



# Beyond Decoding the Disciplines 1.0: New Directions for the Paradigm

## ABSTRACT

Decoding the Disciplines has emerged as one of the foremost approaches to the scholarship of teaching and learning (SoTL) and is being used to increase learning across the globe. But it is often not recognized that the paradigm has undergone enormous changes since its appearance in 2004. The original model has been clarified and perfected, but scholars of teaching and learning have also expanded the scope of this work to include emotional, bodily, and social learning; created new roles for students in these investigations; and explored learning beyond the individual. Some of these changes have been so far reaching that they may be said to constitute a new version of the paradigm, Decoding 2.0. It is the purpose of this article to provide an overview of this paradigm's development since it first appeared on the SoTL stage.

## KEYWORDS

decoding the disciplines, troublesome knowledge, student learning, bottlenecks in learning

## INTRODUCTION

“Why don't my students understand what I am trying to teach? It seems so obvious to me, and yet, so many of them are unable to accomplish the most basic tasks.”

This question has plagued teachers for centuries, and there are few issues of equal importance to anyone concerned about higher education. Yet the answers that have been common in the past—that students are simply too stupid or too unmotivated to do the work—seem utterly inadequate today. Such explanations lead faculty to focus their efforts on those who arrived in their courses already prepared to do the work and seek to flush the rest out of the system. Such responses may have made some sense in a world in which one of the primary purposes of college was to reaffirm the position of a small elite, but it is utterly dysfunctional in an age in which mass education is a necessity for the welfare of large numbers of students, the health of our economies, and the very survival of democracy. The growing inequality in economic and educational opportunities—a condition that has been made even more serious by the COVID-19 pandemic—has only increased the need to find ways to understand the obstacles that thwart student learning and help them surmount these difficulties.

At its core, SoTL is about making such queries the beginning of a process of systematic intellectual analysis (Bass 1999). The publication of *Decoding the Disciplines: Helping Students Learn Disciplinary Ways of Thinking* (Pace and Middendorf 2004) provided the field a new way to respond to such questions. For more than a decade and a half, Decoding the Disciplines has been at the forefront of efforts to understand why so many students struggle in college courses and to find ways to help more of them succeed.

Decoding began with a proposition, a focal point, and a process. It proposed that many of the difficulties that students encounter in college courses arise from the fact that their instructors are so accustomed to performing the basic tasks in their disciplines that crucial steps in the process have become invisible to them and, thus, are not taught. Secondly, to identify such untaught skills, Decoding suggested that rather than beginning with content or with particular techniques, teachers and scholars of teaching and learning should first focus their attention on bottlenecks to learning, i.e., those places in courses where significant numbers of students have difficulty performing essential tasks. And finally, Decoding offered a seven-part process by which the essential skills required in a course could be identified, taught, assessed, and shared with others.

This approach provided a very useful strategic framework for understanding and addressing learning difficulties and it now is being used to increase student learning in at least 15 countries. It also proved to be a powerful research method for scholars of teaching and learning who have produced three additionally significant books (Pace 2017; Miller-Young and Boman 2017a; Middendorf and Shopkow 2018), two online volumes (DiZ – Zentrum für Hochschuldidaktik 2019, 2020; Chistolini 2019), and more than 180 articles and papers based on the decoding paradigm (Decoding the Disciplines, n.d.). By 2012, Nancy Chick, Aeron Haynie, and Regan A.R. Gurung could write that “Pace and Middendorf’s groundbreaking *Decoding the Disciplines* continues to be at the center of most discussions of how to begin thinking about what Shulman calls ‘pedagogical content knowledge’” (Chick, Haynie, and Gurung 2).

The framework laid out in the 2004 publication provided a baseline for this work, which can be designated Decoding 1.0. This, however, was a framework for investigation, not a technique that could be mechanically imposed or a doctrine to be accepted or rejected. Therefore, as scholars of teaching and learning applied it in a variety of different learning situations, they altered it in ways that were not envisioned in the original version of the paradigm. Some of this work simply involved clarification and expansion of the 2004 model and can be viewed as creating an enhanced version of Decoding 1.0. But other scholars of teaching and learning implicitly or explicitly went beyond the initial focus of the paradigm on cognitive processes to consider emotional, bodily, and social dimensions of learning. Some brought students into the picture, both as co-investigators and as the subject of Decoding interviews. Others abandoned the original focus on disciplinary learning and considered ways that the paradigm might be used to respond to larger challenges in academia that transcended the individual classroom, or to critique the ideological foundations of existing disciplines. All of this latter work continued Decoding’s emphasis on identifying bottlenecks and systematically making explicit what students must learn to do to overcome them. However, it diverged sufficiently from the vision contained in the original *Decoding the Discipline* volume that it can more accurately be described as Decoding 2.0.

Decoding 1.0 can still be employed effectively to increase student learning, and the original volume remains a useful entry point into this work. But the model has subsequently been so enriched that it is time for an overview of how the paradigm has been altered and a consideration of how it might be developed further in the future. Therefore, in the review essay that follows, I will trace the expansion of Decoding since 2004 and consider how some of its basic assumptions have been reformulated. The literature is far more extensive than can be adequately presented in a single article and I will be unable to mention many valuable works. Of course, all that follows reflects my own perspective on the field and others might present different visions of its development. Nevertheless, hopefully this essay can provide

a general road map to the refinement of the original model and to the fundamental challenges to the original approach that constitutes Decoding 2.0.

## THE CREATION OF DECODING 1.0

(Readers who are familiar with the 2004 model of Decoding may wish to skip this introduction to the paradigm and move to “Part 1: Enhanced Decoding 1.0” below.)

Decoding the Disciplines approach emerged within the Indiana University Freshman Learning Project (FLP), a faculty development program that Joan Middendorf and I directed from 1998 to 2010. Each year we recruited a group of instructors from various disciplines and led them through an exploration of places in their courses where large numbers of students experienced difficulty doing essential tasks. We recognized that even the dedicated groups of teachers who made up annual cohorts of the FLP faculty were failing to teach some of the crucial steps their students needed to master to succeed in their courses. This was not due to their lack of commitment to teaching. As experts, they were so accustomed to automatically conducting many of the basic mental operations in their fields that these had become invisible to them, and thus, were not being taught. It was as if these instructors provided their students with the kind of directions produced by Google Maps, but had inadvertently omitted many lines of the instructions. Students who were already familiar with the territory found their way with little difficulty. A few students with unusual skills at pathfinding turned the limited set of clues at their disposal into a strategy for reaching the destination. But others, who were not pre-educated in the field or endowed with a special predisposition for the discipline, became hopelessly lost.

Therefore, we developed an interview technique designed to help faculty become more aware of what students need to be able to do to overcome each learning obstacle in their courses. Two interviewers, preferably from outside the teacher’s discipline, would ask the instructor to identify a place where students had difficulty performing basic tasks. They then pressed the interviewee to explain precisely how an expert in the field would go about completing the work that was so challenging for many students. The interviewee would then be pressed to go deeper into the process until all the steps needed to successfully accomplish the task had been made explicit.

Over time the identification of bottlenecks and the interview process evolved into the first two steps of the seven-part process that lay at the heart of Decoding 1.0. This procedure can best be understood by seeing how an accomplished teacher, Tony Ardizzone, used the seven steps as a framework for developing a lesson plan for a course on “Introductory Creative Writing” (Ardizzone, Breithaupt, and Gutjahr 2004).

### **Step 1: Identify a bottleneck to learning**

Ardizzone found that while most of his students had mastered the basic skills involved in expository prose, they had difficulty making the transition to creative writing. Their work “lacked the vitality of well-written poetry and fiction” because they had no process for moving from an initial idea to an effective poem or story (Ardizzone, Breithaupt, and Gutjahr 2004, 46).

### **Step 2: Make explicit the steps that students must follow to get past the bottleneck**

As an accomplished writer, Ardizzone could automatically perform a series of mental operations that would transform a bland first draft into a polished poem. To help more of his students do the same, he had to make these steps explicit. An analysis of his own practice revealed a series of steps, such as “move from abstractions to particular movements” or “be specific and concrete.” It is important to note that in defining these actions Ardizzone was not limiting the creativity of his students, but rather helping them prepare a space in which to express their creativity, just as a piano teacher introduces students to exercises that allow them to eventually give voice to their own individuality.

### **Step 3: Model these steps for students**

Once Ardizzone defined the processes he wanted to share with his students, he devised an ingenious strategy for modeling these in class. He assigned “Morning Song,” a poem by Sylvia Plath about the birth of one of her children. But rather than expounding directly on the virtues of the poem, he asked his students to imagine how she might have gone about writing such a poem if she had been a student in a creative writing course presented with the prompt “write a poem about someone you love.”

Ardizzone then presented the class with an imaginary first draft that Plath hypothetically might have begun when she sat down to create “Morning Song.” In front of his students, he systematically applied the process for rewriting that he had defined in step 2 of Decoding, and the students saw the polished opening lines of Plath’s poem emerge slowly from the kind of crude prototypes that they could produce.

### **Step 4: Allow students to practice each step and get feedback**

In his contribution to the 2004 *Decoding the Disciplines* volume Ardizzone did not describe the opportunities that his students were given to practice these steps, but these are easy to imagine. He might, for example, have provided them with a few lines from the rough draft of a poem and asked them to show how one or two of the processes he had modeled in class could be used to improve it. Later they could be asked to repeat this process with a full first draft of their own creation. Such exercises would allow the students to perfect their abilities to do some of the steps needed to polish their work before they were faced with the potentially overwhelming challenge of producing an effective poem from scratch.

### **Step 5: Motivate students to undertake the work**

Just as many students arrive in college convinced they can never do math, others believe they lack some special gift required to write a poem. If they had simply been given examples of world-class poetry and then been asked to produce work of their own, their crude initial results would confirm their belief that there was no chance that they might produce even a passable piece of work. By demonstrating how a crude draft could be transformed into a finished poem and by providing some of the necessary steps in that process, Ardizzone empowered his students to imagine they could move beyond their initial efforts.

### **Step 6: Assess student learning**

After the presentation described above, Ardizzone used two classroom assessment techniques (Angelo and Cross 1993) to determine whether the students had absorbed the lesson and if the kinds of

practice lessons described in step 4 would provide more information about their mastery of the process. Such assessments allow an instructor to know in real time whether the initial efforts have been successful at helping students overcome the bottleneck or whether it is necessary to offer them more modeling and practice.

### **Step 7: Share what has been learned**

As a participant in the FLP, Ardizzone developed his strategy for overcoming his students' bottlenecks within a community of other teachers, and that fact, plus the systematic nature of the decoding steps, made it easy for him to share the process laid out in his article.

The creativity that Ardizzone displayed in creating this master lesson is impressive, but in the context of this review article, what is important is the framework within which he did this work. Few of us are apt to teach courses in which we can borrow his technique for showing students how to begin writing a poem. But the larger Decoding framework—identify a bottleneck, define operations, model, give practice, deal with potential emotional blocks, assess, and share—is applicable in virtually any teaching situation.

Taken together, these seven steps of Decoding provide an approach to increasing student learning that, in the words of Peter Riegler

*combines elements of research on expertise and misconceptions, of professional development, of coaching, of collegial counselling, and of Scholarship of Teaching and Learning into a process of teaching development, which acknowledges the difficulties students have in learning subject-specific patterns of thought and action as inherent to processes of teaching and learning.” (Riegler 2020a, 7)*

The remainder of this review essay will trace the way the original Decoding paradigm has developed since 2004. Part 1 will consider ways in which the original model has been further developed or expanded into new areas. It will consider how certain elements of Decoding 1.0, such as the interview process or the seven steps, have been modified without moving outside the basic premises of the initial paradigm. Part 2 of this essay will explore the work of scholars of teaching and learning who have explicitly or implicitly made such significant changes in the 2004 prototype that their work constitutes a new Decoding 2.0. Finally, there will be speculation on directions the paradigm might take in the future.

## **PART 1: ENHANCED DECODING 1.0**

### **Situating Decoding within a broader context**

Much of the initial work within Decoding 1.0 involved applying the paradigm to bottlenecks to learning in various disciplines. The 2004 *Decoding the Disciplines* volume included specific applications of the paradigm to teaching in the disciplines of history, biology, physiology, astronomy, literary studies, statistics, and marketing. Over the next several years the History Learning Project (HLP) used the approach in interviews with 24 historians to demonstrate how the central bottlenecks to learning in a particular discipline could be systematically identified and the mental operations students needed to master could be made explicit (Díaz, Middendorf, Pace, and Shopkow 2007, 2008; Middendorf and Pace 2009; Shopkow 2013). A host of scholars of teaching and learning followed in this pathway

providing models for application of the approach in more than 30 fields (Decoding the Disciplines, n.d.).

However, it soon became clear that in addition to such applications of the paradigm to specific disciplines, there remained two crucial issues that still needed to be addressed: 1) making more explicit the theoretical foundations of the approach and 2) situating Decoding within the broader context of emerging models for SoTL. Leah Shopkow undertook the first task by placing the teaching of disciplinary epistemology at the center of this work. “We are calling,” she wrote, “for epistemology to be moved from the periphery of teaching and learning within the discipline to become the core. We are calling for faculty to make teaching the ways of knowing as central to their teaching as it is to their research” (Shopkow et al. 2013, 18). From this perspective, teaching became not just a matter of conveying knowledge to students, but also of immersing them in the processes by which that knowledge had been generated. As such, Decoding offered a particularly powerful tool for accomplishing this task.

Moreover, since students’ misunderstandings of how knowledge is generated in a field leads to many different learning problems, using Decoding to solve one of these could have a positive ripple effect throughout a course and beyond. As Shopkow wrote, “although the bottlenecks can seem disconnected from each other, they are actually interconnected with each other, and they are all surface manifestations of points of the epistemology that students do not fully comprehend” (Shopkow 2013, 24). Therefore, when instructors succeeded in modeling the mental operations required to overcome a particular obstacle to learning in one of their courses, their students often absorbed an understanding of the field that could help them avoid other bottlenecks.

Shopkow’s work provided a firmer intellectual framework for understanding Decoding 1.0, but there remained the task of positioning this work in the broader framework of SoTL. In the German context, for example, it was necessary to specify the relationship between Decoding and the older tradition of *Hochschuldidaktik* (higher education didactics) (Metzger and Brose 2020). More broadly, the decoding paradigm had to be related to the somewhat related inquiry into Threshold Concepts (Meyer and Land 2003; Meyer and Land 2005; Meyer and Land 2006; Land, Cousin, Meyer, and Davies 2006; O’Mahony, Buchanan, O’Rourke, and Higgs 2014). Decoding and Threshold Concepts had developed simultaneously with, but independently of, one another, and both are based on theories of student difficulty. Yet, there are significant differences between the two frameworks that needed to be defined and this task has been taken on in a series of books and articles that have attempted to define the relationship between the two approaches (Shopkow 2010; Bass, Debelius, Maloney, Rivers, and Tilden 2011; Shopkow, Díaz, Middendorf, and Pace 2013; Higgs and Cronin 2013; Pace 2017, 20–23; Middendorf and Shopkow 2018, 187–89). This work has culminated in Leah Shopkow and Joan Middendorf’s recent article “Caution! Theories at Play! Threshold Concepts and Decoding the Disciplines,” which is essential reading for anyone interested in either of these strategies for increasing student learning (Shopkow and Middendorf 2019).

These efforts to define the similarities and differences between Decoding and Threshold Concepts opened the possibility of productive interactions between the two approaches. For example, Leah Shopkow (Shopkow 2010, 2013) and Brad Wuetherick and Elizabeth Loeffler (Wuetherick and Loeffler 2014) pointed out that in fields such as history and art history where there is not a strong explicit methodological consensus within the discipline, the decoding interview could be used to bring to surface hidden Threshold Concepts. Such efforts to harmonize these paradigms were greatly

facilitated by the generosity of the leaders of the Threshold Concepts movement who opened their conferences to sessions on Decoding and explored ways to integrate its insights with their own work. Of particular importance in this regard is Julie Timmermans and Jan Meyer’s “A Framework for Working with University Teachers to Create and Embed ‘Integrated Threshold Concept Knowledge’ (ITCK) in their practice” (Timmermans and Meyer 2017). Their thoughtful appreciation of the potential for cross-fertilization between the two approaches provides a firm foundation for future work in this area.

### **The Decoding interview reexamined and bypassed**

At the core of Decoding is the challenge of countering what Peter Riegler has called the “curse of expertise” [*Fluch der Expertise*] that is produced when teachers have “automated important discipline-specific thought patterns to such an extent that they cannot explicate them” (Riegler 2020a, 5; Riegler 2020c). The decoding interview emerged early in the development of the paradigm as the most effective means of overcoming this curse. But in the intervening years many scholars of teaching and learning have subjected the original techniques of the interview process to greater scrutiny, with special attention paid to the kinds of questions posed, the flow of the exchange, the need to overcome resistance, and the interpersonal relationships between interviewer and interviewee (Miller-Young, Dean, Rathburn, Pettit, Underwood, Gleeson, Lexier, Calvert, and Clayton 2015; Pace, 2017, 39–47, 123–25; Middendorf and Shopkow 2018, 48–59).

A Decoding group at the DiZ – Zentrum für Hochschuldidaktik that meets in Ingolstadt, Germany has produced particularly insightful analyses of the decoding interview. Peter Riegler, a leader in this group, provides a useful commentary on excerpts of an actual interview (Riegler 2019), and Britta Folz has used concepts borrowed from the COACH model (come together, orientation, analysis, change, and harbor), used in consulting and coaching, to explore the formation of questions, the recording of insights, and even the spatial relationship among the participants in the interview (Folz 2020). Another participant in the DiZ group, Niall Palfreyman, has analyzed the linguistic processes involved in these interactions stressing that in listening to the expert, the interviewer must pay particular attention to such phenomena as nouns and verbs that are not sufficiently specified, to “magical information” that appears in explanations, to modal verbs such as “should” that emerge without any justification, and to generalizations that are presented without any consideration for possible explanations. He offers specific examples of how interviewers’ sensitivities to such verbal patterns in an actual interview can reveal elements that are crucial to student learning that might otherwise remain hidden. But Palfreyman goes far beyond simply describing the mechanics of an interview and places the entire process in a broader context of psychological theory that stresses the role of moving beyond a simple statement of disciplinary concepts to reveal the deeper experiential process of meaning making that underlies actual practice in the field (Palfreyman 2020).

Such analyses also open a path to new ways to make use of the interviews. In addition to cognitive patterns necessary for success in the discipline, interviewers can watch for bits of information, cultural references, or counterexamples that are necessary for the task at hand but are not in the possession of many students. And Pakiso J. Khomokhoana and Liezel Nel at the University of the Free State in South Africa have actually shown students carefully selected clips from interviews to help them understand what they need to do to succeed at computer programming (Khomokhoana and Nel 2019).

As Decoding spread, practitioners began to experiment with alternatives to the original form of the interview. Early in the work one instructor was questioned at length by two interviewers, at least one of whom ideally was an “inquisitive non-expert,” to use the apt term coined by a team in Canada (Timmermans et al. 2018). But as scholars of teaching and learning adapted the interview process in different contexts, they began to alter this basic framework. When presenting the process to larger groups, for example, they sometimes used a “fishbowl” approach, in which a larger group would observe the interview and add their observations and questions at specified intervals (for a video of this process see MacMillan et al. 2016). In 2014 a group of faculty from the law school at the University of the Free State in South Africa, including this author, explored another possibility when an entire department participated in a shared interview. They worked together to make explicit the steps that they, as experts in the field, followed interpreting a piece of case law. The scholars of teaching and learning at Mount Royal University in Calgary further expanded the process by having interviewees write commentaries on their interviews and by coding the transcripts to isolate points at which transformations in their understanding of pedagogical issues had occurred (Miller-Young et al. 2015; Petit et al. 2017; Yeo et al. 2017).

As such work demonstrates, the decoding interview has become a powerful and versatile tool for understanding what we need to teach to students. However, the process requires a major commitment of time and a willingness to publicly explore areas of pedagogical ignorance on the part of the interviewee and the presence of at least two other people familiar with the interview technique. Therefore, there have been efforts to find alternative methods for situations in which a full interview is not practical.

Joan Middendorf, who has been using Decoding as a faculty developer longer than anyone else, has developed an impressive array of alternate strategies for helping faculty understand what has been invisible in their disciplinary practice, including instructor-generated metaphors, analogies, mind maps, and rubrics (Middendorf and Shopkow 2017, 39–48, 59–63; Middendorf 2011). Swantje Lahm and Svenja Kaduk have also created an effective writing exercise that prompts participants to make explicit the mental operations that students must master to get past bottlenecks (Kaduk and Swantje 2018), and it is to be hoped that other strategies will be developed in the future.

### **Reconsidering the steps**

The first two steps of Decoding have proven to be so valuable, and in many ways so novel, that some of those using the paradigm assumed that if the basic cognitive operations required to overcome a bottleneck had been made explicit, student learning would automatically increase. However, translating the insights gained through the first two steps into a concrete strategy for increasing learning in a course requires a good deal of serious thought. Moreover, those who were experiencing the paradigm for the first time sometimes reported that they had difficulty fully grasping it until they had actually seen it being applied to specific situations (Froyd et al. 2007).

Thus, those practicing Decoding have devoted serious thought to the process of moving from the identification of bottlenecks to the development of concrete strategies for increasing learning in particular contexts, often making use of techniques such as Problem-Based Learning, Just-in-Time Teaching, or the use of metaphors in the decoded classroom. The best of these, such as Leah Shopkow’s impressive, award-winning essay on “How Many Sources Do I Need?” (Shopkow 2017), combine a



theoretical exploration of the process with descriptions of the specific steps that were taken to help students overcome the bottlenecks.

The (perhaps unfortunate) choice of the word “steps” to describe the seven functions encompassed by Decoding led many people to assume that these always had to proceed in a fixed order. This misunderstanding led one early critic to complain that

*the Decoding the Disciplines model tends to be a somewhat sterile progression of teaching versus a “dynamic endeavor.” It is represented by a series of stages and tasks, which give a sense of a linear view of teaching and learning. One cannot progress to the next stage without mastering the previous one. (Bowden 2007, 6)*

In fact, from its inception Decoding was conceptualized as just the sort of “dynamic endeavor” that Bowden favored. There was a certain logic to the sequence of the steps, but practitioners of the approach have often found it to be more effective to proceed in a different order or even to only focus on a subset of the steps. The process might begin with step six (assessment) to evaluate what potential cognitive or emotional bottlenecks are present in a particular group of students. Step seven (sharing) is often a part of the process from the very beginning, as instructors work together in faculty learning communities. It is sometimes effective to give students an opportunity to engage with a problem (step four) before formally modeling the process for them (step three). And, since this work is all an iterative practice, one may loop back to an earlier step anytime that seems appropriate.

It has also become clear that the elements of Decoding may be viewed not as a series of discrete acts, but rather a set of functions, several of which might be realized in a single action. It is still important to keep the steps conceptually distinct to be sure each function is actually being performed and explicit modeling is still necessary at various points in the course. But modeling, practice, and assessment can be distributed throughout every facet of a course and made part of its innermost structure. A class discussion can be framed so that the essential processes are being modeled at the same time as students are practicing them and the instructor is assessing their mastery of basic skills. The syllabus, a prompt for an assignment, a Just-in-Time Teaching exercise, or an exam can be structured so that the wording and the nature of the task model the basic operations (Pace 2019c).

While it might seem like a minor change, the shift to such a global vision of Decoding can transform the process from a sequence of separate interventions into the creation of a living environment in which the central patterns of operating in the discipline are so ubiquitous that students’ ways of operating are organically reinforced with every experience. Ideally, within such a pedagogical landscape it becomes more natural for students to adopt new ways of functioning than to return to pre-existing, dysfunctional processes (Pace 2017, 5–6, 140–41).

### **The social framework of Decoding**

There is one final area in which there has been significant development within the Decoding 1.0 model. In the original volume, the seventh step of the process was reduced to the question “how can the resulting knowledge about learning be shared?” (Pace and Middendorf 2004, 10). Readers might easily assume that the instructor using Decoding operated entirely in isolation until a final revelation of what had been learned was shared informally with colleagues or through SoTL papers or publications. In

retrospect, this was a distortion of the process because from its earliest origins in the FLP onwards, practitioners of the approach have generally worked with others at every stage of the process. In particular, the interview, which was central to so much work in Decoding, is by its very nature an intensely social experience.

In the years since the original presentation of the model, practitioners of the paradigm have made this collaborative element an even more robust part of the approach. It was recognized that in addition to its function as a process for increasing student learning, Decoding could also serve to create strong communities of instructors who shared an understanding of others' classroom challenges and a common language for responding to them (see, for example, Froyd et al. 2007; Timmermans et al. 2018).

The recognition of the power of the approach, particularly the decoding interview, to bond faculty together emerged most powerfully in the work at Mount Royal University. Janice Miller-Young and her colleagues at this Canadian university stressed the way in which the paradigm created a "climate of trust" within the group that greatly facilitated both communication and exploration, and the word "trust" appeared no less than 26 times in their 15-page article (Miller-Young et al. 2015. See also Miller-Young and Boman 2017b; Petit et al. 2017; Yeo et al. 2017; Miller-Young and Boman 2017c).

Such examples clearly demonstrate that Decoding is playing a new role in faculty development that was only partially visualized in its original formulation. In addition to its functions as a tool for increasing learning in particular courses, it can also bond groups of faculty together around shared goals and understandings, and this can drive both innovation and cultural change within and across departments. As Julie Mooney and Janice Miller-Young have effectively argued, the decoding interview can provide educational developers with a powerful tool for increasing the self-awareness of faculty, for producing podcasts or videos that spread new pedagogical ideas, and for providing the basis for further scholarly research (Mooney and Miller-Young 2021).

## PART II: BEYOND THE ORIGINAL PARADIGM

Each of the changes to the Decoding model described above filled in gaps or extended it into new areas. Yet to a large extent these could still be encompassed within the original vision that focused on the identification and the sharing of basic cognitive operations within particular disciplines. However, as the approach spread internationally and was used to respond to different types of learning issues, some of the initial assumptions of the 2004 formulation were reconsidered. The narrow focus on disciplinary knowledge was often replaced by a broader vision of learning that explored forms of learning that were not necessarily rooted in the epistemology of a specific field. The original emphasis on cognitive operations expanded to include emotional bottlenecks to learning, bodily activities, and patterns of professional socialization. Students were introduced to the process as co-investigators or as the subjects of decoding interviews. The approach was used to solve institutional problems that transcended individual classrooms. And finally, the process was turned back upon the disciplines themselves to reveal ideological assumptions that were hidden within professional practice.

These changes were rarely, if ever, presented as a repudiation of the original model. In addition, the scholars of teaching and learning who expanded the focus of the paradigm may not have always been fully conscious of how far they were moving away from its original formulation. Much of the framework of Decoding 1.0 continued in these newer explorations. There was the same emphasis on making explicit

what students need to be able to do and many of the tools of the original paradigm, such as the interview, continued to be used. But small alterations in the approach began to add up until it is now useful to coin a new designation, Decoding 2.0, to acknowledge the changes that occurred in field. The remainder of this essay will be devoted to an exploration of this work.

### **Deleting the disciplines**

Few elements of the original decoding model would seem to be more essential than the emphasis on disciplines (see, for example, Pace 2008). The very subtitle of the 2004 book *Helping Students Learn Disciplinary Ways of Thinking* seemed to proclaim that there could be no Decoding without disciplines. Indeed, this focus served to distinguish Decoding from the focus on generic forms of critical thinking that were popular in the 1980s and 1990s, and it helped scholars of teaching develop forms of pedagogical content knowledge that would be useful in particular disciplines (Shulman 1986).

But from the beginning, there was also an awareness of the limitations of this emphasis on disciplinary learning. Clearly there were often major differences in teaching within particular disciplines and similarities across disciplinary boundaries. And, as the broader conversation on teaching and learning became less concerned with generic critical thinking, the need to emphasize Decoding's focus on problems in specific fields became less pressing.

Sometimes the impulse for exploring Decoding outside a narrowly disciplinary context was motivated by the application of the paradigm to interdisciplinary areas of study, such as Asian Studies (MacPherson 2015), sustainability (Fischer 2018), service learning (Petit et al. 2017), or Indigenous Studies (Easton, Lee, Roberta Lexier 2017; Easton et al. 2019). In other cases, the power of the interview process itself took scholars of teaching and learning in unexpected directions. Peter Riegler's exploration of bottlenecks in math, for example, led to a fascinating exploration of the linguistic aspects of mastering basic phenomenon in the field (Riegler 2016, 2019).

In addition, as the number of decoding interviews increased steadily, some of the same bottlenecks, forms of expertise, and affective dispositions appeared in multiple fields. A faculty learning community at the University of Waterloo, led by Julie Timmermans, conducted interviews with faculty from fields as disparate as philosophy, environmental science, and mathematics and, yet, frequently encountered "a deep sense of care" that transcended the superficial differences in the disciplines (Timmermans et al. 2018). The creative team of decoding practitioners at Mount Royal also found that shared interviews unearthed similar patterns of operating in nursing, journalism, acting, and engineering. In each area, they found experts were much more likely than students to perform certain kinds of actions, such as breaking down and reconstructing knowledge, pattern recognition, valuing provisionality, examining a problem from different perspectives, and attentiveness to the immediate environment, as well as an emphasis on taking action and on ethics and authenticity (Miller-Young and Boman 2017b, 23–31).

It is important to recognize that such explorations of learning do not represent a return to the search for universal forms of critical thinking that preceded Decoding. The process still begins, not by looking for superficial similarities across disciplines, but rather by carefully examining learning needs within very specific teaching situations. Once these factors have been identified in one area, however, they can alert us to watch for that pattern when we begin to explore what works in a different field. For example, interviews in multiple disciplines have revealed a common difference between novice and

expert practice is that experienced practitioners are much more apt to pause to consider various possible avenues at crucial points in analysis. The awareness that this is a common problem for students can alert a savvy interviewer to the need to explore this process in interviews in many disciplines.

### **Opening to other approaches**

Decoding 1.0 was somewhat insular. Practitioners typically moved through the steps without employing other tools for understanding student learning. Those operating within the context of Decoding 2.0 have begun to move beyond this restriction. For example, in their efforts to find new ways to help students master the intricacies of computer programming, Pakiso Khomokhoana and Liezel Nel of the University of the Free State in South Africa have broken out of those limitations by adding new steps before and after decoding interviews. Rather than launching directly into questions about how instructors went about reading source code, they first prepared for the interviews by familiarizing themselves with some of the theoretical literature on cognitive processes, such as attention, perception, memory, reading, speaking, and listening. The issues raised in this body of work helped shape their questions and their observations of the interviewees' responses. In addition, after the interviews they asked each instructor to complete a particular programming task in a think-aloud exercise that provided them with a second perspective on what instructors in their field needed to share with students. As a result of this three-part process, they were able to identify 17 steps that students needed to master to successfully replicate their teacher's methods of reading source code (Khomokhoana and Nel 2020). Their impressive work can provide a highly useful model for integrating the decoding process with other models for exploring what students need to learn.

### **Beyond the cognitive (1): Putting feeling into it**

From its beginnings, Decoding has been committed to discovering what students need to be taught to do to succeed in particular courses. Early in the development of the paradigm, however, this search for missing steps focused almost entirely on cognitive processes. The effectiveness of the decoding interview in making such steps visible was revealing so much about the purely intellectual procedures that students needed to assimilate that we neglected to fully consider the extent to which there might also be emotional, bodily, and social processes that also needed to be shared.

The recognition of important non-cognitive elements in learning may also have been impeded by the terminology embraced early in the development of Decoding. The phrase "mental operations" was adopted to describe the target of the interviews in order to avoid the word "skills," which might have led readers to think in terms of generic and practical abilities that were very different from those we were seeking. But the word "mental" may have kept those using Decoding from fully recognizing elements of professional practice that were not narrowly cognitive. And the term "operations" may have reinforced the notion that the experts always imposed a series of abstract processes on a passive reality, rather than inhabiting an environment that they needed to respond to.

Increasingly, however, issues were emerging in this work that did not seem to fit smoothly into the categories of Decoding 1.0. As the HLP began to systematically interview historians about obstacles to learning in their courses, it became increasingly clear that emotional bottlenecks were creating obstacles to learning that had not been sufficiently considered in the original model (Shopkow et al. 2013). Step five of the 2004 formation of Decoding had reduced the non-cognitive aspects of learning to a reminder that it was important to motivate students to assure that they fully engaged in the modeling,

practice, and assessment activities (Pace and Middendorf 2004, 8–9). This limited gesture towards the affective side of learning now seemed inadequate in the face of what was emerging in our interviews with historians.

Listening to the historians describe their students' resistance to learning, we identified three different ways in which emotions could impede leaning. Indeed, there were simple, motivational problems that had been considered in step five of Decoding 1.0. However, emotional resistance could also be generated by a mismatch between students' experiences in a course and the preconceptions they brought with them about the nature of the work expected in the discipline. If, for example, they believed history courses were about memorization and they were then asked to deal with evidence and interpretations, students might opt out of the learning process. Finally, if the treatment of a course's subject matter seemed to contradict the stories about the past that they had absorbed earlier in life, the result might be an emotional withdrawal or open defiance, either of which could interrupt the learning process (Middendorf et al. 2015; Shopkow et al. 2013; Shopkow 2013).

These interviews made it clear that Decoding needed to develop strategies for helping students overcome emotional as well as cognitive bottlenecks. Joan Middendorf took the lead in developing a response to these emotional roadblocks, recognizing that the approaches developed to deal with student preconceptions in fields like physics could be incorporated into the decoding process. This work promises to be one of the most important dimensions of Decoding, although to date it has not been explored as thoroughly as the more narrowly cognitive aspects of the paradigms (Shopkow et al. 2013; Middendorf et al. 2015; Middendorf and Shopkow 2018, 105–36; Pace 2017, 73–93).

### **Beyond the cognitive (2): Decoding the body**

Decoding 1.0 focused on discrete intellectual operations that experts perform as part of their disciplinary practice. But even within this body of work the notion of “operation” began to expand when Joan Middendorf recognized that in many fields experts did not just think about the material at hand but were actually generating images in their minds (Middendorf and Shopkow 2018, 69; Shopkow and Middendorf 2020). It soon became a standard part of the decoding interview process to ask teachers if they were visualizing anything as they described the steps that students needed to master, and visualization played a major role in several of the contributions to the 2004 volume (Zolan, Strome, and Innes 2004; Durisen and Pilachowski 2004).

The recognition of the importance of visualization was only the first step in a process of identifying new forms of disciplinary practice that needed to be shared with students. For example, it became clear that in solving problems experts sometimes used their bodies in ways that were not being explicitly taught. In one particularly striking example from a 2016 workshop at the Zentrum für Hochschuldidaktik (DiZ) in Ingolstadt, Germany, an interviewee was explaining how he would deal with a problem involving the lift that kept an airplane in the air. The interviewers became aware that he was extending his arms, as if they were wings, and his body had become the plane. This embodiment of the physical situation did not fit in the category of “mental operation,” but it did seem to be a part of his professional practice that might need to be shared with students.

The observation of the bodily actions of experts has become a standard part of the interview process for many practitioners of Decoding 2.0. In their interviews with computer programmers at the University of the Free State in South Africa, for example, Pakiso J. Khomokhoana and Liezel Nel found it

important to pay attention to the interviewees' "facial expressions, vocal behaviour, verbal consent, pauses or segregates (e.g., 'hmm'), posture or stance, eye behaviour, hand gestures, and head movements" (Khomokhoana and Nel 2020, 6, 19). As such observations piled up, the definition of what needed to be captured in the interview expanded, and it became increasingly clear, as Peter Riegler recently suggested, that it is often important to record the interviewees' physical gestures, as well as their words, because these may indicate the presence of actions that are an important part of disciplinary practice (Riegler 2020b).

The exploration of the role of bodily actions in professional practice has been taken to a new level by Leslie Cameron who is exploring the possibility of putting the technology of academic psychology to work in the Decoding process. Her own decoding interview had interested her in decoding the process of reading graphs and she has been interviewing other faculty to see how they go about this task. But as a psychologist trained to be somewhat suspicious of data obtained entirely from introspection, Cameron is accompanying decoding interviews with the use of eye-tracking equipment to confirm that professionals in the field actually read graphs in the manner that they have described in their interviews (Cameron 2019; Robbins, Pelnar, and Cameron 2019).

This expansion of the notion of what kinds of operations are essential in particular disciplines was visible in efforts to decode the teaching of music. In 2011, J. Peter Burkholder and Jennifer Hund both published articles in which they very effectively applied the principles of Decoding 1.0 to teaching music history and music appreciation, respectively (Burkholder 2011; Hund 2011). But when Robin Attas went through a decoding interview, she discovered that while she had previously taught music theory to her students primarily as a process of intellectual analysis, her own practice was much more complex. As a result, she now views

*this expert process of music analysis as an engagement with my "whole musical self," an inclusive practice that includes listening, singing, playing, composing, and sometimes movement, as well as the more intellectual (and often silent) practices of thinking about music from various disciplinary perspectives and looking at a score.*

It was this multi-faceted experience of the music that she needed to share with her students, and not just the cognitive operations (Attas 2018).

In her interviews with faculty in fields like drama, nursing, and journalism at Mount Royal University, Genevieve Currie, like Attas, found that practice in such fields involved much more than simply carrying out a series of narrowly intellectual steps. Drawing upon the literature of phenomenology, she sought to capture the lived experience of the instructors who took part in her interviews. Going beyond cognitively focused questions such as "how did you do that?" or "how did you know to begin with that step?" that had generally dominated earlier decoding interviews, she began to ask her informants to answer more experiential questions, such as "how did you get the sense that you know this?" or "how have you personally experienced this knowledge?" As a result, the interviewees "described experiencing these disciplinary concepts as not being separate from themselves but a part of their bodily experience." The participants in these interviews came to understand more fully that they needed to not only teach textbook knowledge, but also share the ways that professionals in the field

actually learn from experiencing the physical and the social space in the laboratory, hospital, or other working space within which the field is actualized. She concluded that

*within practice disciplines where we experienced the world with types of knowledge related to touch, perceptions, feelings, actions, and sensations that cannot necessarily be translated or captured in conceptualizations and theoretical representations, we need to give them expression and importance.* (Currie 2017, 46)

### **Beyond the cognitive (3): Decoding the experience of a lived professional environment**

Most work done within the context of the original decoding model implicitly assumed that expert practice involved imposing a set of preexisting procedures upon the subject of study. The task of teaching involved passing these processes on to students and giving them certain cues as to which to apply to particular problems. But as Currie's article shows, the Mount Royal group enriched Decoding by recognizing that professional practice sometimes required a receptivity to the environment, as well as a set of procedures for acting upon it. This theme is very visible in Michelle Yeo's contribution to *Using the Decoding the Disciplines Framework for Learning Across Disciplines*.

Yeo drew upon the work of German philosopher Hans-Georg Gadamer to explore the ways in which many of the bottlenecks dealt with in decoding interviews often "had more to do with ways of being-in-the-world, having affective, relational, and identity elements" (Yeo 2017, 49). In many of the decoding interviews that she helped conduct with the Mount Royal faculty, a crucial element in success within the profession depended not just on the mastery of specific cognitive patterns, but rather on the embodiment of a broader orientation to functioning in the profession. This often involved a provisional interpretation of what might be happening, an openness to experiencing the unexpected, or an awareness that the relationship between the parts and the whole may be more complicated than anticipated. In such situations, students need to learn to have a kind of hermeneutic conversation with the environment in which they are operating that leaves them open to ways of responding that did not exist before the interaction began.

A journalist in the Mount Royal group, for example, needed to teach her students to avoid imposing fixed narratives on a news story and to respond creatively and actively as issues moved in unexpected directions. A theater professor told of how it was necessary to allow the play to emerge dynamically through multiple readings and practices. A nursing instructor taught her students the profession's code of ethics, but in practice she wanted them to also respond empathetically to the lived situation of the people that they were dealing with. Yeo reports that these instructors "desire their students to step back from constructed narratives to deeper questions of interpretation and meaning" (Yeo 2017, 54).

This expansion of the scope of the paradigm has made it necessary to reconsider the kinds of questions posed by the interviewers. In another article in *Using the Decoding the Disciplines Framework for Learning Across Disciplines*, Ron MacDonald, for example, was struck by the fact that some of the interviewees in journalism and nursing at Mount Royal faculty kept bringing up issues that did not fit easily into the implicit protocol of the decoding interview. While questions about the cognitive operations required in work in these disciplines got to certain aspects of what they had to teach, other

crucial elements of professional practice, such as developing or “a nose for news” or a “nurse’s intuition,” were not being addressed.

Drawing upon a close reading of the literature on professional identity, MacDonald came to the conclusion that the preparation of professionals in these fields required, not only the mastery of a set of cognitive skills, but also an initiation into what it means to be a practitioner in those fields. The decoding interview, he suggested, could be an invaluable aid to this process, but only if its scope were expanded beyond narrowly cognitive skills to encompass the lived working experience of the instructors. Expanding the interview process to include questions about how the instructors made the transition from college to actual professional experience, for example, might help them become conscious of parts of the process that it was essential to pass on to students. Thus, he argued,

*unpacking the ways and means by which professional identities are constructed and frame professional practices has the potential to reveal important knowledge often hidden from the identities’ bearers and, therefore, from their students who are trying to find their way into the professions and disciplines in question. (MacDonald 2017, 63)*

The kind of implicit questioning of the assumptions of Decoding 1.0, evident in the work of Currie, MacDonald, and Yeo and their colleagues described above, does not discredit the paradigm. In fact, it provides impressive evidence of the power of the decoding interview. But their work does represent a strong call for reconsidering some of the limitations unintentionally placed upon the original model. In retrospect, it is likely that the original model of the paradigm was shaped by the specific needs of the disciplines that were the focus for most of the early applications of the approach. In these fields, essential bottlenecks generally arose from the inability of some students to impose a particular set of disciplinary practices onto the analysis of data or the interpretation of texts. By contrast, in some professional fields—and quite possibly in certain areas of most fields—students also need to learn to remain receptive to experience, to wait until a deeper understanding emerges, and to pay attention to the messages that they are receiving from their bodies about what is happening around them. On its own, receptivity is a kind of skill that involves a sensitivity to what kinds of experiences are worth paying attention to and a sense of what kinds of responses might be functional in particular situations. Within the context of Decoding 2.0, these aspects of professional practice can be explored and modeled for students just like the more narrowly cognitive issues with which the paradigm began.

### **Involving students in Decoding**

Decoding 1.0 depended almost entirely on faculty for the identification of crucial bottlenecks and for making disciplinary practices explicit. Within the body of literature constituting Decoding 2.0, students are playing a more prominent role, both as sources of information and as co-investigators.

Pakiso Khomokhoana and Liezel Nel, for example, have brought a new level of rigor to the identification of bottlenecks by administering 12 questions involving working with source code to 40 third-year students who completed four programming modules. Fifteen of the students who missed the correct answer in all five of the most difficult questions were asked to participate in phase two of the project in which they described their reasoning processes in a “think aloud.” These data were then used to define six bottlenecks that seemed to be keeping some students from succeeding at these tasks



(Khomokhoana and Nel 2019). Such a strategy provides a much more systematic approach to specifying where students are getting stuck than that was used in the initial formulation of Decoding and offers a model for greatly enriching the process.

A second area in which faculty perceptions can be augmented and corroborated involves including students in the research process, both as subjects of study and as co-investigators. While the incorporation of students has become an increasingly important part of SoTL (see, for example, Cook-Sather, Bovill, and Felten 2014; Healey, Flint, and Harrington 2016), it has, sadly, been less common in Decoding. But in this area, as in so many others, Peter Felten has broken new ground. Recruiting three talented undergraduates from his university, he trained them in the decoding technique and then these student co-investigators conducted a series of interviews with faculty and undergraduates on the challenge of producing literature reviews in political science courses.

The article produced by this team (Rouse et al. 2017) demonstrates the extra dimension that can be added to Decoding through the inclusion of student investigators. Like the work of Khomokhoana and Nel, this project also challenges one of the central practices of Decoding 1.0 by including students as the subjects of interviews. It expands the potential of Decoding 2.0, both because interviews with students can open a second window into each of the first six steps of the process and because student interviewers may be able to collect information that is inaccessible to faculty. It also leads to a third possibility—using decoding interviews as a teaching tool.

This last approach is currently being explored by Jared McBrady at SUNY Cortland and Leslie Cameron at Carthage College. McBrady is asking the future social studies teachers in one of his courses to conduct decoding interviews with other college students to determine the steps that the latter use when identifying and evaluating sources for history assignments. The goal is to simultaneously gather information about the folk methods that students tend to bring to tasks in the discipline, help the future teachers think more deeply about the forms of historical thinking that they will need to foreground in their future courses, and provide them with a new pedagogical tool that they can use as future teachers.

Cameron is also using the decoding interview for multiple purposes. She is training the students in her undergraduate course on social science methods in the interview technique and they are functioning as co-investigators in her ongoing exploration of interpreting graphs (see above). In the process, her students are simultaneously gaining research experience and having an occasion for deep metacognitive explorations in their own use of quantitative methods. The potential for the inclusion of students in future studies is immense, and hopefully this kind of work will play a major role in Decoding 2.0.

### **Beyond individual classrooms 1: Decoding the department, the discipline, or the university**

Decoding arose in the context of the FLP as an effort to help faculty find new ways to overcome bottlenecks in their own courses. But it soon became clear the approach had broader applications, and within the context of Decoding 2.0, the focus of attention is often on aiding learning in a department or an entire discipline.

Arlene Díaz provided a model for using Decoding on a departmental level when she suggested a department could use the results of a series of decoding interviews to base its curriculum on a deeper understanding of the skills students needed to master rather than on content (Díaz et al. 2008, 1221–23;

Shopkow 2010). The athletic therapy faculty at Mount Royal followed a similar path when they decided to make a series of decoding interviews a core element in a major pedagogical and curricular transformation of their program. Members of the group were interviewed and the resulting transcripts provided the basis for a major transformation of their collective strategy for combining theoretical knowledge with practical experience of the field (Petit et al. 2017).

It is possible to imagine a unit applying Decoding to departmental curricular revision in an even more systematic fashion by identifying the most important bottlenecks in the work of graduating seniors supplemented by the kinds of assessments and interviews described by Khomokhoana and Nel (2019) to produce a clear picture of what learning deficits need to be addressed most by the department. The faculty in the unit could then conduct the shared decoding interviews pioneered at the University of the Free State and Mount Royal University to produce a consensus on what skills the department needs to model in its curriculum most. Finally, strategies for sequentially addressing these bottlenecks across the three or four years of the program could be developed using the process suggested by Díaz. The result would be a conscious and carefully articulated framework within which individual instructors would have a clearer sense of what was needed at a particular level in the program and just what skills should be emphasized.

Beyond the departmental level it is possible to imagine institutions using the decoding process to develop better strategies for dealing with broader problems. The Mount Royal interdisciplinary study of reciprocity in service learning mentioned above could serve as a model for many such projects (Miller-Young et al. 2015), and the kinds of student-led decoding interviews pioneered by Peter Felten could be used to explore the bottlenecks encountered by first-generation college students or international students (Pace 2017, 128–38).

Finally, there remains the possibility of using Decoding 2.0 to chart strategies for increasing learning in entire disciplines. Soon after the appearance of the paradigm, the HLP sought to apply it more broadly to identify bottlenecks and essential mental operations common across the field (Díaz et al. 2007, 2008; Glenn 2009; Shopkow et al. 2013). So far, there have not been other major attempts to create a unified vision of teaching in a discipline. However, as the number of applications of the approach in particular fields increases it is to be hoped that Decoding 2.0 will produce broader syntheses of learning within entire disciplines. A list of common bottlenecks and the operations students must master to succeed in typical courses in the discipline could be combined with examples of modeling lessons, practice assignments, and assessments. These could be made widely available through disciplinary organizations and made part of the curriculum of Ph.D. programs.

### **Beyond individual classrooms 2: Decoding cultural capital**

It has also become increasingly apparent that Decoding may serve to make explicit crucial ways of operating that lie outside the realm of disciplines altogether. An interesting example of this expansion of the scope of the approach occurred several years ago in a workshop at the Ostfalia University of Applied Sciences in Germany when a participant asked if it might be possible to use a decoding interview not to explore cognitive processes within her own discipline, but rather to make explicit what students need to be able to do when they realize that they do not understand what is going on in a class. For the next half hour, the group decoded the decision points at which a student needed to make essential choices about whether and how to get assistance once they realized that they were lost. At the end of the process

the group was aware of a set of abilities that were absolutely crucial for success in college classes, but which are almost never taught (e.g., being able to read clues indicating when an instructor is open to questions).

This kind of exploration raises the possibility of using Decoding to make explicit and to teach, not just the skills needed in particular disciplines, but more general forms of cultural capital. Some students arrive at universities with the ability to manipulate the social system around them to get the help they need, and others lack these social skills. As the work of sociologist Jessica McCrory Calarco has demonstrated, these abilities correlate with social class as early as elementary school (Calarco 2011). If university instructors do not work to lessen these differences, they are simply reinforcing the inequalities that plague our societies. Decoding transdisciplinary skills, such as knowing how to get help, can give us tools to work more effectively against such injustices (Pace 2019b).

### **Challenging the disciplines**

Since its origins, Decoding has worked to help faculty achieve pre-existing goals in their courses. Behind this commitment was the desire to help those students who were slipping through the cracks in the current system. We were very aware that the inequalities in society caused students to arrive in college with very different levels of preparation, and if they were going to be graded on the basis of the existing norms in a field, it seemed only fair to share those patterns of thought and action with all of them.

To help more students succeed in academia, however, Decoding often accepted without question the procedures and the values of existing disciplines. In creating a pathway into prevailing academic practice, Decoding could, with some justice, be accused of legitimizing the ideological underpinnings of current structures of knowledge. Such an orientation has become increasingly problematic as powerful critiques of academic practices have emerged. From feminist pedagogy to calls for inclusion of diverse gender identities, demands to decolonize the curriculum, and attacks on higher education as classist, there have been accusations that higher education has focused too long on forcing diverse students to assimilate to existing hegemonic norms. From such perspectives, Decoding 1.0 might be viewed as a more efficient tool for perpetuating the dominant culture.

This concern was experienced very strongly by a group of Canadian scholars of teaching and learning who were seeking to become more conscious of the ways their disciplines were part of “the epistemological structures of a Eurocentric hetero-patriarchal worldview that helped erase, discredit, and overwrite Indigenous worldviews.” Faced with this challenge, they found Decoding 1.0 to be “strikingly apolitical . . . lost in the moment of improvement is the more difficult critical question of ‘complicit’ knowledge, which is entangled with disciplinary knowledges” (Easton et al., 150–51. See also Yeo et al. 2019; Easton and Lexier 2017; Lexier, Easton, Yeo, n.d.).

However, since they used the decoding process productively in other contexts, these scholars of teaching and learning set out to determine “if an adapted Decoding interview could be used to disrupt disciplinary assumptions and unsettle our practices,” (Easton et al. 2017, 157) and thus, to make explicit unconscious hegemonic structures in the disciplinary knowledge that they were teaching. Therefore, they created a new form of “disruptive interview” designed to make explicit not what professors needed to share with their students, but rather what they themselves were unconsciously teaching along with knowledge from their disciplines. The subsequent interviews allowed them to recognize Eurocentric

epistemological biases embedded deeply in their own teaching about early childhood education, writing, and indigenous studies.

This impressive work from the ever-inspiring Mount Royal campus reveals the potential for Decoding as a critical methodology. Hopefully such “disruptive interviews” will become a standard part of Decoding 2.0. This might involve the addition of an extra step in which those using the process would pause to consider whether the material and the techniques that have been unconsciously passed on in particular disciplines really stand up to our current values and understanding of the world. This might lead us to ask questions such as “do standard practices in the discipline present extra challenges to students with certain life situations, cultural frameworks, class backgrounds, or gender identities?” To what extent do they serve to impose a specific identity or world view on students? Does this way of processing information in the field favor the interests of some groups in society over others? Are there alternate processes for assimilating course material that would be more inclusive? It is even possible that casting such a critical eye upon the choices underlying disciplinary traditions might lead to challenges to existing ways of conducting research itself.

## QUESTIONS FOR THE FUTURE

The rapid evolution of Decoding from version 1.0 to 2.0 is evidence of the continuing strength and flexibility of the approach. Therefore, it is worth concluding this essay by posing several practical questions that might aid its development in the future.

### **Question 1: How can we best assess the effectiveness of Decoding?**

Since its inception, Decoding has made assessment a key element in its strategy. Papers and publications on the paradigm typically include assessments that indicate that student learning has increased across individual courses. But there is little external corroboration that this improvement is due to the use of the Decoding process. It is very difficult to compare the results of courses that do or do not use Decoding because there are always so many other factors that can affect the process. Nonetheless, if the size of the sample is sufficiently great some of the extraneous variables may begin to disappear, as has been the case with the application of the Force Concept Inventory in multiple courses (Hake 1998). As Decoding spreads, it may become possible to administer assessments in large numbers of courses in the same discipline, some of which have been organized around Decoding and others taught in keeping with more traditional approaches. If the numbers are great enough to neutralize irrelevant variables, we should be able to get a better sense of how much the use of the paradigm can contribute to student learning.

### **Question 2: How should we go about sharing work using Decoding?**

Like most work in SoTL, Decoding 1.0 initially relied on traditional articles, presentations at academic conferences, or invitations for campus visits to spread the word about developments in the field. But the nature of this work cries out for other ways to share what is being learned in Decoding 2.0. A step in this direction has been taken through the creation of the Decoding the Disciplines website (Decoding the Disciplines, n.d.), a YouTube channel created by Joan Middendorf with videos on various aspects of Decoding (Middendorf 2020), and a blog in which I share ideas about the paradigm and other SoTL issues (Pace 2019a).

Peter Riegler is currently taking this work a giant step forward by developing a Decoding the Disciplines Wiki, which will allow individuals to share new publications and papers, examples of bottlenecks, excerpts or videos from interviews, class lesson plans designed to model particular operations, assignments that allow students to practice these skills, and assessments of students' mastery of certain tasks at the beginning, middle, or end of courses. All this work will be automatically categorized by discipline. Hopefully, this is only the beginning of the search for creative new ways to share this work.

### **Question 3: How can work in Decoding be coordinated?**

An intellectual movement needs not only a set of ideas, but also a network of connected individuals. Such a network is forming, but Decoding still lacks any formal organization to nurture the development and spread of the paradigm and to support new generations of leaders in this work. Thus, we need to ask not simply how we are to use the process, but also how we are to create social institutions and communities that can support its further development and disseminate the scholarship that is produced. The Threshold Concepts movement has engaged in a more coordinated strategy of spreading its work through a series of conferences and resulting publications. This is a model that Decoding might be wise to imitate, although that would require a more formal level of organization than has existed up to the present.

### **Question 4: Do we need to make explicit the values that underlie Decoding?**

Much of the energy devoted to Decoding, like so much of SoTL, has been motivated by a deep belief that social justice requires the profound riches of our disciplines to be made available to ever larger portions of the population. It has also been motivated by a sense that the welfare of the broader society depends on our ability to share more effectively what we have learned with new generations. But this commitment has generally remained implicit as practitioners of the approach have focused on practical steps to bring more students into the learning process.

There is a potential danger in this. As we have often seen in decoding interviews, what remains implicit is often not passed on. In the world of higher education today there are forces that seek to cast aside the high aspirations that have made education a sacred duty to so many of us. As we have seen in a passage quoted earlier in this essay, Randall Bowden questioned the seven steps of Decoding because he (mistakenly) believed that they reduced teaching to "a somewhat sterile progression" (Bowden 2007, 6). But the very qualities that led him to reject the approach might be of great appeal to someone of a more technocratic bent who was only seeking a more efficient mechanism for technical training.

Thus, we must ask ourselves to what extent it may be necessary to affirm the core values that underlie our commitment to this work. Without such an explicit confirmation of the deeper goals of Decoding, the movement might be co-opted by those who see students only as a means to larger economic ends and who lack a sense of responsibility to the larger society.

## **CONCLUSION**

Decoding is, of course, only one tool in the ever more effective toolbox being created by SoTL. There is a range of challenges to learning that can be better addressed using other approaches. And Decoding is often most successful when it is used in conjunction with other frameworks and techniques for increasing learning.

However, Decoding spread around the world because it offered SoTL a new way of understanding why many students were not succeeding in college courses and a framework for overcoming bottlenecks to learning. This original formulation continues to yield value in the classroom and in the pages of scholarly books and articles. But in the years since 2004 both the improvement of this original model and the creation of Decoding 2.0 have opened even greater opportunities for both classroom teachers and scholars of teaching and learning. Decoding 1.0 was improved by situating the paradigm in the context of other approaches to SoTL, refocusing the work on disciplinary epistemology, enhancing the decoding interview, and developing alternative ways to make explicit what students must learn to do in order to succeed in particular courses. Its practitioners reexamined the use of the seven steps of the original model and used the process as a means of bringing groups of teachers together in faculty learning communities.

Other scholars of teaching and learning reconsidered some of the basic elements of Decoding 1.0. They moved beyond the original focus on learning within disciplines and on narrowly cognitive processes to include emotional factors and physical actions that play a role in student success. Whereas the paradigm had begun by concentrating on ways of applying preexisting academic strategies to the material of a course, the new Decoding 2.0 expanded to include ways students needed to respond to external conditions and to embody professional identities. In addition, students were brought into the process as subjects of decoding interviews or as co-investigators.

Finally, Decoding 2.0 moved beyond the individual classroom and disciplinary epistemology as it became a basis for departmental curricular reform or institution-wide projects. It began to consider the broader cultural capital that students need to succeed and to serve as means not only of sharing existing disciplinary process, but also of challenging some of the fundamental ideological assumptions underlying both the content and the pedagogy of existing courses.

All of this represents a major step forward in our ability to understand what blocks student success and to devise ways to help more of them through the bottlenecks that impede their progress. And there is no sign that the flow of new applications and refinements of the paradigm are lessening. As I have often said in workshops, Decoding is like Linux, not Microsoft; it is open to constant improvement and reconceptualization. And hopefully, in another decade and a half, it will be time to write another article reviewing the creation on Decoding 3.0.

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## NOTES

1. It is interesting that Threshold Concepts has followed the same path, apparently quite independently, moving from a relatively narrow focus on cognitive issues to a broader scope that includes emotional and bodily aspects of learning. See, for example, Timmermans and Meyer 2017, 4.

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Note: Though contrary to the standard *TLI* style guide, when multiple sources are cited in a series they were arranged chronologically, rather than in alphabetical order. This allowed supporting information to be presented in the most logical way for this article.

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