CHAPTER 10

TEACHING METACOGNITION TO REINFORCE AGENCY AND TRANSFER IN COURSE-LINKED FIRST-YEAR COURSES

Dianna Winslow and Phil Shaw
Rochester Institute of Technology

The Council for Writing Program Administrators, National Council of Teachers of English, and National Writing Project's (2011) *Framework for Success in Postsecondary Writing* presents eight "habits of mind," which are "both intellectual and practical" and "approach learning from an active stance" (p. 4). Of these, our interest in this study is related to the eighth habit, Metacognition, and how students transfer metacognitive strategies between courses in different disciplines, and then into future learning. In particular, we want to investigate the efficacy of linked courses—one first-year writing and one a course in STEM—to promote the possibility of transfer of metacognitive practices to the students' future learning and composing.

When course links and learning communities are talked about in higher education, it is most often in terms of the benefit these have on first- and second-year student retention. Faith Gabelnick, Jean MacGregor, Roberta S. Matthews, and Barbara Leigh Smith (1990) have documented the affordances of linked courses and learning communities to help build curricular cohesion, produce positive social connections, and involve students in shared, sustained inquiry. Terry Myers Zawacki and Ashley Taliaferro Williams (2001) cite linked courses as a way "to increase first-year student retention by creating a comfortable, less isolating learning environment" (p. 115). Course links have also been shown to play an important role in helping students to understand the connections among the knowledge built in their multiple courses. Vincent Tinto (2003) describes this "shared knowledge" and "coherent curricular experience" as an important commonality in linked courses which "seek[s] to promote higher levels of cognitive complexity that cannot easily be obtained through participation in unrelated courses" (p. 2). Other scholars describe what we consider to be a deficit model of linked course work, where courses are linked in terms of "content" courses and "service" courses

that provide "a shared experience for students that focuses on a content-based course that is actively supported by a skills course" (Kellogg, 1999, pp. 2-3). It is important to note that the courses in this study operated independently, e.g., the first-year writing class we will describe was not set up as a "skills course" for writing in the genres and hybrid-genres of academic science courses.

In the spring of 2015, we had the opportunity to pilot a FYW curriculum, "A Science of Writing," thematically built on metacognition in writing tasks linked to a similarly themed first year science course. The science course, Metacognitive Approaches to Science, was specifically designed to support and track cohorts of first-generation students and Deaf and hard-of-hearing (D/hh) students in order to increase academic performance and retention for these two, often overlapping, populations. Through a multi-year NSF grant awarded to the College of Science (COS) at Rochester Institute of Technology (RIT), Scott Franklin and Elizabeth Hane established the Integrating Metacognitive Practices and Research to Ensure Student Success (IMPRESS) program. Representing the University Writing Program (UWP), we began meetings with Franklin and Hane to design curriculum that linked two first year writing (FYW) class sections with the grant-funded introductory science class. Our primary interest in participating with the IMPRESS program was to explore the ways these linked courses might facilitate transfer of writing knowledge when the curriculum in each was explicitly teaching metacognitive strategies of thinking and learning. In the writing courses, student positionality to the university and its discourse communities into which students were entering was also openly investigate.

Phil Shaw taught the two Science of Writing sections with IMPRESS students who had either taken the Metacognitive Approaches to Science course in fall 2014 or were enrolled in that class concurrently that spring. After enrollment of the IMPRESS students, remaining seats were filled by non-grant students. Although there were many variables, the pilot helped focus the curriculum, evaluate what metacognitive concepts were transferring, and begin to identify how often students were transferring these concepts from one course to another.

Although the IMPRESS grant was written with the specific intention of supporting academic performance and retention for the target populations of first-generation and D/hh students, the FYW courses were designed to serve a mixed population of hearing and D/hh students, some of whom were first generation students, and some who were not. Our FYW pilot study was not designed to look particularly at the teaching and learning of the IMPRESS target population. We designed these first courses to investigate the usefulness of using metacognition concepts to encourage the transfer of those practices from the writing class into students' other courses. The common metacognitive practices in both classes allowed all students, first generation, D/hh, hearing, or post-first

year, to experience, in two different contexts, the application of metacognitive strategies, like concept mapping, task perception, and self-evaluation and reflection. This provided them with the opportunity to develop similar approaches to the writing tasks in each class. The two courses were disciplinarily distinct, but they shared the academic context of the classroom and some similar writing tasks (reflection, online discussion forums, etc.).

STUDY DESIGN/METHODS

The focus of this study is 23 IMPRESS students and 12 non-grant students enrolled in two sections of Shaw's fall 2015 FYW courses. All of the IMPRESS students in Shaw's FYW sections were enrolled in the COS course at the same time, and some had also participated in a four-week summer IMPRESS course focused on scientific inquiry and research.

Constructing this case study, we chose a mixed methods research approach, using qualitative research methods (Denzin & Lincoln, 2003; Stake, 2001; Tedlock, 2003), and teacher research (Cochran-Smith & Lytle, 1993; Ray, 1992, 1993). This project is a small case study—partially instrumental, partially intrinsic (Stake, pp. 3-4)—and is intended to be exploratory and descriptive, while possibly offering a forward look to potential future studies of more scope and scale from which larger generalizations might be made. As a small study, aspects of qualitative research were employed to understand the phenomenological aspects of the case, describing the conditions and multiple contexts of the material, institutional and pedagogical conditions that allowed Shaw to teach the course the way he did, as well as analyze students' participation as co-investigators of their own metacognitive practices.

The students were made aware by the COS faculty teaching the science class that they were part of a grant and study designed to understand the retention benefits of teaching metacognition as a practice of scientific research. Similarly, Shaw was transparent about his role as teacher-researcher and use of teacher research methods, sometimes modeling his reflections about the way the class was unfolding as a form of his own metacognitive practice. Additionally, we conducted personal and small group interviews, which were essential to the data gathering process. Because the participant pool in these communities was small, all informants were "key" ones (Schensul, Schensul, & LeCompte, 1999, p. 128) with intimate knowledge of the course structure, whole-class discussions, and the writing and reflection tasks they were expected to complete. All participants were interviewed in a self-selecting process, in which in-depth, open-ended interviewing methods were used to investigate topics relevant to the research topic (Schensul et al., 1999, pp. 121-161). The advantage of this type of interviewing

was that it allowed us the flexibility to pursue, in the moment, topics that arose spontaneously from the conversations that occurred during the interview process.

The case study includes observations of Shaw's role as participant-observer, critically reflecting on his role as teacher and participant (Tedlock, 2003, p. 151). Although this was not a formal ethnographic study, we were influenced by ideas drawn from ethnography about negotiating the paradox of "distance, objectivity, and neutrality" in relation to "closeness, subjectivity, and engagement" (Tedlock, 2003, pp. 151-152). Working collaboratively to analyze course artifacts and interview transcripts and "emphasize relational . . . patterns, interconnectedness . . . and dialogue" (Tedlock, 2003, pp. 151-152), helped us to mediate the closeness of Shaw's classroom role. This framework assisted in parsing how the participation narratives students shared with us were both personally, socially and institutionally mediated.

By studying a particular classroom setting and a finite set of students, we participated in teacher research as it has evolved in Composition Studies and English Education. Teacher research is can be referred to as "studies of 'classroom ecology' . . . [which] presume that teaching is a highly complex, context specific, interactive activity in which differences across classrooms, schools and communities are critically important" (Cochran-Smith & Lytle, 1993, p. 6). Sometimes designed as collaborations between education researchers and particular classrooms and teachers, teacher research is often considered to be "studies conducted by teachers of their [own] school system, school, [and/or] class" (Ray, 1992, p. 173). It is a form of qualitative research specific to education, and draws legitimacy from its use of methods from anthropology, the social sciences and linguistics, and include "[field] journal keeping, participant observation, interviews, surveys, questionnaires and discourse analysis of student texts" (Ray, 1992, p. 172). Shaw used "methodical data gathering" and a "reflective stance towards teaching and learning" (Ray, 1992, p. 173) to inform and improve teaching and learning practices for this course, teacher research methods used to focus on local and particular contexts to solve local and particular problems (p. 175). We used their methods and reflective practices to assess where and to what extent the course carried out its major goals and objectives and also where it failed to do the work intended.

PEDAGOGICAL FRAMEWORK OF THE SCIENCE OF WRITING FYW COURSE

Shaw's Science of Writing course is designed using principles from Doug Downs and Elizabeth Wardle's (2007) writing about writing essay "Teaching about Writing, Righting Misconceptions": it focuses on building knowledge about writing, rather than attempting to only improve writing skills. Adding a metacognitive

focus to writing about writing provides students with opportunities to reflect and take stock of their writing knowledge by building awareness and regulation of their overall learning, not just about writing. Shaw introduces metacognitive practices and concepts using Raffaella Negretti's (2012) key components of student metacognitive learning processes, as well as vocabulary for talking about those processes.

Most students developed metacognitive awareness of how their performance and learning either challenged or confirmed what they were reading in peer-reviewed journal articles that described different studies about students in FYW. Class discussion often led to course and learning outcome evaluation, offering valuable opportunities for students to evaluate their approaches to assignments and readings, and gave Shaw the opportunity to be more transparent about his role as teacher-researcher. Students signed participant consent forms and read articles that built on teacher research; they were aware from the beginning that this course was part of our research.

Course Unit One: Metacognition and Writing about Writing

This FYW course, the Science of Writing, is separated into three distinct units over the 16-week semester. The design of this course first builds explicit knowledge about writing and metacognition, then applies that knowledge toward developing student agency within institutional contexts, and ends with students formulating their own metacognitive approaches to their writing processes. Articles in the first five-week unit introduce students to metacognitive practices, writing about writing, and transfer (Downs & Wardle, 2007; Negretti, 2012; Pacello, 2014; Rounsaville, Goldberg, & Bawarshi, 2008). Students respond to these readings through online discussion board posts due before the class meeting during which the article or reading will be discussed. Discussion posts are projected on the board and the student-writer presents what they have written. Other students participate in the presentation by asking questions, and when a student has replied before class to another student's post, that student is asked to explain and elaborate on what they have "added to the [Burkean] conversation" of the posting student's original thread (Harris, 2006).

The utility of discussion posts and digital technology toward creating learner-centered classroom is nothing new, but by virtue of the metacognitive focus of this course, when the students present their posts, they are talking about what they were thinking about when they wrote what they wrote. With regards to Deaf/hard of hearing (D/hh) students and the online discussion posts, presenting discussion by voicing, or using ASL, images, and nonverbal media offers greater opportunity for meaning-making. Allan Paivio and others' work has

shown that technology aids D/hh student cognition by presenting verbal and non-verbal information (Paivio, 1991, 2006; Sadoski & Paivio, 2013), though the assumption that D/hh students are inherently audio-visual learners by virtue of hearing loss has been rightly questioned (Marschak, Morrison, Lukomski, Borgna, & Covertino, 2013). In our experience, the student-centered approach of (re)presenting discussion posts composed before class allows students of any communication medium multiple modalities for understanding and responding to texts and the interpretations of others.

As a metacognitive practice, the students self-regulate their presentation by focusing not on what they wrote (i.e., reading it off the screen), but on what they consider the most "interesting" (Harris, 2006) claim they themselves have made in writing about the article. This gives students an opportunity to reflect on and prepare a short re-visioning of what they wrote for a new context: the asynchronous discussion board post becomes the beginning of a synchronous discussion, and the texts students create before class increasingly reflect this awareness as the context and genre become more comfortable. There are 15 total posts during the course of the semester, and the first few in the beginning of the course were mostly summaries and reactions. By midway through the course, students are employing links to videos, memes and other visuals; creating more complex "forwarding" or "countering" (Harris, 2006) arguments; offering questions for class discussion; reflecting on prior learning and educational experiences; and making connections between multiple articles, academic and non-academic discourse communities, and other contexts.

The first unit of the course brings together metacognition as "thinking about thinking" and a FYW writing about writing pedagogy. The effect of this combination of writing about writing and thinking about thinking is that students begin to approach the course as writing about the process they are going through to thinking about "thinking about writing."

Course Unit Two: Authority, Discourse, and the Institution

After students begin exploring and employing metacognitive practice—through task perception, reflection, self-regulation, and monitoring—the second unit of the course turns their attention toward student positionality and authority in the institutional contexts that both support and regulate their learning. Thinking about our own thinking, and regulating our own knowledge in an effort to gain new knowledge, is itself regulated by the thinking of others, and their thinking about our thinking. The question of unit two becomes, "What happens when we turn metacognition outward?"

This social approach to metacognition is supported by the *Framework*

(CWPA et al., 2011). The eight "habits of mind" promote student learning both in and out of school and posit that students who take "an active stance" in their learning are better prepared "for the learning they will experience in college and beyond" (CWPA et al., 2011, p. 4). In order for students to take an active stance within and then beyond their classroom(s), this unit frames course readings as discussions about issues of identity, agency, and institutional power. As Charles Bazerman (2013) calls for in his chapter in this collection, and in *A Theory of Literate Action*, we are trying to find meaningful ways to bring both the sociocultural and psychological dimensions of writing in order to approach writing as "complex social participatory performance, in which the writer asserts meaning, goals, actions, affiliations, and identities within a constantly changing, contingently organized social world, relying on shared texts and knowledge" (p. 11). When students bridge the sociocultural and psychological, they develop a more active stance toward writing and learning in other disciplines.

Course Unit Three: Process, "Taking an Approach," and a Science of Writing

In *Rewriting*, the fourth chapter may be the most interesting and conceptually difficult for students. In "Taking an Approach," Joseph Harris (2006) reimagines the initial three moves of his book (Coming to Terms, Forwarding, and Countering). Those initial moves draw lines between an author's thinking and the student's use or analysis of it, especially in the "yes, and" and "yes, but" explanation of forwarding and countering. In taking an approach, the move is less clear: "When taking the approach of another writer both your thinking and theirs needs to change" (Harris, 2006, p. 74). The focus on metacognition in the FYW course eases this shift from responding to adapting, as one student claims:

> [T]aking an approach not only answers the question as to how we can be successful with diverging our ideas from other authors, but become self-aware about why these sources influence our work. This self-awareness ultimately leads to the direction a paper can head in, because the influence sources had. It really goes to show why, after this class, most of us look down on high school writing; it's almost like subconsciously we knew something was wrong, and wanted to express our millennial perspectives in a way in which others will listen. (Harris, 2006, p. 74)

With this metacognitive awareness of how sources influence their work, students begin their seven-week research project, which includes prewriting,

database research, annotated bibliography, multiple drafts, an abstract, multimodal project presentation, final draft, and reflection letter. Some students in the course took a consciously auto-ethnographic approach and blended their research with reflection and analysis of their prior learning and experiences in educational and other contexts.

RESULTS AND ANALYSIS

Analyzing survey data, student artifacts and group discussions conducted during the following semester helped to support (and challenge) the following claims:

- Linked Coursework facilitates near and far transfer,
- Metacognitive practices support high-road and far transfer,
- Explicit discussions of transfer and metacognition support interdisciplinary thinking, and
- Interdisciplinary transfer of metacognitive practices increases student agency.

Linked Coursework Facilitates Near and Far Transfer

The shared knowledge evoked by having both the Science course and the FYW course tied thematically by the teaching and learning of metacognitive strategies did more than support first year students' sense of security and belonging in their new academic context. The shared, yet disciplinary-specific use of metacognitive strategies between the two courses created the condition for David N. Perkins and Gavriel Salomon's (1992) conceptions of "near" and "far" transfer, with near being "largely reflexive," and far accomplished through "mindful abstraction." Although both near and far transfer can be what Perkins and Salomon call "low-road" and "high-road" transfer, low-road transfer occurs most often in conjunction with near transfer, when similarly configured conditions of the transfer context (i.e., the academic classroom and reading response assignment), "trigger[s in students] well-developed semi-automatic responses" (Perkins & Salomon, 1992). High-road transfer, on the other hand, requires students to look for connections between their immediate academic learning context and other contexts that may or may not be school-related, and see how the overarching theory of their learning can be adapted and applied.

These formed the basis for successful near transfer for some students, while the application of similar metacognitive strategies that asked them to engage mindfully and deliberately to discipline specific problem sets optimized the possibility of far transfer as well.

Metacognitive Practices Support High-Road and Far Transfer

In an internal online survey, students in the course responded to a number of qualitative questions about metacognition and transfer. The first three questions asked about the frequency of using metacognitive writing strategies in UWRT150, in COS Metacognitive Approaches to Science, and in other STEM coursework. The next two questions asked about transfer between FYW/COS and then FYW /other STEM coursework. Our numbers for this pilot were small, *N*=17: 10 IMPRESS grant students, 7 non-grant students, and are not reliable enough to make wide generalization, but the results do suggest a common-sense pattern: students used metacognitive writing strategies most frequently in UWRT 150, somewhat less frequently in COS, and less frequently still in other STEM coursework. In the second set, students were more likely to transfer metacognitive writing strategies between the linked courses, and less likely to transfer them into other STEM coursework. Not surprisingly, linked coursework affords more frequent and likely opportunities for near transfer.

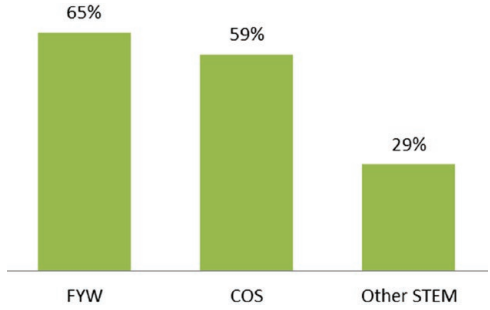

Figure 10.1. Percentage of students reporting use of metacognitive writing strategies as frequently/very frequently/all the time.

Figure 10.2. Percentage of students reporting transfer of metacognitive writing practices between courses as frequently/very frequently/all the time.

Students were able to elaborate their Likert scale answers by responding to the short answer question on the survey, "How do you use metacognitive strategies in your STEM coursework?" Some students reported that they were using metacognitive strategies in useful ways: to track their progress, approach tasks, overcome obstacles, find connections, gain process awareness, become more analytical of themselves and their instructors, and evaluate "why I'm being asked to do that stuff." Others said that they used metacognition to compare what they had done in other writing contexts (i.e., high school, work, community organizations, etc.) to what they were learning about their own behavior as writers in this course. They are engaging in what Kathleen Blake Yancey calls in her chapter of this volume and elsewhere "mapping the prior": "I look back to what I already know," "the various knowledge that I learned," etc. One student's discussion board post illustrates this:

> Negretti's paper related to how I wrote and how I learned to write all the way from my middle school to high school career. Because of my ability to write well in analytical formats, I was always considered a "good" writer . . . but I never really understood what *made* a good writer, and why other people in my class didn't have whatever that was. I never thought so much about how I wrote, or how I thought about thinking about how I wrote (I never even tried to contemplate changing the way I wrote, considering it seemed beneficial to a good grade). Reading Negretti's paper made me think about my shortcomings as a writer, and how I could change my writing style just by analyzing my own thought processes and writing processes to further my "rhetorical consciousness."

In addition to mapping prior knowledge, the student is having what Jan Meyer, Ray Land, and Caroline Baillie (2010) call an "encounter with troublesome knowledge" (p. xi), in which her prior knowledge ("I was always considered a 'good' writer") is now frustrated by a new kind of knowledge ("rhetorical consciousness").

This new knowledge, juxtaposed with the old knowledge, thrusts the student into what Meyer et al. term a "liminal state" (2010, p. xi), where the student now investigates what is now true about her writing. Operating in this liminal state, she begins to integrate new knowledge from both her COS and FYW courses to shift her conceptual frame about her own writing. In her Unit 1 paper, the student continues to question why she self-categorized herself as a "good" writer, connecting that perception to the Dunning-Kruger effect concept from a reading in her COS class—a concept which suggests that that the less

knowledgeable or skilled a person is in a particular area, the more likely they are to overestimate the quality of their performance.

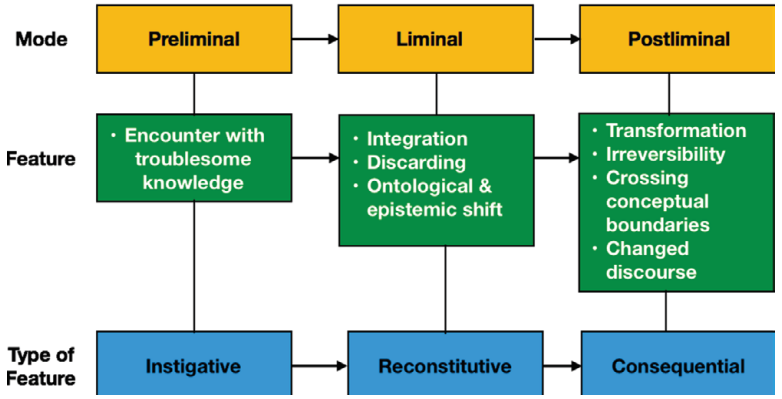

Figure 10.3. A relational view of the features of threshold concepts (Meyer et al., 2010, p. xii).

The Dunning-Kruger effect is referred to in passing in the Negretti reading from her FYW class, but it is a major concept in the linked COS course. The student brings the Dunning-Kruger concept to bear on the Negretti reading: "In reading Negretti's study, I constantly wondered . . . whether this 'Dunning-Kruger' effect applied to the students in [Negretti's] the study." This student-author is engaging in near transfer: the linked coursework on metacognition makes this connection and cross-conversation feel natural, especially as her conceptual framework about her writing shifts to include new knowledge. She also, however, is beginning a deeper exploration of her own agency in the writing process. Reading these authors, discussing these ideas in her linked classes, she feels empowered to alter her familiar approach to writing task to "change [her] writing style just by analyzing [her] own thought processes and writing processes."

Explicit Discussions of Transfer and Metacognition Support Interdisciplinary Thinking

Rochester Institute of Technology (RIT) is somewhat fondly referred to by students as "Brick City" where brick buildings represent different colleges: Engineering, College of Applied Science and Technology, College of Science, College of Imaging Arts and Sciences, etc. As an RIT student, it is natural to think of each building as the home for a particular discipline, a specific place for a particular kind of learning which has implications for their careers. In this context, FYW seems for many students to be not only unrelated, but an unnecessary use

of time in a competitive educational environment where students are advised to delve quickly into their field-specific knowledge.

Most undergraduate students have not yet been "disciplined" to the degree that these specializations become barriers to transfer and are therefore more likely to widen their field of view to include possible interdisciplinary connects between their classes. This helps them to avoid the "monotonic" (Bazerman, 2011) kinds of research questions that stay safely in the field of Writing Studies. In relating his experience with interdisciplinary, Bazerman writes that the diverse "theory, findings, and data I encountered carried baggage, very interesting baggage, which tempted me to rummage about and even play costume games" (2011, p. 13). For FYW students, these costume games are liberating and, because they are participating in these outside of their home disciplines, these games are relatively low-risk.

These "Science of Writing" FYW courses encouraged this kind of interdisciplinary perception, first through the title of the course itself, and then supported by the research project assignments. The students' research topics maintained a focus on Writing Studies, but were encouraged to find innovative ways of blending writing topics and questions from their home disciplines, like "Photojournalism: Visual Storytelling in Media" and "Musings on the Triangular Homogeneity of Metacognition, Writing, and Chess." In "Writing in Math," one student investigated the current underutilization of writing tasks in mathematics education. Acknowledging that the majority of research focuses on teaching math through writing in K-8 contexts, she calls for complicating and expanding writing tasks in math education for college students; because many math teachers "make the learning areas so small and concrete." In her reflection, she discusses her interdisciplinary approach to this project and learning in other classes:

> In First Year Writing we focused on transfer and metacognition and how it would help us to relate our outside courses. In my experience, this helped me greatly. It allowed me to really get a feel for everything I was learning all at once as one giant web structure. It made me more aware as I was trying different concepts from one engineering class to the other or from First Year Writing to a paper in Metacognitive Approaches to Scientific Inquiry. I also took some of the concepts and writing strategies learned in this class and put them into my project for my Calculus class.

By moving knowledge from one context to another, she builds a "giant web structure" of learning that allows her to see connections and applications across her classes in different disciplines in spite of the brick-reinforced disciplinary

compartmentalization at RIT. Students without this awareness may not see learning as interdisciplinary and struggle to make these connections. If we are serious about encouraging transfer between disciplines, having students experience the permeability of these disciplinary walls is important, especially at the beginning of their academic careers.

Interdisciplinary Transfer of Metacognitive Practices Increases Student Agency

King Beach (1999) identifies a number of "crevasses" in analyzing the transfer metaphor, one of which is that transfer has an "agency problem" (p. 108). He uses the analogy of a cyclist who learns that the faster she rides, the easier it is for her to balance and arrive at her destination in good time and without injuring herself. The agency problem is that the cyclist may not be aware of how her interactions with the bicycle lead to her arriving unscathed at the destination, and this lack of understanding of her role in bicycle physics means that she doesn't recognize her role in causing this outcome. Regardless of the prudence in picking at one metaphor (transfer) with another (bicycles), Beach's point is clear: Even if she is in control, she has no sense of control and therefore sense of agency because she is unaware of her role.

Metacognition helps to bridge this crevasse. By presenting transfer and metacognition in an interdisciplinary linked course model, students develop an awareness of how their learning in one context/discipline is brought into another. Once that awareness begins to develop, students see themselves doing the work that is described in the articles read in the courses. One student reflects on how his experience in this FYW/COS linked coursework connects to James Pacello's (2014) study of a metacognition-focused developmental reading and writing course:

> In terms of continuously reflecting on our work, I think RIT's IMPRESS program has so far stayed true to Pacello's studies, and the previous readings on metacognition. We already are going through the processes of writing, and re-writing, sending self-reflections, and even completing these discussion posts to receive feedback from our peers and professors. Along with this, Pacello thinks that if classes are connected with one another, a more cohesive educational bond is created to help students learn, which also occurs at RIT. Although I wish some of the science and math departments approached education this way, I can still apply metacognitive skills to them in

> ways to help myself learn more successfully.

Like the students completing blog posts in Pacello's study, this student is examining the activities of the linked courses and assessing whether or not they fulfill the kinds of activities that "assist students in recognizing how the literacy skills developed in the course could be helpful to their success in college classes and in other contexts" (Pacello, 2014, p. 121). The student concludes that they do, citing a number of literate activities ("processes of writing, and re-writing, sending self-reflections, and even completing these discussion posts") that he and his classmates complete in the linked courses. But where he illustrates agency most clearly is in the last line, when after "wish[ing]" that the approach of his non-linked STEM coursework leveraged this approach, he concludes that it doesn't really matter because he can still apply the skills anyway, and thus get the benefits without the teacher specifically helping him to do so.

Not all students feel comfortable with the processes of metacognitive reflection, and do not necessarily feel empowered with agency. In responding to David Bartholomae's (1986) article, this student fumes:

> I mean sure I have my own essay voice, but it's super sarcastic and a little annoying, and when I write for my reader it sounds so much smarter, like I know the subject on an expert level. To put it in better words I was "trying on the discourse even though I lacked the knowledge to make the discourse a routine." Instead of writing as a student with a minor knowledge I pretended to be an expert on what I was saying, which according to Bartholomae is something every student does whenever they write. Maybe we can never escape [pretending] unless we write for ourselves and with the knowledge that we actually have. And I'll admit right now I have NO idea what I'm doing right now, I don't even know what I'm saying. I usually don't, but it's hard to not pretend that I do, because I was so used to doing it all my life in everything I wrote.

This student is expressing the difficulty of knowing what she is doing as she does it, and how this pretending toward authority unsuccessfully disguises this difficulty. She is developing an awareness of how her thinking and experience, as well as the expectations of others, complicates her writing process and that there is work to do to self-regulate her own writing process from the knowledge she herself feels she authentically possesses. Being aware, and having the authority to act on that awareness are not the same for her just yet. Not all cyclists know that they are in control of how well or poorly their bikes perform for them; when

they do understand the mechanics of it, it may take time before they are ready to repair or adapt it to their needs' ends. Not all writers and learners know how their writing and learning works, or if they do, they may not be ready to trust their knowing. Thinking about the approach to an activity, whether riding or writing, increases the possibility for development and growth.

CHALLENGES AND CONCLUSIONS

Working with the students, watching their metacognitive awareness evolve, and enlisting them as co-investigators has helped us shift our own conceptual framework about the usefulness of teaching writing with a metacognitive. We have identified the following five challenges to teaching writing with an emphasis of thinking about "thinking about writing."

Metacognition is a hard habit. As the above relational mapping of metacognitive skills acquisition by Meyer et al. (2010) suggests, it takes exposure over time to fully incorporate a solid metacognitive awareness and practice. In post-course interviews the following semester, a few students brought a complaint: "I just need something to remind me to do metacognition." This desire to transfer metacognitive practice into new learning situations that do not explicitly present it is what Meyer et al. would characterize as an ontological, epistemic shift in the liminal mode: the students know that they would benefit from applying metacognition in their coursework. However, for these students, post-liminal irreversibility and transformation is not yet achieved because the feature is not habituated. While their discourse has changed in talking about the linked FYW course with us in the context of a post-course interview, it appears that the discourse has not yet changed in contexts/courses that do not explicitly call for it. Student interviews seemed to suggest that they wanted more explicit metacognitive practice in classes they took *after* FYW. At the very least, writing faculty and interdisciplinary writing-intensive faculty could work together to bridge FYW and W-I Gen Ed classes across the Arts and Sciences by using shared curricular practices of journaling about assignment elements and how to accomplish them (task perception), diagraming where their ideas might come from outside the class/discipline (concept mapping) and outlining a revision plan from peer review notes on a writing project (self-regulation and reflection).

Teaching metacognition requires a deep understanding of metacognition. Echoing Downs and Wardle's (2007) call for expert instructors in writing about writing courses, we agree that teachers presenting metacognition as a component of their course need to have conceptual and pedagogical understandings of metacognition and its impacts for student learning. Simply "adding in" strategies to build metacognitive awareness without first understanding it can lead to what

Nance C. Wilson and Haiyan Bai (2010) observed in their assessment of MA Education graduate students, that even with a rich understanding of metacognition, contradictions between theory and practice can and do appear. They present a number of valuable explanations for this, including pressures to cover a lot of material and institutional pressures to teach set curricula (Wilson & Bai, 2010, p. 286). In assessing our own pedagogy moving from the spring 2015 pilot to the present fall 2015-2016 course, we can agree from experience that teacher education and professional development are imperative for successful implementation of metacognitive practices in FYW.

Linking FYW and metacognition puts metacognition in a writing box. The course is still called UWRT150, not META150, and as students transition from this course to other classes, knowledge learned in UWRT150 is likely to be labeled as "writing knowledge," "writing skills," or "English class." This can be an impediment to transfer, particularly in STEM contexts, because Liberal Arts courses are widely regarded as general or unrelated to coursework in STEM majors. Even with the College of Science course link, presenting metacognition in a writing context may have the unintended consequence of leading students to believe that it is a special part of Writing Studies, particularly if metacognition is not presented in future courses as part of that discourse community's concerns.

Metacognition is hard to recognize and assess. This is due, in large part, to the course not explicitly measuring or assessing levels of metacognition; unless there are explicit assessment measures built into the writing process, knowing exactly where and when these strategies were employed during the process is hard to pinpoint. While students did complete reflection letters and discussed their metacognitive strategies, self-response measures like Virginia Jimenez-Rodriguez, Maria Alexandra Ulate-Espinoza, Jesus Maria Alvarado-Inzquierdo, and Anibal Puente-Ferreras' (2015) EVAPROMES assessment scale or introducing more student self-assessment frameworks like those gathered by Kristen Nielsen (2014) may help to make metacognition a more visible part of students' writing process.

Metacognition enhances transfer. Low-road and near transfer may transfer unconsciously, but high-road and far transfer is less likely to happen without a student consciously evaluating how their prior learning can be applied to or influence new learning contexts. Kathleen Blake Yancey, Liane Robertson, and Kara Taczak's Teaching for Transfer (TFT) curriculum turns reflection into a "systematic activity keyed to transfer" (2014, p. 33) and goes a long way toward making student discussion of transfer an explicit goal of the course. In addition to this, wider metacognitive practices beyond reflection, such as self-regulation, self-evaluation, and task perception open more opportunities for what Perkins and Salomon (1988) call "deliberate mindful abstraction of skill or knowledge

from one context or application to another" (p. 25).

For students to engage in mindful transfer, focusing on the habit of metacognition is a valuable addition to curriculum designed for transfer.

The purpose of metacognition. In assigning reflection, we are asking students to re-envision their prior thinking and doing; in task perception, we ask students to interpret new tasks based on their prior experience with similar (and dissimilar) tasks; in self-evaluation, we ask students to see their own work from an outside point of view in order to assess it; in self-regulating, we ask students to take responsibility for their own learning. The purpose of all this metacognitive activity is to regulate, change, or otherwise impact cognition. We want students to think differently, divergently, potentially disruptively, and we want them to continue this habit beyond these linked courses. When students become aware of how they gain, present, and organize knowledge, they are better equipped to transfer that knowledge as well as regulate new knowledge in the future.

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