SC public-school districts integrate the Metacognitive Framework for Assessment Design (see Figure 7) in their secondary English and social studies classrooms utilizing two approaches: school-level instructional coaching and district induction programs. Since this Framework demands embedded PD, the instructional coaches, assistant principals for instruction, and department chairs at middle and high schools are in a position to work with teachers during their planning periods and/or during instruction as teachers identify assessments they want to design or redesign for more critical thinking. Such an approach to instructional coaching, though, will require district- and school-leadership investment ranging from coaching PD to master-schedule design to faculty-culture building. Since the Framework does not require complete overhauls of curricula, but only implementing specific strategies in already-existing assessment practices, teachers can step into the Framework to the degree they are willing to invest. This intervention model is scalable without intruding on teachers' autonomy and time, and all involved develop something more tangible to be used for

accomplishing the task of and collecting data on teaching without experiencing feelings of judging (instructional coach) and being judged (teachers). Teachers and instructional coaches should quickly realize how this approach is neither some prepackaged trend that will pass nor a cumbersome model requiring profound repositioning of pedagogy. This Framework is about asking teachers to enter into creativity within a flexible structure in order to create or improve a useable product and not about asking teachers to open their classrooms to be scored on their behaviors. This should be seen as a much more practical and friendly way to grow through PD.

Although most induction programs are designed around time outside of the school day, exposing new teachers to the Metacognitive Framework as they are first stepping into real assessment design to accomplish real goals should be considered. This could be accomplished via three avenues: the induction curriculum, the mentors, and the instructional coaches. While embedding the Framework into the induction curriculum will give induction teachers needed logistical context and pedagogical grounding, the mentors and the instructional coaches would need to participate in order to embed this real-time PD model into the actual act of teaching.

I also propose that SCDE revisits its SC Teaching Standards 4.0 Rubric (SCDE, 2021d) Thinking and Problem-Solving indicators. While these two domains admirably describe discrete dynamics of (1) students thinking beyond isolated academic recall (Thinking) and (2) students applying multiple thinking skills to arrive at learning goals (Problem Solving), the current indicators produce redundancies across the two domains and could even distract evaluators from acknowledging some important depth (quality) of

thinking as they look for multiple thinking types (quantity). The Thinking indicators equate rigor in thinking with the number of thinking types (analytical, practical, creative, and research-based) students engage during instruction and assessment, but SCDE should consider how giving these types of thinking equal weighting could diminish or detract from the fundamental importance and presence of critical thinking across all four thinking types. For example, an evaluator could observe juniors researching career pathways to create informational presentations (research, creation, and practicality) and score the teacher as "proficient," but the evaluator might have been distracted from the lack of critical thinking students were employing by simply copying and pasting information of practical importance for a visually pleasing slideshow. The 4.0 Rubric's (SCDE, 2021d) four learning types and Problem-Solving indicators should be better aligned with the six critical thinking skills and sub-skills identified in the American Philosophical Association's *The Delphi Report* (Facione, 1990). Such alignment could promote more accurate feedback from teacher evaluators, omit redundancies, and limit the biases evaluators bring into classrooms about what constitutes creativity, practicality, and research. Maybe "creative" thinking should become "productive" thinking, and maybe "practical" thinking should become "contextualized" thinking. SC public-school districts dedicating structured time to help evaluators more accurately evaluate thinking (beyond the numbers) in the classroom will only help the 4.0 Rubric (SCDE, 2021d) become a better tool to improve instruction throughout the state. Such a structured focus should appear in subsequent 4.0 Rubric (SCDE, 2021d) evaluator trainings and in current evaluator refreshers. The focus on numbers in Thinking and Problem Solving may

decrease the cognitive load on the evaluator, but it may not accurately capture the cognitive load the teacher is placing on the students.

Sharing Research with Practitioners, Policymakers, and Researchers

In addition to publishing my dissertation, I plan to share my findings directly with both the research site's principal and the district's assistant superintendent of instructional services. I would also like to share my research with the research site's faculty through practice, finding ways to support school-wide, real-time PD. Sharing my findings with the Mentoring and Induction staff at The Center for Educator Recruitment, Retention, & Advancement (CERRA) could also be a way to scale this intervention model across SC through districts' induction programs, and sharing my research with SCDE's Office of Educator Effectiveness could promote intentional conversations around the 4.0 Rubric (SCDE, 2021d) that could translate into improved guidance and feedback for teachers across South Carolina.

Conclusion

Providing all students access to rigor, no matter their identities, statuses, or addresses, must remain a commitment for all SC public educators because that is our charge and that is what students deserve. As activity theory posits, learning requires "disturbances" (Mak & Lee, 2014, p. 75), and designed-for rigor presents opportunities for intentional disruptions. That charge to teach rigorously is more easily accepted than it is realized, though. This pursuit of quality teaching and learning in every SC classroom requires supports and resources on many levels, but supports and resources are in limited supply at all levels. Within the SC public-education system, The Point of Production (see

Figure 27), where students are putting their thinking into action, might be the micro level, but it is what the entire system should be supporting.

An embedded PD approach that uses the Metacognition Framework for Assessment Design and Annotations of Awareness (see Figure 7 and Figure 8) leverages teacher autonomy and expertise while letting teachers go about their charge of teaching. It offers the promise of increasing the cognitive load on students to show their thinking while decreasing the cognitive load on teachers to offer feedback. It offers the promise of respecting teachers' time by optimizing their assessment-design efforts to free up more time for feedback. It offers the promise of a shared language offering both students and teachers agency in the learning process. While this PD approach requires no new real financial costs, it does require strategy. Schools, specifically, need to equip instructional coaches, assistant principals for instruction, and/or department chairs to support teachers in designing assessments that promote critical thinking and metacognitive discourse. This equipping includes both the providing of time embedded in the school day and a framework to operationalize the externalizing of thinking through assessments without prescribing the specific methods or final products. My study has shown that The Metacognition Framework (see Figure 7) helps move teachers and instructional coaches in that direction of designing product-based assessments requiring deeper student thinking and richer student-teacher feedback loops.

With personalized and specific cognitive and metacognitive feedback remaining an important goal in assessment design, the growth in verbal formative feedback cannot come at the cost of written summative feedback, though. My research revealed this

susceptibility, but such an undesirable result can be easily avoided when the power of Annotations of Awareness is harnessed through teachers using this agreed-upon language or coding to respond to student annotations. As teachers become excited about their abilities to provide more timely and personalized feedback during class-time production and about the possibilities of providing less verbiage in their written feedback, they should not neglect to see the exciting potential in the densely packed written responses that Annotations of Awareness encourage.

When considering all the complex factors that contribute to students (subjects) successfully producing to show their thinking (objects)—factors of rules, community, division of labor, and tools (Hasan & Kazlauskas, 2014; Mak & Lee, 2014), the two-way mediation between the secondary tool ("language, ideas, models") (Hasan & Kazlauskas, 2014, p. 11) of the Annotations of Awareness and The Atmosphere (rules, community, and division of labor) cannot be overstated. This tool, a shared language, promotes operationalizing externalized thinking, and this growing automaticity should promote knowledge transfer. Such a two-way mediation speaks to great potential for growth because, as teachers and students use the tool of Annotations of Awareness, the tool is shaping the atmosphere as the atmosphere shapes the tool. The tool is always interconnected with the environment in which it is used, so both inform and can enhance the other (Hasan & Kazlauskas, 2014, pp. 10-11). As teachers build environments demanding of critical thinking through the use of annotations, their annotation systems will improve to meet student and teacher needs, and as their annotation systems improve, so will their environments.

APPENDICES

Appendix A

Invitation Email

English and Social Studies Teachers,

I am emailing to invite you to join my doctoral research through Clemson University on promoting critical thinking through metacognition in the classroom. I have chosen to study the two content areas of English and social studies in order to focus my ninety days of research and to support my investigation with my existing knowledge base.

I will conduct my research over the course of the Fall 2022 semester, breaking it down into three cycles. Each cycle will focus on the design or redesign of one of your assessments to promote metacognition (metacognition embedded in the actual student endeavors and in the resulting feedback loops). At the end of this research, you will walk away with three assessments you can use in helping your students become stronger critical thinkers.

My research is not about asking you to redesign your curriculum; instead, I want to help you fine tune a few of your assessments to encourage more metacognition within your content. Participation in my research is completely voluntary, and you may withdraw from the study at any time for any reason.

Realizing how busy you are, burdens on your time will be limited to the following: You will complete five, short Google-Form surveys (one pre, three in-cycle, and one post). You will read one short text (four pages or fewer) in preparation for each assessment-design session. Three one-hour design sessions will be scheduled throughout the semester (most likely during your planning periods or right after school), and I will observe you once per three cycles (either as students produce the assessments or as you review the results with them). Following each observation, you will complete a short Reflection Log with a partner in the study, and I will conduct a brief interview with you. The assistant superintendent of instructional services or graduation coach (TBD) will review two of your assessments, one produced prior to the study and the third one you design/redesign during the study. She will use the Academic Feedback, Thinking, and Problem Solving domains of the SC 4.0 Rubric. (Please note that both assessments will have your name and the students' names removed for the sake of anonymity.)

Your time commitment should not exceed 13 hours during the entire semester:

- 5 Surveys = 1 hour total

- 3 Readings = 0.5 hours total
- 3 Design Sessions = 3 hours total
- Assessment Design Time (on your own) = 6 hours total
- 3 Reflection Logs = 1 hour total
- 3 Interviews = 1.5 hours total.

The assistant superintendent's/graduation coach's review of your assessments and my observations are solely for the purpose of my research and your feedback, and all records will be kept confidential for only my use. (A research peer will read some of my notes for accuracy purposes, but only teacher and student pseudonyms will be provided.) Your participation in my research is not tied to any district- or building-level oversight or expectations. Your identity will remain anonymous in the composition of my findings.

If you are interested in participating, please respond to this email with a "Yes." Feel free to ask any questions or express any concerns.

I appreciate your consideration,
Todd Howard, EdS, NBCT

Appendix B

Pre and Post Survey

Please answer the following three questions as specifically as possible:

1. What is metacognition?
2. What are some metacognitive thinking strategies of which you are aware?
3. How do you monitor student metacognition in your classroom?

Select your level or agreement with the following statement:

"There is enough time/space in my curriculum to embed explicit teaching of critical thinking and metacognition."

1	2	3	4
Strongly Disagree			Strongly Agree

How would you rate your level of knowledge of metacognitive strategies?

1	2	3	4
Low			High

How would you rate your confidence level with integrating metacognition into your classroom?

1	2	3	4
Low			High

How would you rate your confidence level with designing product-based assessments that promote higher-order thinking beyond recall/answering questions?

1	2	3	4
Low			High

Please complete the following 20 Likert-scale items that ask you to either rate the level of metacognition or identify your level of agreement:

	1 Strongly Disagree or Low	2	3	4 Strongly Agree or High
Item 1 You are evaluating students' metacognitive processing. Rate the level of metacognitive thinking if they spent most of their time planning the logistics of their final presentations before fully developing their models.				

Item 2 A teacher is modeling for students. Rate the modeling script regarding its helpfulness in guiding students' metacognitive thinking. "Watch me think out loud while I try to predict what this story is going to be about. The title is *Twisted*, by Laurie H. Anderson. There is a picture of one of those flexible pretzel pencils on the cover. The pencil makes me think that this book will take place mostly in a school because pencils are used in schools."				
Item 3 You are evaluating students' metacognitive processing. Rate the level of metacognitive thinking if they are able to describe how and why they plan to use each of the six simple machines to create a roller coaster.				
Item 4 You are evaluating students' metacognitive processing. Rate the level of metacognitive thinking if they are aware of the reasoning involved in completing a Venn Diagram.				
Item 5 When teaching students to use metacognitive thinking strategies, the teacher should recognize that strategies are general and thus students should not worry about the task for which the strategies are implemented.				
Item 6 You are evaluating students' metacognitive processing. Rate the level of metacognitive thinking if they are asked to complete an essay that describes the events of Sherman's March on Atlanta including who, what, where, when and why.				
Item 7 When teaching students to use metacognitive thinking strategies, the problem-solving activities are more important than time for students to talk about the activities.				
Item 8 When teaching students to use metacognitive thinking strategies the teacher should spend most of the time telling students how to fill out the strategy worksheet.				
Item 9 When teaching students to use metacognitive thinking strategies, the teacher should ask inferential questions and check the accuracy of student answers.				
Item 10 When teaching students to use metacognitive thinking strategies, the teacher should explain the mental processes used to answer inferential questions.				
Item 11 When teaching students to use metacognitive thinking strategies, the teacher should increase their awareness of the strategy and understanding of its power by relating it to specific task objectives.				
Item 12 When teaching students to use metacognitive thinking strategies, the teacher should debrief them after a lesson to review the thinking processes that helped students learn the content.				
Item 13 You are evaluating students' metacognitive processing. Rate the level of metacognitive thinking if they were able to describe their actions to explain what was learned.				
Item 14 When teaching students to use metacognitive thinking strategies, the teacher should provide time for students to talk about how they solved problem-solving activities.				
Item 15 When teaching students to use metacognitive thinking strategies, the teacher should allow students to share their thinking.				

Item 16 When teaching students to use metacognitive thinking strategies, the teacher should facilitate discussions on how problems are solved.				
Item 17 When teaching students to use metacognitive thinking strategies, the teacher should model thinking processes.				
Item 18 When teaching students to use metacognitive thinking strategies, the teacher should allow students to generate questions regarding content.				
Item 19 When teaching students to use metacognitive thinking strategies, the teacher should provide problem-solving activities for students.				
Item 20 When teaching students to use metacognitive thinking strategies, the teacher should ask students to explain how they came up with their answers.				

Adapted from Teachers' Metacognition Scale (Wilson & Bai, 2010)

Additional Post-Survey Questions:

1. How has this focus on Annotations of Awareness impacted your **assessment-design approach**? Consider your practices moving forward.
2. How has this focus on Annotations of Awareness impacted your **approach to instruction**? Consider your practices moving forward.
3. How has this focus on Annotations of Awareness impacted your **feedback approach**? Consider your practices moving forward.
4. How has your **assessment design and instruction** in response to this focus on Annotations of Awareness impacted your **students' production**?
5. How has your **formative and summative feedback** in response to this focus on Annotations of Awareness impacted your **students' production**? Consider both your verbal and written feedback.

Appendix C

Pared-Down SC Teaching Standards 4.0 Rubric

	4	3	2	1	Comments
Written Feedback	Written feedback is **consistently** academically focused, frequent, and high quality. Feedback from students is **consistently** used to monitor and adjust instruction. Teacher engages students in giving **specific and high quality feedback to one another**.	Written feedback is **mostly** academically focused, frequent, and **mostly** high quality. Feedback from students is **regularly** used to monitor and adjust instruction. Teacher engages students in giving **feedback to one another**.	Written feedback is **sometimes** academically focused, frequent, and **mostly** high quality. Feedback from students is **sometimes** used to monitor and adjust instruction.	The quality and timeliness of feedback is **inconsistent**. Feedback from students is **rarely** used to monitor or adjust instruction.	
Thinking	The teacher thoroughly teaches **three types** of thinking: • **analytical** (analyze, compare & contrast, and evaluate & explain). • **practical** (use, apply, and implement what is learned in real-life scenarios). • **creative** (create, design, imagine and suppose). • **research-based** (explore & review a variety of ideas, models, and solutions to problems). The teacher **consistently** provides opportunities where students: • generate a variety of ideas & **alternatives**. • analyze problems from **multiple perspectives** and viewpoints. • **monitor their thinking to ensure**	The teacher thoroughly teaches **two types** of thinking: • **analytical** (analyze, compare & contrast, and evaluate & explain). • **practical** (use, apply, and implement what is learned in real-life scenarios). • **creative** (create, design, imagine and suppose). • **research-based** (explore & review a variety of ideas, models, and solutions to problems). The teacher **regularly** provides opportunities where students: • generate a variety of ideas & **alternatives**. • analyze problems from **multiple perspectives** and viewpoints.	The teacher attempts to teach **one type** of thinking: • **analytical** (analyze, compare & contrast, and evaluate & explain). • **practical** (use, apply, and implement what is learned in real-life scenarios). • **creative** (create, design, imagine and suppose). • **research-based** (explore & review a variety of ideas, models, and solutions to problems). The teacher **sometimes** provides opportunities where students: • generate a variety of ideas & **alternatives**. • analyze problems from **multiple perspectives** and viewpoints.	The teacher implements **no** learning experiences that thoroughly teach any type of thinking. The teacher provides **few** opportunities where students: • generate a variety of ideas & **alternatives**. • analyze problems from **multiple perspectives** and viewpoints.	

	that they understand what they are learning, are attending to critical information, and are aware of the learning strategies that they are using and why.				
Problem Solving	The teacher implements activities that teach and reinforce **3 or more** of the following problem-solving types: • Abstraction • Categorization • Drawing Conclusions/ Justifying Solutions • Predicting Outcomes • Observing and Experimenting • Improving Solutions • Identifying Relevant/ Irrelevant Information • Generating Ideas • Creating and Designing	The teacher implements activities that teach and reinforce **2** of the following problem-solving types: • Abstraction • Categorization • Drawing Conclusions/ Justifying Solution • Predicting Outcomes • Observing and Experimenting • Improving Solutions • Identifying Relevant/ Irrelevant Information • Generating Ideas • Creating and Designing	The teacher implements activities that teach and reinforce **1** of the following problem-solving types: • Abstraction • Categorization • Drawing Conclusions/ Justifying Solution • Predicting Outcomes • Observing and Experimenting • Improving Solutions • Identifying Relevant/ Irrelevant Information • Generating Ideas • Creating and Designing	The teacher implements **no** activities that teach and reinforce any of the following problem-solving types: • Abstraction • Categorization • Drawing Conclusions/ Justifying Solution • Predicting Outcomes • Observing and Experimenting • Improving Solutions • Identifying Relevant/ Irrelevant Information • Generating Ideas • Creating and Designing	

Adapted from Updated Environment SC Teaching Standards 4.0 Rubric (SCDE, 2021d)

Appendix D

Design-Cycle Survey

What are your students producing?

What critical-thinking skill(s) will students employ in this production? (Circle.)

interpretation, analysis, evaluation, inference, explanation, self-regulation

What taxonomies, diagrams, or shorthand will you have provided and modeled to help students navigate and show their thinking during production?

How will your students and you (feedback) discuss their planning, monitoring, and/or evaluation of their production?

During the Process	In the Final Product

Will you place creative confines upon this production? Describe.

Will students be asked to contextualize their production within their existing content knowledge or a larger community? If so, explain.

What difficulties are you experiencing with designing this assessment for production and Annotations of Awareness?

If included, what difficulties are you experiencing with designing for creative confines or contextualization?

Appendix E

Metacognition Partnership Reflection Log

Please complete your half of this reflection log as you debrief with your Metacognition Partner:

Teacher 1	Teacher 2
Design What challenges did you face in designing/redesigning this assessment (covering content, making students think, establishing practical and timely measures for effective feedback)?	**Design** What challenges did you face in designing/redesigning this assessment (covering content, making students think, establishing practical and timely measures for effective feedback)?
Implementation What challenges did you face in executing this assessment? (Think about any struggles—resources, time, student buy in— along the way from preparing students for this assessment to providing feedback.)	**Implementation** What challenges did you face in executing this assessment? (Think about any struggles—resources, time, student buy in— along the way from preparing students for this assessment to providing feedback.)
Impact What did you learn about your students from this assessment? What will you try again? What will you leave behind or improve?	**Impact** What did you learn about your students from this assessment? What will you try again? What will you leave behind or improve?

Appendix F

Semi-Structured Interview Protocol

Observation

After observing your class surrounding your product-based assessment, I noticed these strengths/areas of growth:

1.
2.

What dynamics (atmosphere, specific content, instructional strategies, assessment type) fostered or inhibited your ability to engage students in metacognitive discourse?

I also see opportunities for growth with:

1.
2.

What are some ways our assessment-design study has helped or could help you grow with engaging students in critical thinking and metacognition via assessment?

Reflection (participant and researcher looking at shared Reflection Log)

Identify any commonalities that arose between your partner and you as you reflected.

Identify any points of divergence between your partner and you.

Assessment Analysis (participant and researcher looking at a sample of assessments)

Identify how/where you overtly designed into this assessment student production that promoted the development of critical thinking?

- What critical-thinking skills were employed?
- Where is evidence of students employing these skills?

Identify where you designed for practical and timely cognitive/metacognitive feedback through space for Annotations of Awareness.

- Did this assessment employ labeling? Classifications? Diagrams?
- Where is evidence of this two-way communication via the annotations?

Did you add/need creative confines to/for this production? If so, explain how and why.

- Where is evidence of students producing within these confines?

- Where is evidence of students explaining their choices within these confines?

Did you ask students to contextualize their production with previous content or their community?

- Where is evidence of students contextualizing?

Identify a few strong feedback moments. Explain.

Appendix G

Pre- and Post-Survey Results for Teacher Confidence

	Select your level of agreement with the following statement: "There is enough time/space in my curriculum to embed explicit teaching of critical thinking and metacognition."	How would you rate your level of knowledge of metacognitive strategies?	How would you rate your confidence level with designing product-based assessments that promote higher-order thinking beyond recall/answering questions?	How would you rate your confidence level with integrating metacognition into your classroom?
Alex	3 - 4	1 - 4	4 - 4	4 - 4
Anna	3 - 4	2 - 4	2 - 3	3 - 3
Claire	3 - 4	1 - 3	1 - 3	1 - 3
Harrison	3 - 4	3 - 3	3 - 4	3 - 3
Lucy	4 - 4	2 - 3	2 - 4	3 - 4
Molly	4 - 4	2 - 4	2 - 4	2 - 4
Richard	4 - 4	2 - 2	4 - 4	4 - 4
Sophie	4 - 4	2 - 3	3 - 3	3 - 3

Appendix H

Pre- and Post-Survey Results for Five Aligned TMS (Wilson & Bai, 2010) Scenarios

	Declarative (Knowledge of Definitions of Strategies or Making Students Aware of Them)		Procedural (How to Apply Strategies to Provide Assessments Requiring Student Application of Strategies)		
	When teaching students to use metacognitive thinking strategies, the teacher should increase their awareness of the strategy and understanding of its power by relating it to specific task objectives.	When teaching students to use metacognitive thinking strategies, the teacher should explain the mental processes used to answer inferential questions.	When teaching students to use metacognitive thinking strategies, the teacher should provide problem-solving activities for students.	When teaching students to use metacognitive thinking strategies, the teacher should allow students to share their thinking.	When teaching students to use metacognitive thinking strategies, the teacher should ask students to explain how they came up with their answers.
Alex	4 - 4	4 - 4	4 - 4	3 - 4	4 - 4
Anna	3 - 4	2 - 3	4 - 3	4 - 4	4 - 4
Claire	3 - 4	3 - 4	3 - 3	4 - 4	4 - 4
Harrison	2 - 4	4 - 3	2 - 3	4 - 4	4 - 4
Lucy	4 - 4	4 - 4	3 - 4	4 - 4	4 - 4
Molly	4 - 4	4 - 4	3 - 4	3 - 3	3 - 4
Richard	4 - 4	4 - 4	4 - 4	4 - 4	4 - 4
Sophie	4 - 4	3 - 4	3 - 3	3 - 4	3 - 3

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