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Developing and Practicing Pedagogical Metacognition Within Higher Education Learning Communities

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Metacognition is fundamental for learning, and pedagogical metacognition—reflecting, planning, and adjusting teaching—is equally salient to improving pedagogy and student learning. Many faculty have not been taught how to teach and may be unaware of this construct, however. Centers for teaching and learning, particularly through the use of learning communities (LCs), are ideal venues for promoting pedagogical metacognition. The authors introduce metacognition and LCs and explore the role of LCs in developing, promoting, and assessing pedagogical metacognition. They then present the structure of their university's LCs and explain the incorporation of pedagogical metacognition to help educators become both reflective and reflexive.

Metacognition—planning, monitoring, and adjusting one's learning processes—is an essential skill for successful learning. Research on metacognition in education demonstrates that it can be taught, practiced, and improved, whether honed through targeted feedback (Carpenter et al., 2019) or refined through repeated reflection, practice, and journaling (Kuiper, 2004; Was, Beziat, & Isaacson, 2013). Practicing metacognition and associated self-regulatory learning processes is fundamental to en-

gaging in instructional practices that support achieving student learning outcomes. Both reflecting upon previous strategies and outcomes as well as acting upon that feedback are essential to providing a framework for instructor knowledge and student achievement.

The use of metacognition in teaching parallels the ideas of *reflectivity* (that is, looking back and considering outcomes) and *reflexivity* (that is, deliberative action taken based on the information gained during reflection) (Ryan, 2015)—skills that are important for successful lifelong learning. Being reflective and reflexive about the learning process helps build understanding of how learning happens. However, higher education teachers are rarely trained in the epistemology of learning or effective pedagogy and, as such, may be unaware of the role of metacognition in their students' learning. Equally as important, they may be unaware of the role of metacognition in their pedagogical strategies and, as a result, may not engage in the reflective and reflexive practices of pedagogical metacognition.

Professional learning communities (LC) may be ideal environments to bring awareness to and foster this pedagogical metacognition—planning, monitoring, and adjusting one's teaching strategies—among faculty and graduate student instructors. Brower, Carlson-Dakes, and Barger (2007) define learning communities as groups of individuals intentionally brought together to pursue and accomplish specific learning goals. The long-term goal of most learning communities is to use research-based techniques to increase pedagogical knowledge of the complexity, design, and assessment of teaching and learning (Cox, 2001, 2004). The purpose of this article is to advocate for including pedagogical metacognition in higher education LCs to provide a framework for increasing instructor knowledge and student achievement through reflexive and reflective teaching practices. Our University's LCs offer preliminary evidence of this professional development scaffolding.

Metacognition in Learning

Metacognition was originally defined as knowledge about cognition and cognitive phenomena (Flavell, 1979), or "thinking about thinking," but this definition has broadened over time. Modern definitions of metacognition have expanded and clarified this construct to include metacognitive knowledge, metacognitive regulation, and metacognitive responsiveness (Brown, 1987; Meijer et al., 2013), and these three aspects of metacognition are important processes within self-regulated learning (that is, learners employing cognitive and behavioral strate-

gies to achieve learning goals) (Cera, Mancini, & Antoinetti, 2013; Fox & Riconscente, 2008). Self-regulated learning also involves an underlying sense of self-efficacy and personal agency, and it includes self-monitoring, self-judgment, and self-reaction (an emotional reaction or feeling toward one's self-judgments) of one's behavior in relation to personal standards and environmental circumstances (Bandura, 1991; Zimmerman, 1995). As such, metacognitive processes are complex and influenced by multiple personal and contextual factors. Students who use metacognitive skills regulate their learning behaviors and consider their thoughts in order to efficiently plan, monitor, and adjust their learning. Students and faculty members alike can harness metacognition as a tool to focus their attention more intentionally on the learning process and the larger purposes of education (Ottenhoff, 2011).

A significant body of literature supports the important role of metacognitive skills in learning. Learners with higher metacognition can more efficiently adjust their learning strategies to match their expectations of the cognitive processing demands of learning tasks (Ross, Green, Salisbury-Glennon, & Tollefson, 2006). Sternberg (1998) argues that metacognition is essential to developing expertise in learning. Students must plan, monitor, and evaluate their learning strategies to become experts in their own learning. The metacognitive skills of planning, monitoring, and evaluating one's own learning become increasingly important at higher levels of education, which involve increasingly complex tasks and greater responsibility-taking for learning to occur. Research on metacognition in the college classroom has influenced the development of a cycle of self-directed learning, including assessing the task, evaluating strengths and weaknesses, planning, applying strategies and monitoring performance, and reflecting and adjusting if needed (Ambrose, Bridges, DiPietro, Lovett, & Norman, 2010). The cycle of self-directed learning has many influences, including Butler's (1997) strategic content learning (SCL) approach, Boekaerts's (1992) model of adaptable learning, Borkowski, Chan, and Muthukrishna's (2000) process-oriented model of metacognition, Pintrich's (2000) framework for metacognition, and Zimmerman's (1989) social cognitive model of self-regulation (Puustinen & Pulkkinen, 2001). A common theme among these models of self-directed learning is that planning, monitoring, controlling, and reflecting on one's cognitive processes—key features of metacognition—are requisite for learning. These models have informed current research on metacognition in education.

Teaching metacognitive skills to students, and regularly and repeatedly prompting their use, encourages students to incorporate those skills regularly and results in more effective learners (Higham & Gerrard, 2005;

Siegesmund, 2016; Vrugt & Oort, 2007; Villareal & Martinez, 2018; Was et al., 2013). Through training in specific metacognitive techniques, such as a metacognitive study guide, in which learners reflect on their knowledge of key terms and decide whether to study the terms more (Agarwal & Bain, 2019; Ambrose et al., 2010), or metacognitive journals, in which students reflect on self-correction of goals, self-efficacy, knowledge use, and thinking strategies over time (Kuiper, 2004), learners can engage in the practice of planning, monitoring, and adjusting their learning strategies.

Metacognitive skills can be taught, practiced, and improved. A study investigating the effects of metacognitive training on metacognitive calibration (the association between judgments of confidence—student self-ratings of their cofidence in an answer—and test performance) demonstrated that providing direct feedback on metacognitive calibration enhanced participants' ability to introspect about self-performance (Carpenter et al., 2019). Extensive calibration practice, including improving knowledge monitoring through online practice quizzes, weekly self-reflections, discussions, and journaling each week, has also increased exam scores between the beginning and end of a semester and led to more accurate predictions of test performance, demonstrating an increase of metacognitive abilities over the course of the semester (Was et al., 2013). This research shows that metacognitive skills are important to learning and that engaging in metacognition results in better outcomes. Additionally, the research suggests that metacognitive skills are teachable skills. Thus, as a logical extension, faculty should be taught and supported to engage in metacognition focused on their pedagogy to improve instructional effectiveness.

Metacognition in Teaching

The idea of reflecting on one's teaching practice is not new; in fact, in teacher preparation programs and K-12 educational settings, reflection is an integral part of being an educator (Bambino, 2002). Teaching is understood to be a developmental process in which experience, feedback, and reflection results in the need for pedagogical change (Feucht, Brownlee, & Schraw, 2017). Marcos, Sanchez, and Tillema (2011) explicitly refer to reflection on one's pedagogy as a metacognitive tool for K-12 educators. However, several authors (Beauchamp, 2015, Collin Karsenti, & Komis, 2013, Marcos et al., 2011) have articulated a gap in theory-to-practice on how K-12 teachers put their reflection into action; this gap exists in large part due to the variability in definitions of reflection and a lack of empirical work on its outcomes. Russell (2013) states that another is-

sue surrounding reflection in K-12 teachers is that they did not receive adequate modeling of effective reflection from their professors during teacher training. However, developing effective reflection in practicing K-12 teachers, particularly through social or community reflections, can help develop the teachers' skills with instructional strategies and benefit their students' learning (Postholm, 2012).

The general expectation among the campus and community is that an individual with an advanced degree is prepared to teach novice leaners in their content area. However, higher education instructors are rarely trained to reflect formally on their teaching practice. This is likely due to the historical conception of the faculty member's role as primarily a researcher and disseminator of discipline-specific content and to the continued emphasis on research over teaching for funding and prestige (Altbach, Reisberg, & Rumbley, 2009). While higher education is recognizing the importance of effective pedagogy, and instructors are expected not only to be subject matter experts but also to have effective pedagogical skills for delivering student learning outcomes (Hénard & Roseveare, 2012), this is a recent shift. If someone has not learned how people learn or how that information translates to the classroom, it is likely that he or shes either holds inaccurate epistemological beliefs about learning or does not understand the importance of that information to pedagogy. Research shows that faculty and textbooks support and propagate inaccurate pseudoscientific learning strategies (for example, largely debunked learning styles) as effective (Kirschner, 2017; Morehead, Rhodes, & de Lozier, 2016; Warne, Astle, & Hill, 2018). Higher education instructors need to engage in reflection and subsequent action to improve their teaching effectiveness and their students' learning.

Ryan (2015) explains that both reflectivity and reflexivity are important for effective teaching and promoting lifelong learning in higher education. *Reflectivity*, or reflection, is the introspective and data-driven analysis of one's behavior, thoughts, and outcomes. It is an intentional act that seeks to identify strengths, areas of improvement, needed modifications, and successes (Reale, 2017; York-Barr, Sommers, Ghere, & Monti, 2001). Reflectivity can be facilitated by a variety of sources such as student grades on assessments, student evaluations of teaching effectiveness (Golding & Adam, 2016; Winchester & Winchester, 2011), peer observations of teaching (Alabi & Weare, 2014; Martin & Double, 1998; McCartin & Dineen, 2018; Samson & McCrea, 2008; Sullivan, Buckle, Nickey, & Atkinson, 2012), and teaching journals or notes (Larrivee, 2000; Moon, 2006; McCartin & Dineen, 2018). *Reflexivity* is the deliberative action based on reflection. After engaging in reflective practice, the reflexive practitioner modifies

some aspects of their course (for example, topics, strategies, materials, or schedule) and maintains other practices. In other words, reflection is thought, and reflexion is action, and both steps are necessary to improving one's instructional effectiveness and increasing student learning.

The process of reflective and reflexive action parallels the process of pedagogical metacognition, in which educators plan, monitor, evaluate, and adjust their teaching strategies for more effective instruction (Kohen & Kramarski, 2018; Kramarski & Michalsky, 2009; Kramarski & Kohen, 2017). Kramarski and colleagues (Kohen & Kramarski, 2018) have extensively studied pedagogical metacognition in K-12 mathematics and have developed a model for successful pedagogical metacognition in the math classroom; this model includes explicitly teaching educators about cognitive and metacognitive strategies for learning, as well as teaching direct instructional strategies for effective teaching (Kramarski & Kohen, 2017). Explicit, specific prompting to promote pedagogical metacognition in math educators has increased effects on self-regulated teaching and self-regulated learning of teachers when compared to generic metacognitive prompts, indicating that direct emphasis on pedagogical metacognition has positive implications for effective instruction (Kramarski & Kohen, 2017). Furthermore, these researchers argue that effective teaching requires knowledge of effective learning and knowledge of how to put that into practice, which is still rare in educational environments. Their research consistently shows that teaching K-12 educators about pedagogical metacognition and helping them practice how to use it results in educators being more reflective and reflexive in their pedagogical decisions.

Teaching educators how to use pedagogical metacognition engenders reflexivity and reflection in the classroom (Kohen & Kramarski, 2018) and improves student achievement significantly (Hill, Rowan, & Ball, 2005). In a study designed to investigate the effects of instructor knowledge of mathematics on student achievement, extensive knowledge of "carrying out the work of teaching mathematics," or pedagogical content knowledge, was linked to higher student achievement (Hill et al., 2005). Pedagogical content knowledge is argued to be the basis for understanding what makes a specific topic easy or difficult to learn and embodies the dimensions of subject matter knowledge and the underlying pedagogical metacognition necessary for teaching (Schulman, 1986). These examples demonstrate that pedagogical content knowledge and metacognition are instrumental to effective teaching and have positive influences on student outcomes. This research suggests that teaching pedagogical metacognition and content knowledge to college educators is essential.

Research on the practice of pedagogical metacognition among educa-

tors at colleges and universities is sorely lacking. In the only research we found on pedagogical metacognition in higher education, Son, Kenna, and Pfirman (2007) developed, implemented, and researched an intensive field-based project in which interdisciplinary faculty ($n = 40$) fulfilled the roles of both teacher and student during a month-long excursion on the Hudson River to learn about and practice pedagogical metacognition. The authors report that "A significant benefit of the River Summer classroom for faculty was their increased awareness of their teaching strategies; the participants evaluated their strategies based on what others had tried before, modified them "on the fly" during the program, reflected on their teaching and/or learning experience, and many are now applying them in their classrooms at their home institutions. . ." (Son et al., 2007, para. 32). This research provides a strong foundation for the construct of pedagogical metacognition and the impact it can have on instructional effectiveness.

Metacognition in Centers for Teaching and Learning

Transmitting the knowledge and skills of pedagogical metacognition and encouraging and supporting the practice of those skills by large numbers of higher education instructors requires a centralized effort. Centers for teaching and learning (CTLs) seem like the prime venue to develop and practice pedagogical metacognition, but there is currently a dearth of literature about the role that CTLs can play in its development (Castillo, Cabatay, Ronquillo, & Seva, 2019). Because metacognition is central to the teaching and learning process, developing effective teachers in higher education who engage in pedagogical metacognition to improve their teaching and their students' learning should also have a central place in CTLs and in research.

The Role of CTLs in Professional Development in Higher Education

Professional development in higher education is recognized as essential in academic institutions, because it provides avenues for creating continuous organizational and personal growth in teaching and learning (Bond & Blevins, 2020). Bond and Blevins argue that university departments responsible for providing faculty professional development, such as CTLs, are in an influential position to produce change in higher education settings. CTLs can enhance instructors' scholarly teaching by supporting them to use research-based pedagogical techniques to benefit student learning. For example, Vanderbilt University's Center for Teaching (Vanderbilt University, 2020) and Columbia University's Center for

Teaching and Learning (About the CTL, 2020) both emphasize their role in supporting teaching as a research-oriented process that involves foundational teaching skills, experimentation, reflection, and change. Many CTLs address reflection in their vision and mission statements (About the CTL, 2020; Vanderbilt University, 2020; University of Calgary, 2020) and acknowledge that there is a metacognitive component to professional development.

Learning Communities

Intentionally designed faculty professional development opportunities within CTLs, such as faculty learning communities (FLCs), can create a connected, collegial environment for an organization to prosper and improve learning throughout the institution (Eib & Miller, 2006). FLCs are defined as cross-disciplinary groups of faculty and staff who engage in active, collaborative programs with curricula aimed at enhancing teaching and learning goals (Brower et al., 2007). Learning communities in educational settings focus on developing collective values and visions, collaborative relationships, and supportive environments for personal and professional growth through ongoing interaction (Lenning, Hill, Saunders, Solan, & Stokes, 2013). FLC curricula include seminars and activities that emphasize scholarly teaching through learning, development, and community building (Cox, 2001, 2004). Cohort-based FLCs are particularly beneficial for people who have been affected by the isolation, fragmentation, stress, or emotional climate of higher education. These FLCs are especially important to building and fostering supportive networks and motivation among faculty. Topic-based FLCs address specific teaching and learning needs, issues, or opportunities (Cox, 2001, 2004). Long-term goals of FLCs include building university-wide community through teaching and learning; increasing faculty interest, knowledge, reflection, and collaboration in teaching and learning; and broadening faculty understanding of the complexity, design, and assessment of teaching and learning (Cox, 2001, 2004). Research demonstrates that learning communities are worthwhile mechanisms toward the enhancement of pedagogical practices (Lee et al., 2011; Voelkel & Chrispeels, 2017).

In addition to FLCs, graduate student learning communities (GSLCs) are emerging as avenues for educational professional development. Before GSLCs materialized in higher education, the Preparing Future Faculty (PFF) Program was the primary means of graduate student professional development, providing a forum for discussion of teaching and learning, and offering a new vision for doctoral student teaching and professional

development (Pruitt-Logan & Gaff, 2004; Rozaitis et al., 2020). PFF programs embody the idea that graduate student professional development, particularly for teaching, should be thoughtfully integrated into graduate programs while equipping students with the pedagogical knowledge and skills to adapt to ongoing changes in classrooms and curricula (Pruitt-Logan & Gaff, 2004). While not as organizationally complex as PFF programs, GLSCs serve the same purposes of improving teaching and learning and building a sense of community through targeted practice and reflection (Ogilvie & Hernandez, Jr., 2013). PFF programs have had significant impacts on holistic graduate student professional development.

A small number of universities are known to employ GSLC programming through their CTLs. At Iowa State University, GSLCs promote discussion seminars on graduate work, research skills, teaching and learning pedagogy, and leadership (Ogilvie & Hernandez, Jr., 2013). Development of peer relationships and a sense of community are facilitated for students participating in these GSLCs. The University of Wisconsin-Madison also implemented a GSLC program with four key elements: shared discovery and learning, functional relationships, inclusive learning environments, and connections to other learning experiences (Brower et al., 2007). These four elements work together to create a community of graduate students who share a common interest in research, teaching, and learning. Stanford University implemented a GSLC focused on inclusive teaching with an interdisciplinary group of graduate students and found significant changes in members' knowledge of and comfort with inclusive teaching practices (Crosby & Grant, 2017). GSLCs should be more prominent in educational professional development to assist graduate students in building a repertoire of reflexive and reflective teaching strategies through pedagogical metacognition.

Pedagogical Metacognition in Academic Professional Development

Reflection is a core component of faculty development, because it enhances faculty members' quality and depth of teaching and learning knowledge through activities such as notetaking, receiving feedback, setting up checkpoints, and adjusting for improved practice (Giaimo-Ballard & Hyatt, 2012). This "reflection-in-action" allows educators to monitor their teaching practices to benefit student learning while teaching. Critically reflective teaching can also facilitate educators' critiques of their own pedagogy to improve their teaching practices (Rodriguez & Sjostrom, 1998). It is expected that faculty and instructors reflect on their pedagogy. However, they are often given little direction regarding the ap-

plication of reflective teaching methods (Giaimo-Ballard & Hyatt, 2012). Faculty members would benefit from a more thorough understanding of how to apply reflexive and reflective practices in their teaching in order to better critique their own teaching practices and, ultimately, foster the best learning in their students (Hubball, Clarke, & Beach, 2004).

Prytula (2012) demonstrated how faculty reflect on their teaching and begin to apply metacognition in their pedagogy in a professional LC. They interviewed three LC participants who provided rich descriptions of their experiences with metacognition, indicating that reflection on their own thinking was heavily involved in their learning community participation and greatly impacted how they viewed their knowledge, educational growth, and teaching practices. The community environment played a large role in fostering their metacognitive thought through discussions with others, realizations of new perspectives, collaboration, strategy building, and shared accountability. Also, each participant described how their metacognitive efforts influenced the learning of others in the learning community. This dissertation study provides initial evidence that learning communities can foster metacognition. Perry (2017) investigated the impact of metacognitive reflection in FLCs using semi-structured interviews, observations, and course documents such as instructors' course requirements, activity worksheets, and assignment descriptions. Results demonstrated that FLCs create opportunities for faculty members to be self-aware of their own pedagogy. Furthermore, implementing organized, reflective, and consistent practices within an organized CTL makes reflective metacognitive thought more likely (Perry, 2017). Current research on metacognition in FLCs reveals the need for more consistent reflection on learning and pedagogy, in order to provide a sounder basis for "thinking about thinking" within the context of professional development.

Research on graduate student professional development in PFF programs demonstrates the increased need for pedagogical training of graduate students (Pruitt-Logan & Gaff, 2004). In a qualitative study aimed at exploring graduate student experiences, Wulff, Austin, Nyquist, and Sprague (1992) investigated the stages of development that graduate student teaching assistants experience along their journey to becoming scholarly teachers. The researchers found that 59% of the participants acknowledged the benefit of the opportunity for reflection during their graduate teaching careers. Furthermore, many students indicated that they would value more opportunities for reflection in their future endeavors. Reflecting and thinking about one's own learning is valued by graduate students, which supports the need for GSLCs to implement pedagogical metacognition to improve reflection and metacognitive thought.

Reflective and reflexive pedagogical practices are essential aspects of professional development for teachers of higher education. Research demonstrates that learning about and implementing metacognitive strategies in the classroom has a profound impact on development of planning, monitoring, and adjusting one's learning. The same is true for using pedagogical metacognition when teaching. CTLs may be the institutional body that can bring about pedagogical change in the form of reflective and reflexive teaching strategies. Our CTL, the Center for the Enhancement of Teaching & Learning (CETL) at the University of Northern Colorado, has recently begun implementing LCs focused on effective pedagogy with a theme of pedagogical metacognition. Though these programs are in their infancy, early evaluation of the LC reveals the success of teaching and supporting pedagogical metacognition through LCs.

An Example of Developing and Practicing Pedagogical Metacognition Through Learning Communities

To illustrate the integration of literature in pedagogical metacognition and learning communities, we present preliminary information from our University's series of learning communities that align with Kohen and Kramarski's 2018 framework for pedagogical metacognition. Though these learning communities are still novel and evaluation of their long-term efficacy is ongoing, their immediate success suggests that LCs can serve as an effective mechanism for supporting teaching through pedagogical metacognition.

Developing and Practicing Pedagogical Metacognition

From the Fall of 2019 to the Spring of 2020, our University conducted a pilot LC with a group of faculty fellows and staff ($N = 8$) working on revitalizing the CETL through effective professional development. This group met monthly, read and discussed chapters in a book about learning (Ambrose et al., 2010), and made modifications to professional development workshops grounded in newly learned content and LC member feedback. Based on this process, participant feedback, and the effectiveness of this pilot, an LC open to the entire University faculty was implemented the following year.

The ongoing goals of our LCs are to (1) increase participant knowledge about the learning process, (2) increase participant understanding of the relationship between learning and instruction, (3) provide opportunities

for practicing pedagogical metacognition through both reflection and reflexion, and (4) support continued work in pedagogical metacognition to improve teaching effectiveness.

When the larger-scale LC was implemented, instructors were recruited from colleges across the University to apply to the How Learning Works FLC (HLW FLC). This interdisciplinary group of faculty ($n = 9$) led by two facilitators met monthly to discuss each chapter of Ambrose et al. (2010). Think-pair-share exercises to encourage reflection on how each chapter's content was related to their own teaching, to encourage reflexion with strategies for improvement, and to encourage an awareness of the impact of these strategies on students (pedagogical metacognition) were enacted during each LC meeting. Two cohorts of participants were included in the following year's HLW FLC. A total of 15 faculty members participated and were divided between two online sections due to social distancing restrictions and scheduling considerations.

Taking feedback from the first year's cohort, the second iteration of the HLW FLC extended the think-pair-share design to include individual "think" and partner "pair" assignments completed before the LC meeting to allow more time for "sharing" and opportunities for pedagogical metacognition during the meeting. The "think" assignments asked participants to reflect individually on each meeting topic, answering questions such as "What types of feedback do you offer your students?" or "How can you improve your feedback using the strategies in this chapter?" "Pair" assignments required each LC member to meet with another LC member to discuss the similarities and differences between their teaching approaches regarding each meeting's topic. LC participants selected a partner at the beginning of the semester and met monthly to discuss their thoughts about each chapter. The "share" portion occurred during each LC meeting, during which all members shared their ideas and questions in the larger group. A metacognitive reflective journal, completed after each month's meeting, was also included in the second year of the HLW FLC to facilitate pedagogical metacognitive growth over the duration of the year.

During the second year we also offered an advanced FLC, the Peer-to-Peer (P2P LC), for members who had participated in the HLW FLC. The P2P LC is a structured facilitated mentorship in which participants engage in in-depth reflection and reflexion of the concepts and strategies learned from the HLW FLC. Members ($n = 4$) in the P2P LC were assigned an interdisciplinary peer with whom they worked each month. Every month of the LC covered a different pedagogical topic (for example, teaching philosophy, syllabus and learning outcomes, assessment, teaching and

learning activities, instruction, pedagogical metacognition). Peers were asked to share an aspect of their pedagogy that aligned with the month's topic (for example, teaching philosophy, rubrics and instructions, live teaching observation) and to review their peer's pedagogy according to material provided by the facilitator. These materials included scholarly and theoretical readings on the topics, guided questions and rubrics to help members connect the content from the HLW FLC to their peer's instruction, and monthly meetings with the FLC to discuss the topic and answer questions.

We recently implemented our first GSLC, modeled on the HLW FLC but with added topics specifically relevant for graduate students (for example, writing a teaching statement, trends and issues in higher education). Participants included graduate students ($n = 6$) from programs across the university who read pedagogical literature and met bi-weekly to promote deep discussion and scholarly conversation, while also building an interdisciplinary community among graduate student scholarly teachers. As in the HLW FLC, participants in the GSLC were asked to respond to post-meeting reflection prompts to promote pedagogical metacognition.

Assessing Metacognition

As part of program evaluation of our LCs, we include pre- and post-surveys asking LC participants the same questions: (1) how do you define learning? and (2) how does your definition of learning influence your teaching? In the post-survey, participants were also asked what specific strategies they learned during the LC and specific ways in which they have or will incorporate those strategies into their teaching. We also use LC member responses to the metacognition journals as a source of program evaluation data. LC facilitators keep notes during the LC meetings and interesting or relevant quotes from members are recorded. The facilitators meet regularly with CTL leadership to reflect on the progress and outcomes of the LCs as well as to engage in reflexion by making changes to components of the LCs that need modified. These activities are completed as part of the program evaluation of the LC by our CTL, and simultaneously they provide evidence of pedagogical metacognition incorporated into our LC.

Evidence of Pedagogical Metacognition Use Prior to the LC

Several faculty members provided evidence in their responses to a presurvey of demonstrating pedagogical metacognition before their participation in the LC occurred. When asked how their instructional planning and teaching reflects their views of how students learn, par-

ticipants responded with many references to pedagogical metacognition. One faculty member explained, "I give pretty thorough feedback on larger assignments, and am working on giving better feedback in class during activities. I struggle with fostering a student community (with ice-breakers, etc.) and am definitely hoping to improve in this area." This excerpt demonstrates the faculty member engaging in reflection about teaching practice, monitoring the strategies being used in the classroom, and suggesting an adjustment for future teaching. Another faculty member who engaged in pedagogical metacognition before the learning community mentioned consistently checking in with students after exams with the goal of adjusting their teaching modalities appropriately after receiving student feedback: "I constantly ask for feedback from my students. After each exam, I touch base with them to see how they felt about the exam, what they would like to see in the second half of class, what we can improve on, etc. It helps me better understand how students learn so that I can adjust my teaching modality appropriately." Both faculty members provide clear examples of reflection, monitoring, and adjusting based on feedback from self and others.

Evidence of Pedagogical Metacognition Use During the LC

A major component of our LCs is practicing pedagogical metacognition throughout the program. The pre-meeting activities, meeting discussions, and post-meeting reflective journals emphasize reflecting on newly learned content about teaching and learning and engaging in reflexion by focusing on how to use the new content in instructional decisions. Reflective journal entries from two community members show the process of pedagogical metacognition during the LC.

During the HLW FLC, one faculty member reflected on how experience and prior knowledge influenced interactions with students:

> One struggle that I have had is working with students' prior knowledge and misconceptions. In a class we are discussing . . . systems and supervisor observations. Sometimes in the discussion, it feels like I am arguing with the students. Given all my years of practical experience plus readings . . . I have a broader depth of knowledge. They have limited prior knowledge. . . . I would like to use strategies that help me explore students' prior knowledge without coming off as judgmental or as a know-it-all. While I am the professor, I find that when I have tried to correct students' misconceptions, they resist and it hurts the teacher-student relationship. . . . In the next month, I will ask students about their prior knowledge about a topic and how the [class] reading supports their experience and which parts of the reading refutes their prior experience and knowledge.

This LC member is reflecting on an area of personal struggle, relating it to new content from the LC, considering why it is an area of struggle, and selecting a concrete strategy to implement potentially to modify this aspect of instruction.

During the advanced P2P LC, one faculty member shared a rubric used in a course and explained their thinking.

> . . . I want to make sure I am being equitable and accessible . . . but I don't want my rubric to have words that are laden with judgment about the student. If I use the words "exemplary" or "surface" or "no effort" to describe levels of performance, will they internalize that? How might that impact the student's learning and feelings about themselves and the class? So, what if I change my rubric and get rid of the middle category [surface level]: Either they do it or they don't? That gets rid of that value judgement. . . . But you lose something if you get rid of this middle category, right? What am I losing? And am I holding students to high standards if the high end of the rubric is "You completed it"? This is definitely something we [member and partner] need to think on more and figure out how to change.

This LC member also shows active pedagogical metacognition through consideration of how the content and the way in which it is presented can impact student learning, affect, and outcomes. The member is considering ways to make modifications that were prompted by LC participation and the potential implications of those changes.

Evidence of Pedagogical Metacognition Use After the LC

It was clear from the descriptions of adjustments to their teaching that faculty engaged in pedagogical metacognition after participation in the LC. One faculty member offered insight into making changes in multiple areas of teaching by stating,

> I am looking forward to refining the climate of my classroom. . . . I feel confident that the climate is a good one for learning and exploring new ways of thinking about material and that my classroom gives students space to fail and try again productively. However, I often have several extremely resistant or behaviorally challenging students each semester . . . and I want to more overtly employ the ideas in the [FLC] with those students in mind.

This faculty member's reflection on refining classroom climate and making explicit pedagogical adjustments demonstrates a propensity to plan, monitor, and adjust teaching practice that was influenced by the faculty learning community.

Pedagogical metacognition was also displayed in another learning community participant's response. This participant explained,

> I really enjoy thinking about motivation and how it contributes to learning. I have also been trying to discuss the things that I've learned with those that I work with (for example, colleagues, graduate students, teaching assistants), not only as a way to spread the knowledge, but also so that I continue to think about them myself. I plan to review my notes on the [FLC content] as I create my syllabi this summer to incorporate as many things as possible to continue to improve my courses.

Planning to review notes, adapting future syllabi, and spreading pedagogical knowledge to others demonstrates the use of metacognition in teaching, suggesting that our learning community was successful in fostering reflexive and reflective practices through pedagogical metacognition.

One of the most profound impacts of the learning community program unfolded during an interview with a learning community participant concerning how she incorporated specific practices into her pedagogy. She stated, "After incorporating principles from the FLC, no one failed the first test, and the class average went up by a full letter grade." She further described the lasting impression of the learning community on student outcomes, declaring, "There is a lot of emphasis on helping students get to [the university], but once they are here, we put very little attention on how to help students be successful in the classroom, and that is what this FLC is all about!" The insights from our FLC participants illustrate the impact and implications of implementing pedagogical metacognition in a collaborative, supportive environment focused on improving teaching and learning.

While our LCs are ongoing and we will not know the long-term effects of them for several more cohorts, this initial feedback and data suggest that the intentional inclusion of pedagogical metacognition throughout the LCs effectively increased the participants' knowledge and practice of both reflective and reflexive action.

Conclusions and Future Directions

Thinking about thinking, as introduced by Flavell in 1979, has since evolved into the complex construct of metacognition. Research demonstrates that metacognition can be trained and taught in K-12 educational settings, while metacognition in higher education instructors remains relatively unstudied. Pedagogical metacognition—planning, monitoring, and adjusting one's teaching practices—has been shown to increase

instructional effectiveness and student achievement in K-12 settings. We argue that learning communities are an ideal environment for pedagogical metacognition to influence reflective and reflexive practices in higher education. After implementing pedagogical metacognition into our learning communities, we have burgeoning evidence to support learning communities as an effective mechanism through which to teach, practice, and support pedagogical metacognition in higher education. This area deserves explicit attention, and research in our CTL is beginning to move into exploring the role of pedagogical metacognition in LCs and the longer-term impacts on faculty engagement, student learning and attitudes, and a sense of community among higher education instructors. Metacognition should be given a stronger emphasis in professional development, including CTLs, FLCs, and GSLCs. Altbach and colleagues (2009) state that there is momentum building for institutions to assume centralized oversight for teaching-quality practice and development. Embedding pedagogical metacognition into LCs and CTL programming may be the key to creating a lasting impact on instructor knowledge and student achievement.

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