

**FACULTY ROLES IN CURRICULAR CHANGE:
POSTMODERN NARRATIVE ONTOLOGIES**

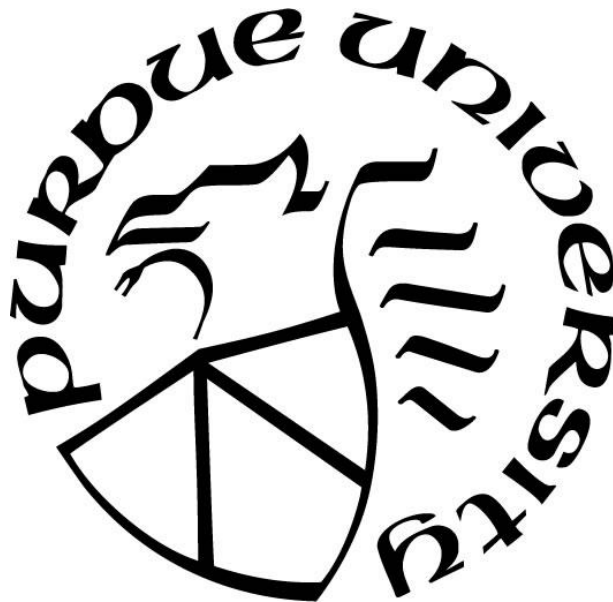
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*Dedicated to my ancestors – blood, chosen, scholarly, and spirit –
who look at me and see their wildest dreams come true.
Chua Bieng Diu, “Bright Flow” (Philippine Hokkien)
“Puppymel” (ASL name sign)*

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To a cast of thousands of friends, mentors, colleagues, and family members (both blood and chosen) who have pulled me across the finish line and helped me find a writing glove that fit.

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ABSTRACT

Faculty are the primary designers and implementers of engineering curricula within the U.S. higher education system. This places them in a unique position to respond to decades of national calls for curricular change in undergraduate engineering education. Individual and institutional faculty efforts to respond to these calls are inevitably influenced by faculty ontologies of curricular change – in other words, what faculty understand curricular change to be. By ‘ontology,’ I mean what is or what they perceive as what is. Ontologies are agentic, meaning that ontological assumptions shape how faculty envision their own roles and thereby influence the sorts of curricular change actions they envision and legitimize for themselves.

Faculty ontologies of curricular change and their roles therein are complex roles within complex phenomena. By interrogating these ontologies, I make-visible the ways faculty might view – and thereby shape – the curricular worlds they and their students inhabit. To use a theatrical analogy: how do faculty stage their narratives of curricular change – what kinds of worlds do they set up in their stories? What kinds of interactions do they allow within that world? What kinds of characters do they cast themselves and others as playing?

To investigate faculty ontologies of curricular change, I analyzed the narratives they told about several curricular change projects they had been personally involved with. I gathered narrative data by conducting recurring interviews with six faculty narrators. I deconstructed the resulting narrative data corpus using a postmodern approach focused on tensions and contradictions. The resulting analysis generated four distinct and interrelated ontologies for curricular change. These four ontologies are presented as a starting point rather than an exhaustive catalogue, since infinitely many ontologies could be generated. Each of the four ontologies created for this work portrays faculty roles in curricular change in relation to both curriculum and students. Creating multiple ontologies then enabled me to show how the interaction of multiple ontologies can create insights that are not apparent from each ontology alone. Among other things, the interactions of all four ontologies form a complex portrait of faculty as learners who are always unmaking and remaking themselves in the context of curricular change.

By constructing a collective memory of faculty ontologies, I work to interrogate and disrupt current conceptions of roles and relationships in curricular change. These ontologies, and the methods developed to pursue and play with them, serve as tools for “cutting meaning loose” and

“keep[ing] difference... at play” (Jackson & Mazzei, 2012, p. 70-71). In turn, these tools open up a wider space of new ideas and possibilities for courses, pedagogies, and cultures to be expressed, evaluated, and legitimized.

1. INTRODUCTION

1.1 POSSE: an introductory story

From 2009 to 2011, I co-facilitated weeklong workshops called the Professors' Open Source Software Experience (POSSE). These workshops were for engineering and computing faculty who wanted their students to participate in open source projects. (Ellis, et al., 2012). Each attendee brought in a course they were designing or redesigning to incorporate open source participation, and we workshopped their curricular designs over the course of a week.

I soon found myself doing a lot of what my co-facilitators and I jokingly called “faculty therapy,” where I sat with faculty members as they said things like, “But classes don’t work that way!” or “Undergraduates aren’t ready for that!” I and the other facilitators (and sometimes attendees) would gently ask, “Why?” to each of these statements until we uncovered competing commitments (Kegan & Lahey, 2009). On the one hand, they wanted students to get involved in open source and could see that certain curricular changes were needed - but on the other hand, those changes sometimes clashed with their constructs of what they, as “good” faculty members, “should” do or “had to” do. Those underlying constructs constrained the teaching approaches each faculty member was willing to consider, and also provided affordances and opportunities for them to engage their classrooms in ways they may not have previously done.

To illustrate with a specific hypothetical example (see table below): let’s say there are two faculty members, A and B, who teach their undergraduate engineering classes using a primarily lecture-based method. Faculty A’s construct of a “good” faculty member is one who *supports* students in finding all the information they need, whereas Faculty B’s construct of a “good” faculty member is one who *provides* students with all the information they need. Lectures are compatible with both of these constructs of faculty roles, since lectures can both be “a way to support students finding all the information they need” and “a way to give students all the information they need.”

Let’s imagine that both faculty A and B are asked to switch from lectures to an open-ended, student-driven project approach - meaning that their undergraduate students may be exploring topics they are not familiar with. Faculty A still has many options for “supporting students in finding all the information they need” (taking them to the library, helping them read datasheets, introducing them to colleagues etc.). Their construct of their faculty role affords them opportunities

to change their teaching approach without needing to reconceptualize their notion of what a “good faculty member” is.

In contrast, since faculty B believes they need to “provide students with all the information they need,” they might panic - how can they possibly provide students with all the information they need when students can pick any topic - including ones faculty B doesn’t know much about? It’s impossible for them to know all the information students might need, which means it is impossible for them to be a “good” faculty member by teaching this way! The faculty member may experience cognitive dissonance, distress, and a psychological block about changing their teaching approach unless they examine and reconceptualize their constructs of what it means to be a “good” faculty member.

Table 1.1. Hypothetical faculty representations

	Faculty A: (“Good”) faculty support students finding all the information they need.	Faculty B: (“Good”) faculty provide students with all the information they need.
Lecture	This works!	This works!
Open-ended, student-driven projects	This works! (take students to the library, help them read datasheets, etc.)	I can’t do this - it’s impossible for me to be a good faculty member under those conditions!

1.2 Ontologies and ontological conflicts

The first row of the preceding table contains statements about what exists (faculty, students, and information) and the relationships between those things (“faculty support students in finding information” vs. “faculty provide students with information”). These kinds of statements are ontological in nature. According to the Merriam-Webster dictionary, an ontology is "a particular theory about the nature of being or the kinds of things that have existence." In this project, I utilize ontologies as “explicit specification[s] of a conceptualization" consisting of a "set of objects, and the describable relationships among them" (Gruber, 1993, p. 1-2). In other words, ontologies deal with the kinds of objects (e.g., people, groups, institutions, ideas, etc.) that exist in a given reality, what roles those objects are allowed to play, and how they are permitted to interact with one another.

I will now connect this simplified, hypothetical scenario to the chronic story of engineering education's struggles with curricular change. In the example above, the ontology held by Faculty A ("faculty *support* students finding the information they need") accommodates both lecture and open-ended, student-driven projects. Enacting the curricular change of switching teaching methods does not present an "ontological conflict" (Blaser, 2013) to Faculty A. In contrast, the ontology held by Faculty B is impossible for them to requires them to *provide* all the information students need, meaning that they'd need to know everything about every possible project students might want to pursue – an impossibility.

Spotting Faculty B's ontological conflict can give us insight into why Faculty B might not just resist the curricular shift away from lectures. Instead of painting faculty B as intentionally interfering or resistant, there is space for meeting them with compassion and respect; this person might be unable to conceptualize it entirely, as it resides within a reality they do not (yet) share. More generally, techniques for uncovering ontological conflicts might aid engineering education researchers in studying complex scenarios where multiple perspectives and/or multiple people are involved.

1.3 Engineering education epistemologies and the ontological turn

Ontological work has been quietly adjacent to the epistemological work that has been done in engineering education research since the field was formally conceptualized. Epistemology was put forth as one of the five core topics for engineering education research (National Engineering Education Research Colloquies, 2006). In addition to (Montfort, Brown, & Shinew, 2014) examples of epistemological work in engineering education includes (King & Magun-Jackson, 2008; Beddoes, Montfort, & Brown, 2014). However, by not acknowledging ontologies, these works and others miss an opportunity to go deeper into the complexity of engineering and educational philosophies as held by various individuals. Epistemologies and ontologies are inseparable; we cannot discuss knowing and knowledge without some reality to be known and one or more knowers to know it.

Dall'Alba and Barnacle advocate for "an ontological turn in higher education" in a paper by that same name, pointing out that "ontology has tended to be subordinated to epistemological concerns" (2007, p. 679). The ontological turn is a movement sweeping across disciplines with the proposal "that worlds, as well as worldviews, may vary," which in turn gives us a "radical

challenge to our ways of thinking about difference" (University of Cambridge et al., 2017). Holbraad and Pedersen say that "the ontological turn is not so much a matter of 'seeing differently', in other words. It is above all a matter of seeing different things. Hence the flagship turn, 'ontological', indicates the need to shift anthropological concern onto questions about what kinds of things might exist, and how" (2017, p. 6).

In this project, I am deliberately engaging with ontologies of curricular change as a different way of making-visible foundational metaphysical assumptions in engineering education. In doing so, I bring the ontological turn to engineering education and contribute engineering education voices to the dialogue on the ontological turn. My explicit engagement of ontology as methodology may also provide a different angle for reading the existing body of work on engineering and engineering education epistemologies, as discussed above.

1.4 Engineering education's continued investment in curricular change

Engineering education in the US has a long history of engaging with curricular change, from the Mann report in 1918 through the Wickenden Reports (SPEE, 1930; SPEE, 1934) and beyond (Hammond, 1940; Grinter, 1956; Walker Pettit, & Hawkins, 1968; NRC, 1986). "[These national reports]... have each, in turn, examined the practices of engineering educators in the light of changing needs and have provided the basis for a conscious effort to keep educational programs attuned to the requirements of engineering practice" (Walker, Pettit, & Hawkins, 1968, p. 373). More recently, the Revolutionizing Engineering Departments (RED) initiative from the National Science Foundation (NSF) was launched in 2014 to fund multi-million dollar curricular change experiments across the country. RED grants involve disruption and deconstruction of existing structures so that different ones might have room to flourish, and - interestingly - are written with the assumption that faculty members will be the ones enacting this disruption and change. Looking at the underlying ontological work being performed, as in the example above, may help us gain a different understanding of the ways people, including faculty, engage (or disengage) in curricular change.

1.5 Curricular change as a good site for examining ontological work

Ontology is already a large part of engineering education practice, albeit often an unspoken one. Many design choices in engineering education are ontological acts. For instance, what is the nature of our field, such that we may split it into courses and majors and credits? What are the roles our practitioners might play, so we can create certification programs to place them inside or outside of boundaries of legitimacy? All this makes curricular change a good place to examine ontological work, because curricular change itself is an ontological act. This project is not *about* curricular change per se; rather, it is *situated* in the context of curricular change efforts at two institutions, and examines and engages with the ontological work therein.

1.6 Focusing on faculty ontologies and faculty roles in curricular change

In this project, I examine the ontologies of curricular change held by faculty participating in curricular change projects. Along with determining the master narratives of what it means to be an engineering student (Pawley, 2009), faculty determine and implement the curricular environments within which those narratives take place. In the US higher education system, faculty members have considerable freedom and flexibility over how to carry out their job duties, including instruction. This model for the life of the professoriate, first articulated in Wilhelm von Humboldt's vision for the university, positions academic freedom as a key factor of faculty jobs, and includes within it the freedom to teach as desired. (Anderson, 2004). Since faculty are both the designers and the implementers of curriculum, the ontological assumptions held by faculty are key to curricular change. In other words, faculty ontologies of a curricular change are what gets enacted as curriculum, and thereby influence *everyone's* experience of that curricular change.

Faculty conceptions of their own roles in curricular change are also important. For curricular change to occur, the actions of change must be incorporated into the roles that faculty understand themselves as playing. As Dall'Alba (2009) put it, "if we are fully to understand knowing within various forms of professional practice, we must understand the being of those who know" (p. 25). Since ontologies are configurations of objects (including agents/people) and allowable roles and interactions of those objects, understanding faculty ontologies of faculty roles in curricular change can inform our understanding of why a curricular design or implementation of that design turned out the way it did.

Despite this, faculty are under-studied in engineering education research. Huff pointed out that "since 2016, only four articles in the Journal of Engineering Education (4% of all articles) studied faculty members (Blair et al., 2017; Eastman et al., 2019; Lattuca et al., 2017; Pembridge & Paretti, 2019)" and that "the dominant trend is to... regard faculty members as static, supportive features of student outcomes" (2020, p. 1). My project examines faculty members as complex agents involved in complex situations - here, curricular change situations.

My choice of investigating faculty roles in their ontologies of curricular change does not mean that only faculty do ontological work, or that ontological work only applies to curricular change activities. On the contrary, all people are doing ontological work at all times in all activities; this "constitution [of agents and forms of social order] is a visible phenomenon... an aspect of everyday practical activity" (Packer, 2010, p. 22). However, for the reasons discussed above, understanding faculty ontologies of faculty roles in curricular change could inform interventions for addressing and supporting faculty changemaking across the curricula at a deep ontological level.

1.7 The difficulty of examining ontologies directly

When faculty engage in curricular change, they spend a large portion of their time "doing" curricular change by teaching or preparing for a specific course, as opposed to "theorizing" curricular change in the abstract without a specific course for context. Participants in an interaction – here, curricular change – talk and act in ways that display to others who are present what they understand themselves to be doing, and they act into these mutually understood contexts. (Tsai, personal communication, 2023). In their role as curriculum implementers, the moment-by-moment decisions of faculty embody their ontological assumptions in the concrete reality of the courses they design and teach.

However, people do not typically speak or even think explicitly about their underlying ontologies or use them as an active, conscious site of sensemaking. Rather, ontologies are the underlying beliefs that are - mostly unconsciously - assumed by people to be true, and they do their sensemaking *atop* those beliefs (Schein, 2010). We need a way to investigate that will get us to the "explicit specification[s]" of a reality or realities (Gruber, 1993, p. 1). This typically requires a disruption of some kind that makes-visible assumptions about the nature of being and reality, and prevents them from being so easy to unconsciously access (Heidegger, 1962).

1.8 Investigating ontologies through examining narratives

Narratives provide one possible solution as to how we might investigate ontological work. Narratives are a common way that people construct and make meaning and sense of their worlds (Bruner, 1986). Looking at the narratives told about a particular site of sensemaking - which here happens to be curricular change - might uncover underlying beliefs about the ontologies of that site. There is precedent for the use of narratives in engineering education research; for examples, see (Adams et al., 2007; Pawley, 2009; Chism, 2010; Johri & Olds, 2011; Case & Light, 2011; Fincher & Tenenberg, 2012; Johri & Olds, 2014). Narrative interviews also serve as an intervention for the mood and sensemaking of participants telling autobiographical narratives, even if this is not the narrative study's intent (Turner, A. F., Cowan, H. R., Otto-Meyer, R., & McAdams, D. P., 2021).

In this project, I build on the tradition of narrative analysis in engineering education by examining narratives of curricular change. Part of a narrator's sensemaking around curricular change pertains to the ontological assumptions they hold about what roles and relationships are possible within curricular change efforts. These ontological assumptions are reflected in the curricular narratives they tell. Another way of saying this is that all narratives presuppose underlying ontologies, since all narratives make assumptions about the nature of the reality that they narrate.

To make a theatrical analogy, all theatrical productions have an underlying staging, a certain set of actors and props and stage geometries. A playwright can write an infinite number of plays for a particular staging, but the bounds of their stories are constrained by the setup of their theatrical world. If they only have three actors available, they cannot call for four to be onstage at once; they cannot use a curtain or balcony that does not exist, and so forth.

Similarly, all narratives presuppose a certain set of allowable roles, relationships, and moves from which they draw their sequence of events. There are an infinite number of narratives for each particular ontology, but the bounds of these narratives – the types of characters they have, the actions those characters can take according to their types, the ways those characters can interact with each other, and so forth, are ontologically constrained. In other words, the role boundaries defined by an ontology determine the allowable actions of the characters who enact those roles. Investigating these role boundaries for curricular change narratives makes-visible the kinds of actions the engineering education community can imagine and is willing to allow. Every curricular

change narrative that exists is one that walks amidst the whispers of all the curricular change narratives that it is not.

My narrative data consists of stories situated in the curricular change experiences of six faculty on two campuses. The narratives are also overtly dialogic within and across communities, since faculty narrators read and comment on each other's narratives as a way to elicit their own. Although it is not the primary intent of the study, the narrative exchanges may also serve as an intervention for faculty participants in emergent ways that were not specifically targeted.

Examination of the ways narratives about curricular change are told and not-told can make-visible the powers that narrators are giving to various ways of conceptualizing and enacting curricular changes. Unspoken narratives are the narratives of those without political power; to examine unspoken narratives is to “ask questions about what we have not thought to think, about what is most densely invested in our discourse/practices, about what has been muted, repressed, unheard” (Lather, 1991, p. 145). Unspoken narratives and their unheard narrators may hold untapped potential for change of a sort we cannot yet envision.

1.9 Taking a postmodern approach in engineering education

As mentioned in the earlier section on engineering education epistemologies and the ontological turn, epistemology and ontology are inseparable, but epistemology has been a focus of engineering education research whereas ontology has not. Montfort, Brown, and Shinew’s 2014 study of civil engineering faculty epistemologies can be used as an example to illuminate how an ontological take on faculty roles – specifically, a *postmodern* ontological take – could contribute to our understanding of faculty as complex change agents in complex situations.

Montfort, Brown, and Shinew interviewed 26 civil engineering faculty about the nature of reality, and 24 responded in ways that indicated belief in a single, objective, and knowable - although perhaps not *completely* knowable (2014). This reflects how engineers, including engineering educators, are generally trained to be objective and empirical. On the surface, their faculty participants worked within positivist or post-positivist paradigms, both of which use the scientific method to remove human bias and error in order to better understand objective reality; post-positivism additionally acknowledges that the world is complex and that this might compromise the objective truth of findings (Guba & Lincoln, 1994; 2005). This position is also illustrated by a subfield called “ontology engineering,” (Mizoguchi, R., & Ikeda, M.,1998;

Alterovitz, G. et al, 2010; Gómez-Pérez, A., Fernández-López, M., & Corcho, O., 2010). Ontology engineering generally uses methodologies that merge disparate items into a single conflict-free ontology that can be consumed by computer systems such as the semantic web (Sure, Y., Staab, S., & Studer, R., 2009).

However, a closer investigation of the interview transcripts reveals something more complex than a single objective positivist or postpositivist reality. The faculty statements, taken at face value, "...somehow combine core elements of positivism... with unexpected and apparently contradictory epistemological stances," suggesting that "participants hold and maintain complex and carefully adapted combinations of stances that allow them to evaluate and justify potential knowledge claims by sometimes referring to [one stance based on] their truth and other times [another stance] referring their usefulness" (Montfort, Brown, & Shinew, 2014, pp. 18-19). Due to the close relationship between epistemologies and ontologies, this statement holds true for engineering faculty ontologies of curricular change as well – that multiple ontologies might be in play at any given time.

This complexity is not in keeping with a purely positivist or post-positivist paradigm, which, if one followed the pure philosophical definitions (Guba & Lincoln, 1994; 2005) only allows for a single objective reality (a single ontology). On the contrary, Montfort, Shinew, and Brown (2014, p. 18) discuss how their faculty epistemologies resemble a postmodern take, with the “incredulity towards metanarratives” that constitutes Lyotard’s (1984, p. xxiv) definition of that paradigm.

Postmodernism is a paradigm that works by enfolding and works with “multiple fragmented realities” to “deconstruct existing ‘grand narratives’ [also called metanarratives]”; it uses “methods and approaches generated during the study,” and its outcome is a set of “reconceptualized descriptions of the phenomenon [being studied]” (Koro-Ljungberg & Douglas, 2013, p. 165). Postmodernism is at present not widely represented in the engineering education research literature (Koro-Ljungberg & Douglas, 2008; Beddoes & Borrego, 2011). The “postmodern turn” has swept across other fields ranging from art to physics to politics, economics, and more (Best & Kellner, 1997). As a result, the literature of engineering education is limited in its ability to “speak postmodernism,” and those who have taken the postmodern turn are limited in their ability to work within the realm of engineering education. Part of my contribution in this

work is to contextualize engineering education research and the postmodern turn in relation to one another, thus joining the two wide-ranging, highly diverse, complex, and multivocal conversations.

In this study, I use postmodernism as a paradigm, and, in keeping with that paradigm, create and operationalize postmodern tools for working with the multiple ontologies I encounter. These tools are also a methodological contribution to the field.

1.10 Review and research question

So far in this chapter, I have discussed how underlying ontological assumptions and conflicts may aid engineering education researchers in studying complex scenarios and understanding resistance to change. I have pointed out that ontological work is a silent partner to the overt epistemological work that has been a main thread of research in engineering education since the field began. I have recalled the history of engineering education's investment in curricular change, which happens to be a good site for examining ontological work because it is itself an ontological act. I have explained why examining faculty roles and ontologies are good starting places, because faculty enact curricula and thus inform the ontological experience of others in the classroom (students, etc.). Since ontological assumptions are often unconscious and hidden, I have put forth narrative approaches as a way of getting at the underlying ontological work at play. Finally, I have circled back to the "ontological turn" in other fields and hinted at the underlying complexity already mentioned in engineering education literature, positing that postmodernism and its methods and methodologies may support us in finding language for that which we seek to see anew.

Bringing these threads together, I propose this research question for examination: In what ways might we make sense of faculty roles from how they tell stories about their own involvements in curricular change?

1.11 Brief project description

In this project, I examine curricular change narratives told by members of the engineering education community. I use interactions across ontologies of curricular change to illuminate affordances presented within ontologies of curricular change. In other words, I frame ontologies as tools for sensemaking rather than the singular "truth" of reality, which opens the discussion to

when and why one might choose which ontology. In doing so, I contribute to the engineering education community's ability to challenge and change our ontological assumptions, freeing the creation of further possibilities of what curricular change could be, and who might play what roles within it.

1.12 Summary of chapters

In Chapter 1 (this chapter), I have outlined the various threads that set the stage for my project: ontologies and the ontological turn as fertile soil for engineering education research, curricular change as one of many possible sites for examining ontological work, faculty roles as key to curricular change, narratives as an approach to address that which usually goes unspoken, and postmodernism as a paradigm with tools that may help us find language to describe ourselves anew. In doing so, I have set the stage for this project's exploration of faculty roles in narrative ontologies of curricular change.

In Chapter 2, I provide theoretical and historical contextualization for curricular change, faculty roles, narrative, and ontology. I do so twice: first in the context of engineering education research, then again after an explanation of the postmodern turn. The overarching thrust of the chapter is a demonstration of how postmodernism provides a different way to view and interact with these concepts in engineering education work, as these "different ways" will continue to be utilized throughout the remainder of this document.

Chapter 3 covers method and methodology. Since post-qualitative methodology is new to engineering education research, this chapter is large. It describes my protocols for creating the intersubjective and intertextual dataset and going from that dataset to the four ontologies produced during the course of this project.

Following Chapter 3 is an intertext that introduces the layout and conventions for Chapters 4-7. Those four chapters describe the four ontologies that serve as the analytical "results" of this project. Each analytical/ontological chapter works within a different ontology, using excerpts from this project's narrative dataset to illustrate how faculty roles interact with students and curriculum within that ontology.

Chapter 4 describes "faculty as makers of curriculum for the benefit of the students." Chapter 5 describes "faculty as inheritors of curriculum and students." Chapter 6 describes "faculty as embodiments of the curriculum encountered by the students," and Chapter 7 describes "faculty

as collaborators on curriculum with students.” The Makers, Inheritors, Embodiments, and Collaborators ontologies (named after the roles of faculty within them) provide four distinct but interrelated ways to make sense of faculty roles in curricular change.

Chapter 8 brings together the four ontologies detailed in Chapters 4-7. Instead of looking through each ontology in order to look at the narrative data, I now employ each ontology as a thing to look through in order to look at each of the other ontologies. In other words, imagine each ontology as a pair of glasses through which the world can be viewed. Whereas Chapters 4-7 are about putting on one of those pairs of glasses and seeing what the world looks like through them, Chapter 8 is putting on each pair of glasses and using them to look at each of the other pairs of glasses. The chapter closes with the implications of this project’s results and methodological contributions to engineering education research

2. REVIEW OF LITERATURE: SEEING THINGS DIFFERENTLY AND SEEING DIFFERENT THINGS

This chapter serves as a historical and theoretical introduction to several key concepts I engage with in the study. It is divided into two major parts. The first part unpacks four key concepts: curricular change, faculty roles, narratives, and ontologies. The second part introduces the “postmodern turn” in engineering education, or the adoption of postmodern paradigms for engaging concepts such as these in the context of the field. At the end of the second part, I revisit the four concepts from the first part in light of the postmodern turn, showing how they can be engaged in postmodern ways that are also contextualized within engineering education research.

2.1 Part one: Unpacking four key concepts

In this first part of the chapter, I unpack curricular change, faculty roles, narratives, and ontologies in light of their past usage in engineering education research, as well in relation to one another. For each concept represented by those terms, I first explain what it means as used in this study. Second, I give historical background on the concept, focusing on how it relates to engineering education research and curricular change. Finally, I focus on important attributes of those concepts that come into play for this project.

2.1.1 Concept 1: Curricular change (in engineering education)

The first concept I will unpack is the notion of curricular change, expanding on the brief introduction given in the first chapter. I first position curricular change as an ongoing conversation in U.S. undergraduate engineering education that has been ongoing for at least a century, drawing primarily from formal, national-level, large-scale comprehensive reports on the field in order to quickly sketch a broad, high-level picture. I then pull back to discuss the sorts of assumptions and definitions of “curriculum” and “curricular change” explored in those discussions. Finally, I examine underlying assumptions and trends in the discourse.

Historical discussions of national undergraduate-level curriculum in engineering education

Engineering education at the undergraduate level has undergone dramatic changes in the past century. Prior to the Morrill Act of 1862, “undergraduate-level” engineering education in the sense of formal university instruction scarcely existed; learning largely happened on the job in an apprentice-style setting. The Act funded land-grant universities in many states, and those universities were the ones that opened up the possibility of engineering as a college major (Reynolds, 1992). In 1895, the Society for the Promotion of Engineering Education (SPEE, later renamed the American Society for Engineering Education, or ASEE) was established as a coordinating body across institutions. One of SPEE’s early tasks was to facilitate national discussions about what the undergraduate-level engineering curriculum was, as well as what it ought to be (Reynolds & Seely, 1993).

Early engineering faculty and curricula, and therefore students, initiated engineering education with a practice-centric focus. Over the next century, the curricular pendulum swung back and forth on the predominance of theory (math and science foundations and the “engineering sciences”) vs. practice (hands-on laboratory/experimental work). This process continued alongside debates over the inclusion of the humanities, engineering sub-discipline specific content (in mechanical vs. chemical vs. electrical engineering and so forth), and the suggestion of 5-year and/or required graduate-level programs to fit all this into the curriculum (Seely, 1999). A sampling of the breadth of curricular recommendations over time can be seen in the table below, pulled from a collection of national reports on the state of engineering education written over the last 99 years.

Table 2.1. Curricular recommendations in national reports

Document	Curricular recommendations
Mann Report (Mann, 1918)	Reduce the courseload to a reasonable size, as students are currently burdened with unsustainable workloads. Increase the curriculum dedicated to practice; it is currently theory-heavy.
Wickenden Report (SPEE, 1930; SPEE, 1934)	Increase the curricular content in math and science so students have stronger theoretical backgrounds.
Hammond Report (Hammond, 1940)	Increase the curricular content in liberal arts, since many engineering graduates later go into management.
Grinter Report (Grinter, 1956)	Emphasize the engineering sciences (foundational/theoretical work tied to research) in the curriculum.
Goals Study (Walker, Pettit, & Hawkins, 1968)	Make the engineering undergraduate degree a broad preparatory one, and expect engineers to obtain a graduate degree in the field.
NRC report (NRC, 1986)	Improve the curriculum for lab (hands-on experimental) skills; consider a dual-degree 5-year (2+3) program to give enough space to cover a breadth of material.

These reports on engineering curriculum are cognizant of the field's curricular history and speak to a shared narrative of that history. Even the earliest document, written by Charles Mann in 1918, begins with a history of American engineering education, then goes on to describe how the 126 engineering schools in the country all believe that “the ultimate aim of engineering education has always been and still is more intelligent industrial production” (p. 336). Ironically, parts of this "history" are ahistorical; the claim that something "has always been" removes the need to investigate how it came to be. Nevertheless, the authors of these reports (and others) were aware of their relationship in a historical progression with regards to one another. The Goals Report of the 1960's provides a typical example of its proclamation of lineage:

The Mann report of 1918... the Wickenden investigation during the 1920's... the two Hammond studies immediately preceding and following World War II... the Grinter evaluation of 1955... and the Burdell report of 1956... and other less exhaustive studies have each, in turn, examined the practices of engineering educators in the light of changing needs and have provided the basis for a conscious effort to keep educational programs attuned to the requirements of engineering practice. The general success of this continual self-analysis and consequent modification of educational programs is evident in the current attitudes of the employers of engineers. (Walker, Pettit, & Hawkins, 1968, p. 373)

By citing their “ancestors” in the introduction, the authors of each document position their work as the next generation in the thread. In doing so, they reconstruct and reify the narrative of such a thread existing. In this project, I join them in proclaiming that there is a discourse on engineering curriculum. Although the content of that discourse is highly varied both over time and in any given moment, the discussion itself has been ongoing for nearly a century in formal research literature, and longer than that in other, less formal and more ephemeral venues.

Broad, shape-shifting definitions of curriculum and curricular change

In this study, I use the term "curriculum" in a broad sense to refer to the learning experiences that are part of an undergraduate engineering student's formation in college. The word "curriculum" is used in many ways in educational literature, with conceptions ranging from a narrow focus on formal course objectives, to a somewhat broader focus on the courses themselves, to the broadest definition of "curriculum" that encompasses student learning experiences in general, including the hidden curriculum and cultural knowledge that do not necessarily show up in course learning objectives (Su, 2012). I employ this broadest possible usage, which covers classes, extracurriculars, advising, implicit cultural transmissions of behaviors and expectations, and more. Curricular change in undergraduate engineering is therefore a change in the formation experiences of undergraduate engineers, broadly conceived.

National reports on the state of the engineering curriculum have a strong focus on the content of formal coursework when discussing "curriculum" and "curricular change." For example, the Wickenden report spends dozens of pages detailing the content of engineering sub-disciplines (chemical, electrical, mechanical, etc.) in consultation with working engineers (SPEE, 1930) in order both to paint a picture of the current state of the curriculum and provide recommendations for its revision. The National Academies report based its historical analysis of engineering curricular changes on the examination of textbooks and course catalogs in the 30 years prior to its publication (1986, p. 70). The Grinter report spends four full pages simply listing areas of curricular content such as:

- new scientific material (from research)
- basic sciences (math, physics, chemistry)
- engineering sciences (Mechanics of solids, Fluid mechanics, Thermodynamics, Transfer and rate mechanisms, Electrical theory, Nature and properties of materials)
- engineering analysis and design

- engineering laboratories
 - non-departmental engineering courses
 - humanities and social studies
 - electives
- (Grinter, 1956, p. 79-83)

That having been said, there is also an acknowledgement of broader aspects of the student formation experience. For instance, "humanities and social sciences" and "electives" are in the Grinter list above, though these still represent formal (albeit non-engineering) coursework. The Mann report discusses non-content aspects of the curriculum, such as co-op programs, experiments with grading, and other innovations of the time (1918). A more recent NSF call for proposals for engineering curricula reform requested projects that maintained "a solid mathematical and scientific knowledge base... integrat[ing] subject matter by introducing fundamental principles in the context of applications" – that is to say, the content and practice of the engineering sciences – but also requested a great deal of attention be paid to non-content curricular attributes.

[The curricular change proposals sought include a] combination of learning experiences not limited to traditional course structures... [that] integrate the development of teamwork, communication, and group project definition and problem-solving skills in learning experiences throughout the curriculum; address issues of cost and timeliness, quality, social and environmental concerns, health and safety, etc., in the context of engineering practice; recognize diverse learning styles and career goals; increase opportunities for international experience, possibly taking advantage of distance learning technologies; and integrate research and education. (NSF, 1997)

All these attributes – technical and non-technical content in the context of formal courses on the "basic sciences" and "engineering analysis and design," resources such as textbooks and course catalogs, environmental factors such as "cost and timeliness" and "learning styles and career goals," administrative decisions such as assessment, and more – are included in the notion of "curriculum" for this project. All these attributes are thus subject to revision when considering the phenomena of curricular change. In other words, incorporating laboratory exercises, changing grading schemes, and switching textbooks are just as much a part of "curricular change" as the decision to add or remove a physics topic in the required course progression. This flexibility in considering curriculum and curricular change provides a broad space for this project within which I can consider not only new variants on existing forms and aspects of change, but new forms and aspects themselves.

This sort of flexibility of form is a paramount attribute of the type of curricular change I examine in this project. Several national-scale engineering curriculum documents note the necessity of working outside existing structures when pursuing curricular change. As the NRC report noted, "Revolutionary change in the curriculum is brought about by the creation of entirely new fields or by substantial revision of existing fields. For example, the creation of materials science as an independent discipline represented the appearance of an entirely new engineering field" (1986, p. 10). Similarly, the ABET report proclaims that "a blurring of disciplinary boundaries is occurring that is incongruent with existing accreditation structures" (2004, p. 5). The NSF's 1997 CFP on engineering curriculum change is even blunter, searching for approaches that will "break through" the "barrier" set up by the "current academic culture and reward system":

Most observers agree that the current academic culture and reward system discourage development and implementation of educational innovations and the adoption of new educational paradigms... The Action Agenda for Systemic Engineering Education Reform described in this announcement seeks truly innovative approaches to break through this implementation barrier. (NSF, 1997)

To summarize, in order to accommodate the variety of conceptions of "curriculum" found in the literature, this project uses broad and somewhat adaptable conceptions of "curriculum" and "curricular change," which allows greater opportunity for comparison between different conceptions of curricular change. The structures and categories used in (and sometimes newly defined by) prior work, including those listed above, are worth being aware of, and I do not dismiss the possibility of iterating on improvements within those categories. However, in discussing "curricular change" in this project, I also explicitly include work that challenges and reconceptualizes those structures of curriculum and what it might be.

Underlying assumptions and trends in the discourse on engineering curricular change

There are several underlying threads across the lineage of national documents on engineering curriculum. In the following paragraphs, I discuss three of them: change as a consideration in discussions of engineering curriculum, a systematic and generalized description as opposed to one that admits its own situatedness and partiality, and compatibility with a singular, unified, and concrete conception of reality. I will interrogate these three attributes of engineering curriculum and curricular change during the course of this project.

First, curricular change is a constant across these documents in both content and mood. I give a few excerpts below for the general flavor of the "change" attitudes present in this writing. There is a general sense of constant innovation and improvement both in the onwards progress of a technologically-influenced society and in the engineering practitioners who train to keep up with, and push forward, its leading edge.

There probably never was a time when the minds of teachers were so intently alive and receptive to rapid changes, as at the present moment. (Mann, 1918, p. 232)

Engineering education finds itself confronted also by the rapid and constant advance of science and by the swift changes in technology. New knowledge, new techniques, and new fields of application are pressing for adequate attention in our curricula... (Hammond, 1940, p. 557)

It is relatively easy to look backward and recognize changes; it is more difficult to visualize what lies ahead... the engineering art taught in colleges will normally reflect practice that is already obsolete in part, since the teacher's knowledge of practice becomes rapidly outdated... College faculties must perform this work [of revising undergraduate curricula] year by year. The task initially undertaken by this Committee is not finished nor can it ever be finished. (Grinter, 1955/1994, pp. 84, 94)

There is a breadth and breathlessness, a sweeping urgency, to these portrayals. Teachers are "alive and receptive to rapid changes," science is "rapid[ly] and constant[ly] advanc[ing]," and technology has "swift changes." Current curricula and teaching practice become "rapidly outdated," and the work of curricular change "is not finished nor can it ever be finished." Furthermore, this rapid change is always in an upwards direction. The problems are those of "finding the best organization, of constructing the best curriculum, and of discovering the best methods of teaching," and "their solution requires extended experiments in education under conditions that command respect" (Mann, 1918, p. 335). Later authors are "encouraged by recent evolutionary trends" such as "improvements in methods of instruction, by better selective processes of admission, and by further development of graduate work" (Hammond, 1940, p. 560).

Secondly, the authors of these reports also work systematically to describe the field as a whole, which follows naturally from their position as survey documents of the state of the nation's engineering programs. As one example, the Grinter report describes its centralized spoke-and-hub process for distributing over eight thousand copies of interim reports, being sure to hit all colleges with accredited engineering curricula for feedback, and iterating through comments until the committee of authors "concluded that the Interim Report has been accepted as pointing the trend

for the evolution of engineering education over at least the next decade" (1955/1994, p. 74-75). Note the grand sweep of this generalization and the singular rather than plural nature of these progressions: pointing *the* trend for *the* evolution of the field.

This sort of observation leads to the third note of similarity: these sorts of statements fit within a view of reality as single, unified, and concrete. They do not require such a view of reality – others may fit – but they are compatible with it. In such conceptions of reality, facts may be socially constructed, but they are knowable, or at least knowable enough for practical purposes. Pursuing these facts is viewed as a job worth doing.

The national reports exhibit patterns that fit into this conception of reality. For instance, the Wickenden Report introduces its job as "determin[ing] just what the facts are... the fundamental requirement is to investigate comprehensively the facts bearing on engineering education in its several fields and to arrange and present the results" (1930, p. 8). Facts lead us inexorably onwards. After giving its own collection of facts about conditions in and attitudes regarding engineering curricula, the Hammond report authors state their belief that "engineering colleges will desire at this time to examine anew their functions as institutions of higher education, to reconsider the selection and grouping of their materials of instruction, and to weigh without prejudice the duration and character of the formal training needed to prepare engineers for their careers..." (1940, p. 557). In particular, the instruction to "weigh without prejudice" these considerations speaks to a desire for objectivity and an assumption that it can and ought to be obtained. Similarly, the Goals report represents itself as "an attempt to indicate, in broad and general terms, the direction which engineering education must take if it is to meet the demands of the future" (Walker, Pettit, & Hawkins, 1968, p. 373), which presupposes that such an attempt is valuable. In other words, the assumption is that it is possible for a report to indicate "indicate, in broad and general terms" what the field "must" to meet "the demands of the future" – future demands and required directions being broad and general concepts themselves – at least well enough to be pragmatically useful.

In this project, I build on the idea of constant curricular change as an embedded feature of the undergraduate U.S. engineering curriculum by utilizing theoretical and methodological tools designed to investigate constant change and disruption. However, I challenge the sweeping, generalized natures of these curricular change descriptions by presenting partial and unashamedly incomplete alternatives, then working to show the benefits of multiple partialities. I also challenge

the notion of a single unified reality and examine what curricular change portrayals might look like if they were portrayed by multiple conflicting ones, and what implications this might hold.

2.1.2 Concept 2: Faculty roles (in curricular change)

Having discussed curriculum and curricular change, I now turn to faculty as people who are highly influential (as described in Chapter 1) within it. I will first define what I mean by “faculty” and give some examples of both faculty development research and faculty as objects of study in engineering education research. Following this, I step back to the calls for curricular change detailed in the previous section and examine the attributes of faculty that are implied in these calls, with a focus on the attributes I engage in during this project.

Faculty are college-level curriculum designers and instructors

In this project, I use the word "faculty" to describe people who are responsible for both designing and teaching college-level engineering courses at a college or university setting. As mentioned in Chapter 1, this echoes the American Association of University Professors' criteria for "faculty," which requires that such curricular work be at least half the person's full-time job (Barnshaw, 2016). This functional definition centers around a faculty member's relationship to curriculum/instruction. It is compatible with the national reports' usage of the term "faculty," but also sometimes "instructor" or "teacher" or "professor." In the context of this work, I will use the word "faculty" to indicate all three.

Utilizing this definition of faculty, I can now talk about the development of those faculty as professionals. Faculty development exists as a professional field in its own right, with a professional organization (Professional and Organizational Development, or POD), an annual conference, and a regular peer-reviewed research journal (To Improve the Academy). Engineering faculty are free to participate in general faculty development initiatives on their campus, just like any other faculty member. However, engineering education is still in the formative stages of representation in the faculty development practice and research community (Strong, Chua, & Cutler, 2016; Cutler, Strong, & Chua, 2015). Engineering-specific faculty development centers reside at the University of Washington and the University of Michigan, but they and other discipline-specific faculty development efforts are minorities among the much larger number of

general Centers for Teaching and Learning. Additionally, such centers have responsibilities towards improving faculty practice directly (via activities such as course consultations and on-campus workshops) in addition to any research output that may come from these activities.

Similarly, efforts to advance the faculty development conversation at engineering education research conferences are still in the beginning stages, especially compared to research on engineering students. Research on faculty and within faculty development was represented at the most recent meetings of engineering education research's two major conferences. The 2016 Frontiers in Education (FIE) conference had three paper sessions dedicated to faculty development, and the 2016 American Society of Engineering Education (ASEE) conference included a meeting to explore the idea of starting a Faculty Development division within ASEE (Pulford, Cutler, Hahn, Harris, & Kappers, 2016).

Some of the faculty-centric work represented at these conferences represent work that treats faculty as an audience or dissemination target (i.e. workshops intended for faculty, rather than workshops about research done on faculty). This work can have a deep and lasting impact on engineering education as a research field. For instance, both the Rigorous Research in Engineering Education (RREE) and Institute for Scholarship on Engineering Education (ISEE) initiatives were formative in the decisions of many engineering education researchers to seriously pursue research in the field (Streveler & Smith, 2006; Streveler, Smith, & Miller, 2005; Adams et al., 2006). Additionally, this work can investigate the deep and lasting impact of engineering education research on faculty (Fincher, Richards, Finlay, Sharp, & Falconer, 2012; Borrego, Froyd, & Hall, 2010). However, this sort of work represents faculty as an audience or dissemination target rather than of their activities and viewpoints object of study in their own right.

Prior research in engineering education has included faculty as objects of study, as in Mondisa's investigation of African-American faculty as mentors (2016). Faculty viewpoints have also been investigated, as in Pawley's research on how engineering faculty conceptualize "engineering" (2009). Additionally, faculty viewpoints on engineering curricula have been captured both by the national reports, largely written by senior engineering faculty and administrators, and in more deliberate multivocal collections of multiple faculty views on engineering education (Adams et al., 2011). This project simultaneously engages all three of these foci; it takes the faculty role as an object of study, situates that faculty role within the context of engineering curriculum, and uses data from faculty viewpoints in order to do so.

Attributes of faculty in national calls for curricular change

Several attributes of faculty appear in the national-level historical documents on curricular change. In the paragraphs that follow, I will discuss four attributes that are particularly relevant to understanding faculty roles in curricular change in the context of this study. The first is that faculty are important to curricular change. The second is that faculty curricular activities are intended to benefit students. The third is that faculty ought to have continuous self-development opportunities in order to support their curricular work, and the fourth is that the past experiences of faculty – including their formation prior to becoming faculty – affect the kind of curricular change work they can do. I will examine each of these in turn.

First, faculty bear important responsibilities not only for curriculum design and implementation as per the definition of faculty roles in this project, but also for curricular change as a result of these role attributes. Therefore, faculty play a key part in curricular change and investigating curricular change. Several parts of the national-level discourse on engineering education state this explicitly, as in the examples below.

(NRC Report) Engineering faculty play a critical role in the introduction of the kinds of curricular change discussed above. Faculty unfamiliar with the research frontier will lag in the introduction of important new material into the curriculum; faculty far removed from advances in industrial practice will miss important opportunities to tailor the curriculum to crucial industrial needs—which will be to the disadvantage of their students. (NRC, 1986, p. 11)

(Wickenden Report) Our real function as a Society [for Engineering Education] is to develop teachers who can train engineers. Real progress must come largely from inward growth. The greatest gain must come from better teachers and stronger faculties (SPEE, 1930, p. 9)

(Goals Study) Next to the student body, the faculty is the most important factor in assuring the success of any engineering educational program (Walker, Pettit, & Hawkins, 1968, p. 374, 377)

These statements explicitly address the importance of engineering faculty in curricular change and success. In addition to these explicit statements, the central role of faculty appears implicitly throughout the documents as well. Although not stated directly, the responsibility of faculty for curriculum can be inferred by their portrayal in the documents on curricular change. Take, for instance, a few examples from elsewhere in these documents:

(Mann Report) There probably never was a time when the minds of teachers were so intently alive and receptive to rapid changes [in engineering curricula], as at the present moment (Mann, 1918, p. 232)

(Goals Study) The task of educators is to understand the forces and trends at work in the process and to assure themselves that changes [to the engineering curriculum] are made at the proper time and in the right direction. (Walker, Pettit, & Hawkins, 1968, p. 374)

(Hammond Report) Many engineering educators are therefore seeking ways of increasing thoroughness and breadth of instruction in fundamental matters and of stimulating among students initiative, resourcefulness, and originality (Hammond, 1940, p. 557)

(Grinter Report) College faculties must perform this work [of revising undergraduate curricula] year by year. The task initially undertaken by this Committee is not finished nor can it ever be finished. (Grinter, 1956, p. 94)

These excerpts – which are representative of other sections of the collection of documents – focus on the “minds of teachers,” the “task of educators,” “engineering educators,” and “college faculties” – in other words, faculty. The actions portrayed by these excerpts are all taken in respect to engineering curriculum: being “receptive to rapid changes” in it, “understand[ing] the forces and trends at work” and “assur[ing] themselves that changes are made... in the right direction,” and “perform[ing] this work” of curricular change. In other words, the documents seem to assume – sometimes to the point of not explicitly stating it – that faculty do curricular change work. Secondly, in engaging with curricular change, faculty are responsible for and oriented towards fostering student growth. Students are portrayed as the end users of curriculum; the Grinter report does so most explicitly.

The instructional goals of engineering education include helping the student to learn to deal with new situations in terms of fundamental principles, on his own initiative, with confidence and sound judgment. (Grinter, 1956, p. 79)

Similarly, the NSF’s call for curricular change projects is full of language detailing how engineering faculty ought to be oriented towards fostering the growth of engineering students:

Create a learning environment in which it can be clearly demonstrated that the faculty who participate in the engineering program: view themselves as mentors dedicated to nurturing and developing students; develop and use advanced educational materials... that promote student-based learning; provide learning experiences that meet the needs of students with different learning styles... integrate subject matter by showing relationships from the beginning of the

student's program... and develop students' capability and motivation to engage in lifelong learning. (NSF, 1997)

In both the Grinter and NSF examples, faculty are portrayed as people who help students learn via their curricular work. Similar smaller examples recur through the other documents. For example, Hammond's statement above on how "many engineering educators" are "seeking ways" of improving the curriculum includes a note that these educators are attempting to "stimulat[e] among students initiative, resourcefulness, and originality" (1940, p. 557). The faculty are not only changing the curriculum, they are doing it to increase positive qualities in their student body. Similarly, the NRC report's statements on the "critical role" of engineering faculty above problematize underprepared faculty as being to "the disadvantage of their students" (1986, p. 11). Again, students are portrayed as the beneficiaries, or the potential parties harmed, by faculty preparation and work on curricular change.

In these portrayals, students are "others" (that is, non-faculty) who help faculty solidify their identity and positioning by defining who they are not. The existence of students as a group-that-is-not-faculty forces faculty themselves to take a worldview in relation to those who are not-them. In the context of curricular change, the concept of students as a different (non-faculty) type of person interacting with the curriculum ends up clarifying how faculty are "supposed" to act with respect to the curriculum and to the students.

Thirdly, in order to promote ongoing and positive curricular change, ongoing developmental experiences need to be built into the faculty role. The NRC report says outright that "to preserve current relevance and vigor, it is essential that engineering faculty participate continuously in professional development" (1986, p. 11). It goes on to explain that aspects of this development are challenging due to departmental reward structures, and that most universities do not have faculty development opportunities in both research and teaching, before listing possible activities that could constitute such support:

...travel to other universities for cooperative research, short courses, and sabbaticals; periods of residence in industry and government laboratories where there are equipment and expertise not found in the universities; release time on campus for course and laboratory development, taking courses, and internal educational fellowships; and team teaching in emerging areas by combinations of specialists and experienced faculty (p. 51).

The notion of ongoing faculty development can also be seen in the Wickenden report, which devotes an entire bulletin to teachers. This bulletin lists opportunities for faculty development such as sabbaticals, instruction for faculty on how to teach, and programs devoted specifically to early-career faculty (1930). The Goals study gives a brief study of such an early-career faculty development program, this one run by the Ford Foundation for those who are “entering faculty careers with doctoral degrees but with little, if any, experience in the practice of engineering,” (Walker, Pettit, & Hawkins, 1968, p. 393). The program was based on surveys of engineering faculty by the same foundation, which noted that the faculty surveyed “reported some type of professional growth activity” such as “research, consulting, industrial experience, [or] self-study” (ibid). These excerpts are representative of the notion of developmental experiences occurring both during and as part of a faculty career.

Finally, there is the idea that new faculty should enter the university with backgrounds that develop their skills as both engineers and educators. The discussion of faculty backgrounds is present in many “calls for curricular change” documents. For instance, Duderstadt’s proposal for post-baccalaureate professional schools of engineering details the desired background of their faculty:

The faculty of these schools would have strong backgrounds in engineering practice with scholarly interests in the key elements of engineering, e.g., design, innovation, entrepreneurial activities, technology management, systems integration, and global networking, rather than research in engineering sciences... At the professional level, a practice-oriented and experienced faculty could develop topics such as design and synthesis, innovation, project and technology management, systems analysis, entrepreneurship and business development, and global engineering systems, as well as more abstract topics such as leadership and professional ethics (Duderstadt, 2010, p. 13-14).

Implicit in Duderstadt’s statement about the backgrounds of these faculty is the assumption that the experiences that faculty have prior to becoming faculty are influential factors in how they approach curricular design, and by extension, curricular change. Other documents similarly critique the lack of industry background of current engineering faculty as not providing students with exposure to active practitioners (Mann, 1918; Walker, Pettit, & Hawkins, 1968). Additionally, such prior experiences may influence whether people become faculty at all. The NRC report looks at talented students who might become future faculty, and pays attention to how they are exposed to conceptualizations of the faculty job during their formation. If students see the faculty job as being high-pressure and overburdened with many responsibilities, they will be

deterred from becoming future faculty (1986, p. 45-46). More generally, these discussions of faculty include the notion of their identity and past – who they are and where they have come from.

These four attributes of faculty will reappear in the narratives of faculty on curricular change that I investigate in this study. Various conceptions of faculty roles in curricular change resonate with some of these attributes and conflict with others. The attributes themselves can also variously resonate and come into conflict in some applications – for instance, a faculty member’s focus on helping students may come into conflict with the identity formed by their past experiences. In this study, I look at the ways these attributes interact with one another in faculty narratives.

2.1.3 Concept 3: Narratives (of curricular change)

In this project, curricular change and faculty roles are the things I make sense of, whereas narrative is the modality of sensemaking that I employ. Taking a narrative approach with this project refers to two different things. First and most obviously, it means that I am working with narrative data – that is, stories with characters that unfold over some timeline, as opposed to demographic numbers or survey statistics – to explore the topic of faculty roles in curricular change. Secondly, it refers to a "narrative approach" for making sense of that data, since narrative data can easily be analyzed in non-narrative ways (for instance, counting word frequency).

This section gives background on the project's usage of narrative, which I frame as a communal practice. I begin with an overview of how narrative has been used and contextualized in prior engineering education research. I then move into what narrative is (or rather, what I take it to be in the context of this project), drawing heavily from Bruner's conceptualizations of narrative as a way of sensemaking. Finally, I discuss the communal aspects of narrative sensemaking that contextualize this project’s transformative potential.

Narrative in engineering education research

Engineering education research has a history of using narratives and the narrative mode of sensemaking to explore how various people make meaning and sense of the worlds of engineering education that they encounter. Within engineering education, narrative tends to be related to conceptions of learning as situated rather than abstractable; under this sort of worldview,

knowledge is contextual (Brown et al, 1989) and cannot be completely separated from its immediate circumstances. In “Situated Engineering Learning: Bridging Engineering Education Research and the Learning Sciences,” Johri and Olds (2011) provide numerous examples of how situated learning is already embedded in engineering education by virtue of its emphasis on tangible, real-world, hands-on project work. Narrative provides a means for transmitting and making sense of situated knowledge.

There are many examples of narrative work for situated sensemaking in engineering education research. To list just a few, a 2007 paper titled “Storytelling in Engineering Education” highlights the importance of personal narratives as ways to express community values by “[providing] a vehicle for scholarly discourse that makes explicit our implicit knowledge, promotes reflective practice, and provides entry points into a community of practice” (Adams et al., 2007, p. 4-5). Case and Light list “narrative analysis” in their 2011 Journal of Engineering Education paper “Emerging methodologies in engineering education research,” as does the Cambridge Handbook of Engineering Education Research (Johri & Olds, 2014) and Nancy Chism’s booklet Qualitative Research Basics: A Guide for Engineering Educators circulated by the Rigorous Research in Engineering Education (RREE) group (2010).

Narrative has also been used specifically for research on faculty within engineering education. Pawley’s 2009 paper “Universalized Narratives: Patterns in How Faculty Members Define “Engineering” (2009) and Fincher and Tenenberg’s Disciplinary Commons project which seeks to “[move] narrative from its naturalistic role in teacher conversation to a more purposeful investigation” (Fincher 2012, p. 28) are both examples in this area. The narratives used in these and other projects provide a rich and contextualized view of the complexity within engineering education, and assist readers in making a different sort of sense of that world for themselves.

In this project, I build on these traditions of framing narrative as a situated process of sensemaking. The narrative data for the project consists of stories situated in the curricular change experiences of particular faculty on particular campuses, rather than focusing on abstract theories. The narratives are also overtly dialogic within and across communities, since faculty narrators read and comment on each other's narratives as a way to elicit their own. Finally, the conceptions of faculty roles in curricular change I produced via my analysis are not roles described in isolation; rather, they are situated in various sorts of communal contexts.

Narrative as a communicative and hermeneutic mode of sensemaking

Having discussed the usage of narrative in the context of engineering education research, I now step back to discuss narrative itself. In doing so, I draw on Jerome Bruner's conception of narrative as a way to make sense of the world. This conceptualization of narrative as sensemaking includes several features of narrative reality and truth that are important to the project, and I discuss those below as well.

Sensemaking is the process of making meaning from experience and/or data. Bruner (1986) describes two modes of sensemaking: the paradigmatic/logico-scientific mode and the narrative mode. The two modes are complementary, not contradictory; each gets at a sort of knowing that the other does not, and most people use both simultaneously and constantly. The paradigmatic/logico-scientific mode of sensemaking aims towards categorization, prediction, and control in order to arrive at a meaning that corresponds to a single pre-existing truth. In contrast, the narrative mode of sensemaking is concerned with how people make meaning and sense of their worlds.

One feature of narrative sensemaking that Bruner describes is its "hermeneutic composability," meaning that narratives are boundary objects through which people express and extract meaning (1991, p. 7-11). Narrative sensemaking is not a simple unidirectional process of transmitting meaning from narrator to reader. Rather, it is an interpretive process that relies heavily on the actions of the reader. From a narrative perspective, truth and reality would not exist without the reader, since "narratives do not exist, as it were, in some real world, waiting there patiently and eternally to be veridically mirrored in a text" (p. 8). Readers are not "just" readers, they are also coauthors constructing "a virtual text of their own" based on material from the narrator along with their own prior knowledge and experience (Bruner, 1986, p. 36-37). "The writer's greatest gift to a reader," says Bruner, "is to help him become a writer" (p. 37).

The reality "authored" by the sensemaking of the reader considers two things simultaneously: one is what Ruthrof calls the "presented world," or the reader's interpretation of what the narrator is attempting to communicate. This is the world within the narrative: its characters, its settings, its timeline, and so forth. The second is the what Ruthrof calls the "presentational process," or the reader's interpretation of the narrator. This is the world of the narrator themselves: their viewpoints, their attitudes, their trustworthiness, and so on (Ruthrof, 1981, p. 3-6). Readers decide how and how much to trust their narrators, reading between the lines

instead of merely taking the narrator's words at face value This means that the "truth" that a reader obtains from a narrative depends on such contextual elements such as the intention of the narrator and reader, the background knowledge narrator and reader have regarding each other, and so forth (Bruner, 1991, p. 7-11). The reader's interpretation of the message is filtered through their assumptions about the nature of its medium.

From this point of view, narrative truth is not something that is purely objective and external to a reader; rather, it is something that engages with a personal and internal process. Such a view of truth does not presuppose a devolution into pure relativism where anything can be true and all possible meanings carry equal weight. Rather, the determination of whether something is "truthful" is not restricted to "constructions generated by logical and scientific procedures that can be weeded out by falsification" (p. 4-5), a sort of "forensic truth" where things must correspond to dates and facts that cannot contradict (South African Truth and Reconciliation Commission, 1998). Instead, a determination of a narrative's "truth" asks whether a narrative has what Bruner calls "verisimilitude," or the possibility or resemblance of forensic truth and the truth of personal recollection and memory (Bruner, 1991, p. 13) The fables of Aesop and the tales of Tolkien are narratively true not because of video or archaeological evidence that talking ants, Hobbits, and magical rings "really existed," but because they resonate with readers as saying something true about the world they live in: preparation pays off, friends can carry you when you can no longer walk yourself, and good ultimately triumphs over evil.

In the context of this project, adopting a narrative mode of sensemaking means attending to the meanings that different readers make of the phenomena at hand, which is faculty roles in curricular change. There are many "readers" in the project, including the faculty narrators, myself as the primary author of this document, and you (yes, you) as a reader making sense of the stories you encounter. In this project, I aim not at a single forensic "truth" of what things "really mean" or what "really happened." Instead, I draw on the feature of hermeneutic composability and use faculty narratives as boundary objects through which meanings may be expressed and extracted. The question is not "what do these stories mean," but on the possibilities for what people might use and interpret them to mean.

The transformative power of narrative situated in community

In this project, I also position narrative as situated in community. Narrative sensemaking takes place between people, so one can conceptualize a community as creating a shared sense of the world – a shared sense of reality – through the sharing of narratives amongst its members. In the paragraphs that follow, I discuss community as a site for narrative and sensemaking. I end by explaining how narrative work such as this project can open up different possibilities for understanding and practices within communities.

Community is also a common concept in engineering education research. In particular, the Communities of Practice (CoP) framework is widely used in engineering education literature as a way of discussing community. Briefly, communities of practice are the domain-specific groups of practitioners with whom we share a fellowship, and narrative is an everyday occurrence and means of communication within them (Wenger, 1999). The activities of curricular change and the exchange of narratives regarding it are not undertaken in solitary confinement. Rather, narratives of curricular change are exchanged among communities of practitioners.

CoP theory is widely used in engineering education research, including usage specifically geared towards faculty. For example, the NSF-funded Rigorous Research in Engineering Education (RREE) workshops previously mentioned were based on a CoP model (Streveler, Smith, & Miller, 2005). Engineering education conferences feature workshops and special sessions with titles such as “Feminist engineering education: building a community of practice” (Pawley, Riley, Lord, & Harding, 2009) and “Communities in practice in engineering education: what are we learning?” (Adams, Allendoerfer, Bell, Fleming, & Leifer, 2005). While not limited to engineering or technology faculty, the Faculty Learning Community (FLC) movement within faculty development has been described as a specific type of CoP (Cox, 2004). Finally, the American Society of Engineering Education (ASEE) is developing a NSF-funded virtual CoP model for faculty, citing familiar-sounding frustrations with the “inherent limitations” of the “develop-disseminate” model in which researchers develop new materials “and then try to convince others to use them... without any follow-up activity,” (Pimmel et al., 2013, p. 2).

One feature of communities of practice is a shared practice of language usage that develops among its members. For instance, as part of their training, materials engineers need to learn the names of various types of metals and ceramics; electrical engineers learn how to navigate the datasheet as its own peculiar literary form, and engineers of all sorts learn a host of acronyms

within their first few years of schooling. This sort of language acquisition is not just some sort of abstract theoretical framework for analyzing one's practice from a distance. Rather, it is an everyday toolset of "shop talk" for engaging in that practice, the chatter of practitioners as they coordinate a tricky antennae calibration or set up surveyor's tripods across a field. The purpose [of this language]," wrote Lave and Wenger, "is not to learn from talk as a substitute for... participation; it is to learn to talk as a key to... participation" (1991, p. 109).

The everyday language and narrative practices of a community point towards a sort of fluency of narrative reception that marks someone as belonging to that community. For example, researchers often refer to common theories to succinctly communicate ideas; by citing Lave and Wenger in this document, I draw my research into a web of ideas others have already thought and written about, thereby marking myself as someone knowledgeable about scholarly literature and its conventions. As another example from the domain of engineering education, consider the adoption of a popular textbook for an introductory Mechanics course, and how it provides a common discussion reference point for students. These common discussions are not limited to sample equations or specific homework questions, but also encompass attitudes towards them – consider the popularity of complaints towards unpopular textbooks as a point of solidarity among students. Practitioners tell each other stories about their work all the time; telling the "right" kinds of stories about the "right" kinds of things (for instance, in a literature review) is a mark of belonging in its own right.

Noticing how a community constructs and uses its shared language for narratives can be a way to make sense of how that community constructs its shared realities. In this case, noticing languages for curricular change narratives, and the degrees to which they may or may not be shared, can provide clues as to how curricular change itself is conceptualized and subsequently carried out by members of the engineering education community. In turn, this means that examination of the ways narratives are told (and not told) can expose the privileges that a community grants to ways of narrating and the realities presupposed by those narratives. In this case, the question is how narratives of curricular change are told by faculty to others within their communities of practice, and how various narratives (and the faculty roles they present) might be privileged within those communities under various circumstances.

In addition to learning the acceptable forms of everyday language and narration within their community, members of a community of practice also learn specific narratives from their

community. The collection of narratives shared by a community is called a "narrative accrual," and it constitutes an aspect of shared culture (Bruner, 1991, p. 18-20). The history of a country, the "foundational" papers of an academic discipline, and the dinner-table stories that "everyone in the family knows" are all examples of narrative accruals. These narrative accruals are important enough that they are often enforced: children are required to learn national and world history in school, graduate students are required to read a common core of "foundational" works in their field, and prospective sons- or daughters-in-law learn certain family stories and traditions when they come to visit.

Communities of practice and their narrative accruals co-construct each other. Learning the stories in a community's narrative accrual is part of learning to belong to it, and demonstrating that knowledge is part of displaying that membership. At the same time, the cultural identity of a community is held and transmitted by the stories it shares and by the assumptions packaged inside those them. Narratives remind us who we have been, who we are, and who we could be. To become a full member of a community of practice, it is not enough to become a passive reader of this narrative accrual; a full community member must contribute to the joint process of creating the collective story pool. This is the act of co-authoring a community's narrative accrual, and it is an act that enters and transforms the community and the co-author – which are not separate, since the community is comprised of co-authors.

As narrators place and shape their narratives within the narrative accrual of our community, they place and shape themselves within and in relationship to their communities. "Our individual autobiographies," says Bruner, "...depend on being placed within a continuity provided by a constructed and shared social history in which we locate our Selves and individual continuities. It is a sense of belonging to this canonical past that permits us to form our own narratives of deviation while maintaining complicity with the canon" (1991, p. 20).

In the context of faculty roles in curricular change, the co-constructing nature of narrative accruals and communities of practice means that looking at (part of) a faculty community's narrative accrual around curricular change can be used to open up understandings of (part of) that community and its practice(s) of curricular change. As this project demonstrates, examinations of narrative accruals can also take narrative form and weave into the narratives they are examining. In doing so, they move beyond understanding the communities and narratives they examine, and

into transforming them into the sort of communal and hermeneutic dialogue of narrative sensemaking I have been describing.

2.1.4 Concept 4: Ontologies (of curricular change)

This section deals with the philosophical concept of ontology, or the nature of being and reality. Ontologies are, in many ways, the underlying "objects of study" I engage in this project. When I look at curricular change, I am asking about underlying assumptions of what the reality of curricular change is. When I examine faculty roles, I do so in the context of what we understand faculty to be within these conceptions of curricular change realities. Similarly, narrative is a place where these assumptions about curricular change realities and faculty roles therein are played out. The "results" of this study consist of ontologies – versions of curricular change reality within which various faculty roles live.

In this section, I begin by explaining what ontology is, then examining it as a missing twin to the epistemological work that has dominated much of engineering education research thus far. I then transition into an explanation of how ontologies are presupposed by narratives. Finally, I examine the idea of affordances as they relate to ontologies, and explain how ontological affordances will play out during the course of this project.

Ontologies are about the nature of reality, and ontological assumptions shape reality

The concept of ontologies is usually found within the discipline of philosophy, hearkening back to foundational metaphysics. Simply put, ontology refers to the study of the nature of being. Ontologies are a basic, everyday concept: every time someone uses categorizations or taxonomies ("there are five engineering majors at our school" or "courses can be one, two, or three credits wide"), they are engaging with ontological knowledge.

To revisit and expand upon the introduction to ontologies given in the first chapter, an ontology is "a particular theory about the nature of being or the kinds of things that have existence" (Merriam-Webster, n.d.). I draw from Gruber's conceptualization of ontologies as "explicit specification[s] of a conceptualization" consisting of a "set of objects, and the describable relationships among them" (1993, p. 1-2) and focus on the kinds of objects (e.g., people, groups,

institutions, ideas, etc.) that exist in a reality, what roles those objects are allowed to play, and how they are permitted to interact with one another.

Ontology is already a large part of both engineering education and engineering education practice, albeit often an unspoken one. Many design choices in engineering education are ontological acts: what is the nature of our field, such that we may split it into courses and majors and credits? What are the roles our practitioners might play, so we can create certification programs to place them inside or outside of boundaries of legitimacy? Similarly, many acts of engineering itself are about making change in the world, or making or remaking ontologies. The deep materiality of engineering and its concern with constantly being able to tinker with concrete things in concrete ways can be framed as a practice of ontological fluidity – the notion that the world is changeable and that one can participate in changing it.

Ontological assumptions regarding the nature of being are often unstated and taken for granted. Heidegger (1962) pointed out that our being itself and the being of other things and people in our worlds are so "ready-to-hand" that we simply use them and are only forced to think about them when that "readiness" is disrupted. However, investigating the ontological assumptions inherent in a practice is an important part of understanding that practice. As Dall'Alba (2009) put it, "if we are fully to understand knowing within various forms of professional practice, we must understand the being of those who know" (p. 25).

Ontologies are not merely theoretical concepts. When assumed by those with power within a particular reality, ontologies shape – or more accurately, become – that reality. For instance, the implicit ontologies of a first-year engineering director will be enacted as and within the structure of a new curriculum. If that director sees engineering as inherently being split into distinct sub-disciplines, this structure is likely to be reflected in the first-year courses, as in ensuring that students are exposed to an equal number of faculty speakers "from each discipline" (which begs the question of where transdisciplinary faculty fit in this count). If the director sees engineering itself as transdisciplinary, distinctions between engineering majors (bioengineering, civil engineering, etc.) may be less emphasized in the introductory courses.

Ontologies are similar in some ways to Kuhn's notion of paradigms; speaking of ontologies allows the possibility of multiple ontologies and shifting between them, just like speaking of paradigms allows the possibility of multiple paradigms and shifting between them to see things that are "already there" in a different sort of way (1962). Among the ideas raised by Kuhn is the

notion of incommensurability of paradigms, which also applies to ontologies. This is the notion that there is no external, “objective” measuring stick by which paradigms can be compared. This is not to say that paradigms or ontologies cannot be compared at all, but rather points out that any comparison must take place within a paradigm/ontology. In other words, there is no such thing as being “outside all paradigms” or “outside all ontologies,” only the notion of being within or outside specific ones.

In this project, I engage ontologies primarily by looking at the roles and relationships various people construct as being "real" in the world – in other words, what kinds of things exist, and how are they related to each other? This sort of ontological work can address questions about progress in engineering education. Some voices have claimed that the "lack of progress in educating engineers is not a function of ineffective solutions but rather of ineffective problem formulation," and that a "more inclusive problem formulation space" is needed (Adams et. al., 2011, p. 50). Ontologies provide a way to conceptualize spaces of problem formulation and solution enactment. They are the foundational substrate of reality within which those acts take place.

Epistemology's hidden twin

Ontology's study of being and reality is intertwined with epistemology, or the study of knowledge. Both are concepts that every thinking being engages with daily, whether they realize it or not; as beings in the world, we are simultaneously selves who exist and are (ontology) and know and do-not-know (epistemology). Ontology and epistemology cannot be separated, as Dall'Alba points out: "If we are fully to understand knowing within various forms of professional practice, we must understand the being of those who know" (2009, p. 25). For this project, I conduct ontological investigations of faculty as "those who know" and curricular change as part of their professional practice.

While ontology has not received much explicit discussion in engineering education research, its twin of epistemology has been the focus of significant attention. "Engineering Epistemologies" is one of the five core topics for engineering education research (National Engineering Education Research Colloquies, 2006). Since then, research on engineering thinking and knowledge has proliferated. For example, King and Magun-Jackson (2008) looked at epistemological beliefs of engineering graduate students as correlated with demographic

characteristics such as education level, gender, and ethnicity. Montfort, Brown, and Shinew (2014) wrote a JEE paper on "The Personal Epistemologies of Civil Engineering Faculty," and Beddoes, Montfort, and Brown (2014) looked at how engineering students use metaphor to express their epistemologies of engineering. The boundaries of engineering knowledge, ways in which that knowledge is socially constructed, and mechanisms by which that knowledge is changed all fit within the realm of epistemological investigation in engineering education.

Although ontologies are not explicitly mentioned in much epistemological engineering education research, they are never very far away. Epistemology cannot exist without ontology; it is impossible to talk about knowing and knowledge without assuming some kind of reality that can be known, and which that knowledge can occur within, as well as assuming some kind of knower with some kind of nature of being. Every epistemological project has an ontological aspect, even if that aspect is not explicitly discussed. For example, looking at epistemological beliefs and their correlations with education levels, gender, and ethnicity assumes the existence of such things (high school graduation, male/female, black/white/Hispanic/native, etc.) as relevant constructs. The personal epistemologies of civil engineering faculty cannot exist without assumptions about how "civil engineering" exists in the world. Engineering students use metaphor to communicate taxonomies they are applying to delineate relationships between things in the world, and conceptual change relies on the existence of a thinker who can re-conceptualize their thoughts about the world around them to the extent that their assumptions about the nature of the world itself are transformed.

In this project, I explicitly engage with ontologies of curricular change as a way to make epistemology's lesser-known twin more visible in engineering education research. While this project centers ontological work, it also uses epistemological framings for the same work as a way to bridge to the familiar. The language of "making-visible" and "understanding" comes from an epistemological framing; how can we know and understand, what can we see and therefore know? I use epistemological language in order to point to ontological concepts and get at foundational, metaphysical assumptions about curricular change in engineering education.

Narratives presuppose ontologies

All narratives presuppose ontologies. To use a theatrical analogy introduced in Chapter 1, an ontology is like a theatrical setting. Assumptions about the nature of reality can be framed as

constraints on the possible roles and relationships within it. The theatrical equivalent is the constraints presented by a certain set of actors and props and stage geometries. Within these constraints, an infinite number of plays can be staged. Saying that "all narratives presuppose ontologies" is like saying that all plays presuppose some kind of staging and cast. These presuppositions do not prevent a theatre and cast from staging an infinite variety of plays, but they do affect how they can do so. The "same" story (for instance, Romeo and Juliet) as staged by a large all-girls high school, a one-man show, and a professional troupe of 30 actors of varying genders, ages, and ethnicities will be quite different shows.

Narrative ontologies can loosely be thought of as a cast of characters (and props and settings). Each component in a narrative is defined in relation to each other component; it is the interrelationship of the components that give them their meaning. Specifically, narratives have characters (among other things), and these characters have roles in relation to each other. Indeed, plays will sometimes list a cast of characters in this manner: this character is another character's mother, husband, or colleague; this house belongs to this character and is being bought by this other one.

Even simple statements within narratives imply ontologies; to say that "Amy taught Bill about chemistry" is to imply the existence of not only Amy, Bill, and chemistry, but the sorts of things they are and how they are related. There exists a person named Amy (an ontological statement) that is a type of person who is able to teach chemistry; therefore, not only does Amy exist, but the type of person Amy represents also exists. Similarly, Bob represents a type of person who is able to be taught chemistry, and chemistry is a sort of thing that can be taught. This is akin to watching a play and thinking about what other plays could be staged in that theatre with the same group of actors, props, and stage constructions. The narrative of Amy, Bill, and chemistry hints at the possibility of narratives about other people teaching other things.

I engage faculty roles in curricular change with this kind of framing in mind. In this project, I examine ontology within engineering education, since curricular change can be framed as uncovering and modifying ontological assumptions. What is engineering, anyway? What expectations surround the roles of those who teach and learn it – who are they allowed to be, and how are they to relate to one another? To analyze the many possibilities for these roles and their relationships is to undertake an ontological investigation. Since, as previously discussed, American engineering faculty have a high degree of power over the curriculum they design, their implicit

ontologies of curricular change are an important aspect of how they engage in curricular change, and their narratives hold hints to what ontologies these might be.

Ontological affordances

One of the benefits of talking explicitly about ontologies rather than taking them for granted is that it opens up the possibility of discussing ontological affordances. First articulated by James Gibson (1977) and developed further by Donald Norman (1988), an affordance is a combination of properties that a thing has that determine just how that thing could possibly be used (Gibson, 1977, p. 67; Norman, 1988, p. 19). In other words, as Norman puts it, affordances suggest what a thing "is-for." Gibson's original definition also specified that the combinations of properties that made up a particular affordance must be "taken with reference to" an actor. In this project, I look at the affordances of faculty roles within various ontologies of curricular change – within different ontologies, what might a faculty "be for"?

Norman describes the obviousness of affordances that are deliberately designed into existence, noting that they "provide strong clues to the operation of things. Plates are for pushing. Knobs are for turning. Slots are for inserting things into... the user knows what to do just by looking: no picture, label, or instruction is required." (Norman, 1988, p. 9). This is not necessarily the case with the ontological affordances examined in this study. Affordances are only easily perceived by those who grasp their meaning (Gibson, 1977, p. 67-69); those who don't simply perceive the same combinations of properties as noise (de Groot, 1965) because of their lack of context (Dreyfus & Dreyfus, 1980). However, Scarantino (2003) reassures us that "affordances are what they are independently of whether or not they are perceivable (some may not be), and independently of how they are eventually perceived (directly or indirectly)" (p. 954). One of my contributions in this study is working to decouple the notion of what-these-ontologies-are-made-for (possible design intents) from what-they-can-be-used-for (affordances). Again, it is not just about what faculty "are" for, but what they "might be" for in the context of curricular change.

When discussing ontological affordances, it is helpful to use both ontological and epistemological framings. As previously discussed, an ontological framing of curricular change reality can be analogized to a theatrical setup of performers, props, and stages upon which an infinite number of plays can be performed. An epistemological framing can be analogized to different sets of glasses – various perspectives through which those plays can be seen and

understood, different sets of lens that make-visible different things. Ontologies can be "epistemologized" as viewpoints, and I draw on this "lens" and "looking through" analogy heavily during the course of this project in order to make it more concrete and easy to understand.

Just as I can use my own eyeglasses as things to look through (when I wear them) and things to look at (when I take them off and hold them in my hand for examination), so can treating ontologies in this quasi-epistemological fashion help make sense of their affordances and possibilities. "Looking through" an ontology roughly corresponds with Heidegger's concept of an object that is "ready-to-hand," a thing being actively used without theorizing (Heidegger, 1927). When I put on my own eyeglasses in the morning, I don't spend a lot of time thinking about what eyeglasses are; I simply use them to achieve my goals of seeing other things. In contrast, "looking at" an ontology roughly corresponds with Heidegger's concept of "present-at-hand," a thing being observed and theorized.

Switching back and forth between "looking through" and "looking at," as well as switching between the four ontologies, highlights that ontologies are constructed, chosen, and designed. My intention is to illustrate that we, as engineering educators, have made choices about the nature of curricular change reality, and we can make different choices going forward. Perceiving affordances in a reality goes hand-in-hand with shaping that reality in order to more strongly afford the option perceived. If we can see even the slightest edges of a few affordances, we can develop and clarify our perceptions simply by trying them out. As we see something as a possibility within our current reality, we can create more opportunities to make it even more possible to see and do.

2.2 Part two: Taking a postmodern turn

In this second part of the chapter, I introduce the postmodern turn as a way to reconceptualize the four concepts introduced in the first part. Postmodernism is a paradigm that can help us disrupt our approaches to faculty roles in curricular change. Interrogating the ontologies proposed by faculty narratives of curricular change provides a starting place for this work. The three sections of this chapter cover postmodernism as a disruptive element in engineering education, the historical and theoretical context of the postmodern turn, and the concepts from part one of this chapter as seen through the postmodern turn.

A terminology note before continuing: throughout this document, I use the word "postmodernism" as an umbrella term to refer to a movement that is encompassed by various terms

sometimes called "the posts": poststructuralism, postcolonialism, postmodernism, post-post, and so forth. These multiple and intertwining movements have a complex co-evolutionary history, and there are fine distinctions and debates on the differences between them, but such a discussion is outside the scope of this work. As such, I will use the term "postmodernism" for the remainder of this document to mean any of the various "post" movements, and then specify poststructuralism, etc. if a specific historical reference or theoretical idea requires more detailed unpacking.

2.2.1 Postmodernism as a disruptive element in engineering education

As noted in the first chapter and the first part of this second chapter, the dialogue around curricular change in engineering education features a diversity of viewpoints – sometimes conflicting ones. These conflicts can and sometimes have been framed as problematic; disorganization and lack of unity makes communication and coordination of effort harder, and so forth. They can also be seen as beneficial, generative, thought-provoking, and a way to become aware of and un-stuck from potentially unconscious habits. As noted in the first chapter, curricular change attempts have not been as successful so far as engineering educators have hoped (Eiseman & Fairweather, 1996; Kezar, 2001; Seymour, 2001; Dancy & Henderson, 2008); my aim in this section, chapter, and project as a whole is to present another possible alternative.

With that framing in mind, this section introduces postmodernism as a paradigm that embraces these contradictions and tensions instead of problematizing them. Postmodernism specifically focuses on engaging multiplicity and diversity instead of attempting to unify it, and the “postmodern turn,” or the emergence of the paradigm within a given discipline, was developed and adopted across other fields seeking to disrupt their usual modes of operation. I begin by describing postmodernism in light of aspects that are familiar within engineering education practice, but not (yet) engineering education research language. I then focus on the disruption of power and meaning as threads that underlie postmodern work, and show how they operate in engineering education. Finally, I discuss multiplicity/proliferation and intersubjectivity as the basis of tools for disrupting power and meaning.

Postmodernism disrupts things in ways that look strangely familiar to engineering education

In his book "The Postmodern Condition," Lyotard defined postmodernism as "incredulity towards metanarratives," or totalizing narratives that exclude the search for other explanations (1984, p. xxiv). Loosely, postmodernism is a refusal to concretely define foundations and settle on definite meanings and what Lyotard calls "good forms," or forms that settle into a comfortable interpretation. Postmodern thinking is "centrally concerned with decoding the multiple images that occur," which "brings into question previously unchallenged ideas about language and identity" (Tierney and Bensimon, 1996, p. 15). It is full of an intentional search and embrace of tension and paradox, much like the tradition of Zen koans; the intent is to shake readers out of their habitual ways of thinking, being, and making-sense.

As a philosophy, postmodernism extends to the very first principles of things, touching on "the concepts of causality, of identity, of the subject, of power, knowledge and of truth" and "dismantling most of our normal ways of thinking about how meaning, interpretation, and reality works" (Zeeman et. al., 2002, p. 96-98). Postmodernism is a foundational paradigm that seeks to destabilize the foundational; it is a paradigm that deliberately resists convergence.

This lack of "conventional" definitions and the challenge to a unified notion of "truth" can make postmodern philosophies difficult for engineering educators to grasp, since engineering is a high-consensus field (Biglan, 1973). Practitioners of high-consensus fields expect interpretations of meanings to converge within a single shared reality; although terminology may evolve and be socially constructed, it is precise and widely agreed-upon (Storer, 1967). In contrast, postmodernism grew out of arts and humanities fields with traditions of lower consensus, where meaning is negotiated and not necessarily convergent. One challenge for engineering educators encountering postmodernism and other culturally low-consensus research for the first time is setting aside expectations based on a high-consensus culture's expectations of stable and consistent terminology (Borrego, 2007). It is precisely postmodernism's challenge to these engineering cultural norms that makes it such a powerful approach for engineering education research. By questioning the very concept of a single overarching explanation of meaning and the promise of certainty it offers, postmodernism disrupts the assumptions of engineering education philosophies and forces practitioners to reexamine them.

From a postmodernist perspective, to paraphrase the Tao Te Ching: the curricular change you can define isn't really curricular change; the faculty roles you can define aren't really faculty

roles – these are things that are complex beyond the ability of any articulation to fully capture. Any description of a complex, chaotic space like engineering curricular change will, of necessity, be incomplete. Postmodernism does not deny that explanations are useful or claim that all meanings are false; rather, it holds that no meanings are finite or fixed (Derrida, 1967/1998).

This state of constant turnover and play is not unfamiliar to engineering culture. Consider the figure of the mischievous Hacker (or, more recently, the Maker) who is characterized by "exploring the limits of what is possible, in a spirit of playful cleverness" (Stallman, 2002). Similarly, engineering education literature is full of statements that engineers need a lifelong commitment to learning and (re)adaptation in order to contend with a world of rapid and constant technological change (Dutta, Patil, & Porter, 2012). Engineering itself is a discipline where practitioners "make a world of difference" and "shape the future" (National Academies Press, 2008) – in other words, engineering is the practice of changing the world and making it other than it is. Postmodernism is a paradigm of disruption; engineering and engineering education can be seen as places where that paradigm is practiced. Postmodernist language and engineering education practice can be brought together as two halves of a praxis – a conscious, self-reflexive practice that can articulate not only surface-level descriptions of its actions, but also its underlying values and philosophies.

If engineering education practice has postmodern elements, but engineering education philosophy and research do not yet widely use postmodern language, it comes as no surprise that articulating those practices might be an issue for the field. Trying to describe postmodern practices without using postmodern language is working at cross purposes. It is like translating Shakespeare into scatterplots; it can be done, but much is lost in translation, and the end representation leaves something to be desired. The playful materiality of the field and its charge to (re)make the world has a distinct postmodern thread that would benefit from connections to postmodern language, theory, and philosophy.

In this project, I contribute to this translation and weaving-together of postmodern language and engineering (education) research/practice in two ways. The first consists of conducting my investigation as part of the "postmodern turn" in engineering education, or the deliberate and conscious adoption of postmodern theories and languages within the field. Among other things, this means that I refuse to settle on a single explanation or interpretation while "answering" this

project's research question, deliberately producing not one but four analysis chapters, and having those four analyses interact and contradict each other in the final chapter.

The second way I bridge engineering (education) research/practice and postmodern language is by framing engineering curricular change as a postmodern act. In fact, one possible way to interpret engineering education calls for curricular change is as calls for postmodernist practice to be enacted in the curricular domain. A call for curricular change implicitly recognizes that the current structure for educating engineers is something that can be questioned and disrupted. It is a power system to be probed, tinkered-with, and constantly turned over, and the meanings and forms within that power system are fluid rather than fixed.

Postmodernism disrupts power and meaning in engineering education

The disruption of power systems and the cutting-loose of meanings are two major recurring themes in postmodernism. Both are central for exploring radical curricular change using a postmodern approach. In the paragraphs that follow, I expand briefly on the disruption of power and meaning in postmodernist work, engineering education research, and curricular change.

Patti Lather, one of the first scholars to take a postmodernist approach to qualitative research in education, used postmodernism as a feminist as a way to resist and disrupt the power of the patriarchy. For Lather, postmodernism "ask[s] questions about what we have not thought to think, about what is most densely invested in our discourse/practices, about what has been muted, repressed, unheard" (Lather, 1991, p. 145). If history is written by the victors, as the adage has it, then to challenge stories is to challenge the power structures that produce and disseminate them. Similarly, challenging these stories means challenging the languages in which they are told, and the meanings that those languages are used to point to and inscribe.

In the context of this project, curricular structures are embedded in power structures – and are themselves power structures – that can be questioned and changed. Faculty roles are likewise embedded in, and influential within, power structures that can be questioned and changed. The meaning of phrases like “the role of faculty” or “the engineering curriculum” can likewise be interrogated. These interrogations allow competing commitments (Kegan & Lahey, 2009) to be examined and then consciously decided upon; what do we have invested in our current conceptions of these things, and how might we loosen which of these investments in order to shift them? Disrupting power structures and what they might suppress and keep "unremarkable" goes hand-

in-hand with cutting meaning loose and changing what is marked as "good," or "powerful," or "valid."

In engineering education research, the challenge to existing power structures can be seen in the thrust of critical, feminist, queer, crip, and other efforts related to diversity and inclusion, one of the five key research areas of the field. This is in keeping with postmodernism's "challenge [of]... divisions between the center and the margins," which in turn "ma[kes] room for those groups generally defined as the excluded others" (Giroux, 1988, p. 166). Similarly, the cutting-loose of meaning can be seen in epistemological work that questions what engineering thinking and knowledge might be, which constitutes another of the five key research areas.

In engineering education research, disrupting power and cutting meaning loose are also intertwined. As one example, Alice Pawley heads the Feminist Research in Engineering Education (FREE) group at Purdue University, which asks questions that span both. For instance, the questions of "when someone talks about 'real engineering,' what do they mean?", "what is 'real engineering'?", and "how does someone become a 'real engineer?'" cut loose the meaning of terms like "engineering" and "engineer," whereas the question of "who decides the answers to these questions?" points directly at structures of power and privilege within the field (Pawley, 2016). As another example, the first tenure cases involving engineering education faculty were a substantial contribution to the field by virtue of creating new kinds of spaces for participation (Hilson, 2016). They served as both an incursion into existing power structures (tenure in the academy) and a management of meaning such that engineering education research was considered "legitimate" by others in the university.

Curricular change necessitates both the disruption of existing curricular power systems and structures and the redefinition of roles and the language used to describe them. Examining it from within a postmodern paradigm asks questions that trouble both. To paraphrase Lather, how has the field of engineering education invested in our discourse/practices of curricular change, and what (and who) has been muted, repressed, and unheard because of it? To paraphrase Jackson and Mazzei, when we decide what words like "faculty," "curriculum," and "student" mean, what other choices of meaning have to be excluded? A postmodern examination of (in this case) faculty roles in curricular change deals with both power and meaning as underlying themes.

How multiplicity/proliferation and intersubjectivity disrupt power and meaning

Multiplicity/proliferation and intersubjectivity are two things often used in postmodern works in order to disrupt stuck patterns of power and meaning. In the paragraphs that follow, I discuss multiplicity/proliferation as they are used by postmodern thinkers, then draw out their parallels in engineering, engineering education, and engineering education research practice. At the end, I briefly tie the discussion back to curricular change.

In order to disrupt power and meaning, there must be alternatives to disrupt them towards – not as a single finite goal, but as moving points between which they can constantly be tossed. In other words, since it is impossible to have a world without any structures of power and meaning, and postmodernism rejects single totalizing versions of the two, it seeks a multiplicity of both instead. Proliferation, or the creation of multiplicity, is often used in order to open up a space with room for these disruptions to occur. In the context of this project, multiple conceptions of the reality of curricular change allow for the examination of those realities as objects, rather than unquestioned backdrops against which change takes place. Multiple conceptions of faculty roles within those curricular change realities provide room to flex between possibilities for who faculty are and what they might do.

Postmodern thinkers often engage in acts of proliferation by generating as many options and choices as possible. For instance, a proliferation of colors would go well beyond black and white, or even red, yellow, and blue, and include thousands of subtly different shades of grey (and other colors). When applied to the concepts of truth and meaning, proliferation decenters the notion of a single big-t Truth by playing with the idea of a multiplicity of little-t truths; it decenters the notion of a single big-m Meaning by playing with the idea of a multiplicity of little-m meanings. What would it mean to have many meanings and many truths? Again, in probing the notions of truth and meaning, postmodernism does not mean to reject those notions – indeed, it would have nothing to work against if it did so. Rather, postmodernism seeks to question and interrogate what our assumptions about meaning and truth by exploring alternate possibilities for what they might be. It frames viewpoints as inevitably situated, partial, and perspectival. This allows for divergent rather than convergent thinking on topics such as curricular change and faculty roles within them, rather than insisting on a single, universally shared conception of such phenomenon.

The existence of multiple possibilities opens up the option of interactions between them. When those possibilities are perspectives and interpretations, the phenomenon of their interaction

is known as intersubjectivity. The word "intersubjectivity" refers to a proliferation of perspectives and the interactions between interpretations proposed by multiple people. For instance, a conversation between faculty members reflecting on a shared experience (such as reading a PhD dissertation like this one) is intersubjective; although their interpretations of the experience may not converge, their interpretations will interact and change during the course of the discussion. Even at the point where the committee agrees to approve the dissertation, their interpretations are likely to still be non-identical, and this intellectual, intersubjective vibrancy is not usually framed as an error.

A postmodern approach of proliferation/multiplicity and intersubjectivity values a potentially divergent dialogue across multiple viewpoints instead of seeking convergence on a single "objective" truth. Extending this idea is the notion that all texts "always absorb and transform other texts" and "can be thought of as a tapestry of quotations, a mosaic of allusions"(Cavallaro, 2001, p. 60). The texts – which refer to anything encoded with meaning (films, music, graffiti, etc.) rather than just literal words on a printed page – interact in ways that blur their boundaries. Both meanings and the power structures they describe remain fluid rather than frozen, in the state of constant disruption valued by postmodernism.

Multiplicity and intersubjectivity are not new to engineering education research. One example that can be easy to overlook is that conferences and other scholarly gatherings provide a place for the community of engineering education researchers to dialogue intersubjectively and intertextually across their work. Sometimes, the intersubjectivity and multiplicity are structured deliberately; for instance, the 10th Design Thinking Research Symposium (DTRS) presented the same dataset to research teams from different disciplines in order to generate a wildly diverse array of approaches, and the in-person gathering component of the symposium featured groups sharing how-else the “same thing” could be seen (Adams & Siddiqui, 2016). Both the engineering education practices depicted in the DTRS dataset and the facilitation methodologies used to connect the researchers using it demonstrate a valuing of multiple viewpoints and perspectives. Explorations of “multiple perspectives on engaging future engineers” (after the paper title) explicitly pursue divergent thinking, working with boundary agents across paradigms to open up a space for engineering education innovation (Adams et. al., 2011). Similarly, the NSF-sponsored "Who's Not At The Table?" conference was hosted by Clemson University, Drexel University, and the University of Washington in 2016 to bring together researchers and practitioners with various

angles on diversity and inclusion in engineering education, working to connect dialogues and efforts across perspectives both represented and absent.

Multiplicity/proliferation and intersubjectivity can be used both as aspects for curricular changes to adopt, and as tools to articulate and facilitate curricular change itself. In this project, I primarily use them as the latter. Later, in the methods chapter (3.3.1), I will turn these theories into methods that use proliferation and intersubjectivity to interrogate faculty roles in curricular change. Multiplicity/proliferation and intersubjectivity are elements whose adoption into a curriculum or curricular culture makes curricular changes easier, similar to how a chemical catalyst lowers the activation energy of a chemical transition involving other substances. They help postmodernists disrupt structures of power and meaning by creating a "distance for the generation of alternatives... the existence of alternative stories on one event, the existence of more than one interpretation of the world and the thought that the self has more than one view or part bring about big shifts and freedom" (Zeeman et. al., 2002, p. 96-97).

2.2.2 Taking a postmodern turn in engineering education research paradigms

In this section, I engage with the historical and theoretical context of the postmodern turn. I begin with an explanation of the postmodern turn itself as a response to modernist and premodernist paradigms. Following this, I explore postmodernism alongside qualitative research paradigms as portrayed in engineering education research literature as well as qualitative methodology literature. Finally, I present four theoretical concepts from the postmodern turn that will turn into methodological tools in Chapter 3.

The postmodern turn as a response to modernity

The recognition and development of postmodern paradigms within a field is known as the "postmodern turn" within that field; one can also speak of a more general "postmodern turn" across multiple fields (Best & Kellner, 1997). In the paragraphs that follow, I explain the postmodern turn as a response to modernism and premodernism. While doing so, I point out modernist and premodernist elements in engineering and engineering education that a postmodern turn in the field would respond to.

As its name implies, postmodernism is a movement which came out of (“post”) the paradigm of modernism. It is therefore instructive to look at the philosophical paradigms of premodernism and modernism in order to see postmodernism's relationship relative to both. The image below provides an overview: premodernism viewed reality as static and predetermined, modernism brought with it an emphasis on continuous progress in the name of human liberation, and postmodernism questioned modernism's relentless pursuit of that notion of "progress" while inquiring what, exactly, "progress" might mean.

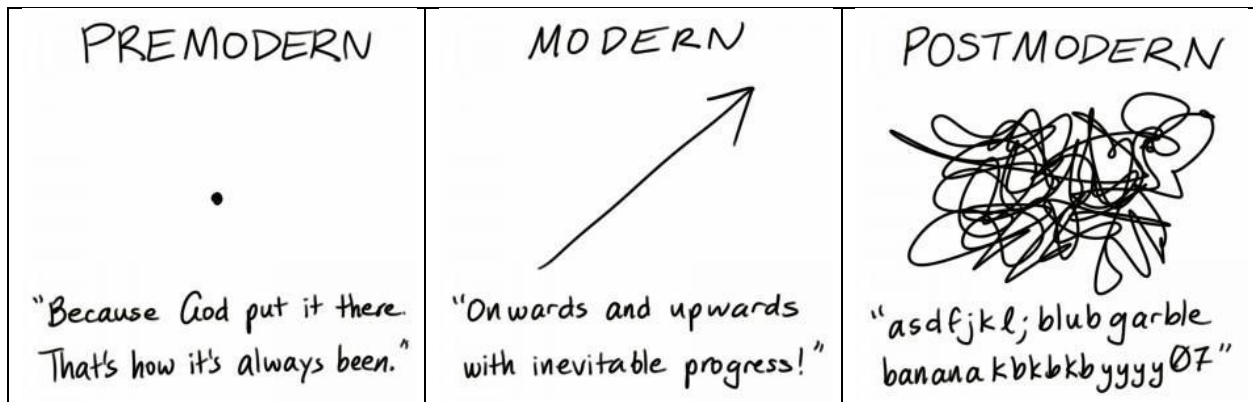


Figure 2.1. Premodern, modern, and postmodern turns

Prior to the 19th century, premodern (or sometimes "romantic") viewpoints were widespread across Westernized societies such as the US; such a viewpoint viewed the world as ordered by divine and governmental authority, and a human's role within that world to be pre-ordained by the circumstances of their birth. In other words, if your parents were farmers, you would probably be a farmer, because that was the will of God; one's identity was fixed. An example of a premodern viewpoint in engineering education is the notion that some people are innately talented engineers and others are not; this has been critiqued by engineering education researchers emphasizing a growth mindset where engineering skills are developed rather than inborn (Dweck, 2006).

Modernism came of age during the time of the Industrial Revolution, revolting against the notion of a fixed identity. The importance of the individual and the "sovereign self" that could determine its own destiny was reflected in narratives about self-starting bootstrappers who pursued "The American Dream" and went from rags to riches. This notion of identity developed in parallel with the rapid development of technologies that made the average 19th and 20th century

American's life dramatically different from their parents, and the narrative of constant economic, technological, and social progress. Simultaneously, in the biological sciences, Darwin's theory of evolution also provided a narrative of ongoing progress that was literally encoded into the nature of humans and the world around them. Scientific quests for knowledge and betterment, and a belief in progress and perfectibility became highlights of a modernist way of thinking.

Postmodernism is a response to the modernist emphasis on unrelenting "progress" towards a "better" world that interrogates the assumptions and power structures behind those terms and asks how they might be otherwise. Correspondingly, the postmodern inquirer's work is not towards the increasingly "better" articulation of knowledge and truth which they are attempting to teach their audience. "The postmodern text is evocative as opposed to didactic; extended argument is displaced... [in favor of] pastiche, montage, collage, bricolage, and the deliberate conglomerizing of purposes [that] characterize postmodern art and architectural styles" (Lather, 1991, p. 10). The postmodern movement, or "turn," is deeply steeped in such refusals to settle, opting instead for the constant motion of "keeping meaning at play" (Jackson & Mazzei, 2012, p. 70-71). For this reason, it is important to not simply conceptualize postmodernism as "a better and more recent form of modernism," because the emphasis on constant improvements over time comes from a modernist rather than a postmodernist perspective.

Modernist thinking came of age alongside engineering education's appearance as a widespread formal course of undergraduate university study. Many concepts familiar to engineers – optimization, improvement, the notion of a better world – are modernist in nature. A postmodern turn in engineering education would need to work both within and against these sorts of ideas, which represent a great number of deep-seated modernist habits. In a modernist world, the stock market always goes up in the long term; transistor density (and thus computing power) always becomes smaller and cheaper (Moore's law). The population can be divided into individuals whose accomplishments can be tracked and rank-ordered, as with arranging student grades on a curve. Most crucially, it is a modernist statement to claim that humankind is on an inevitable trajectory towards upwards and measurable progress, and that the job of the engineer is to work on solving problems in order to drive forward that progress.

The postmodern turn is conceptually challenging and often meets resistance within a field that is undergoing it. Elizabeth St. Pierre, who came of age as an educational studies graduate student during the postmodern turn in the social sciences in the 1980's and 90's, described how

“academics, without reading that [postmodern philosophical] literature closely, accused the ‘posts’ of being relativistic, nihilistic, deliberately obfuscatory and then just dismissed them” (St. Pierre, 2014, p. 5). However, engineering education is a young field with a history of revolutionary reconceptualizations in the face of difficult-to-change structures, such as the introduction of rigorous research practices graduate programs and tenure-track lines in a previously practice-centric, pedagogical reform paradigm (Borrego et al., 2008, p. 285).

Just as the introduction of rigorous research into engineering education did not replace its work on pedagogical reform, but rather conceptualized it in a new light, the introduction of a new paradigm is neither neat nor complete. Paradigm shifts – or rather, the layering of new paradigms over and alongside preexisting ones – trickle into a field over time, such that multiple paradigms remain at play during the same timespan (Kuhn, 1962). It is an open question how engineering education will respond to incorporating postmodern paradigms for investigation, methods, and evidence into what it considers to be “rigorous research.”

Postmodernism in the context of engineering education qualitative research paradigms

Having discussed the postmodern turn as a paradigm shift, I now situate postmodernism amongst other qualitative research paradigms in engineering education. Glesne's introductory book on qualitative research methods defines a paradigm as "a framework or philosophy of science that makes assumptions about the nature of reality and truth, the kinds of questions to explore, and how to go about doing so" (2011, p. 5). These assumptions affect our research, as “research approaches inherently reflect our beliefs about the world we live in and want to live in” (Lather, 1991, p. 5). Becker (1996) describes qualitative research fields as being protective and self-preservational about their own boundaries, as human communities are wont to do. After all, one needs a way to distinguish who and what belongs within a group and who and what does not, and how to determine which things within the field's accepted boundaries are "best." Paradigms provide a way to legitimize and privilege work that shares a field's assumptions about the nature of reality and knowledge.

In their meta-review of qualitative research paradigms in engineering education, Koro-Ljungberg and Douglas distinguish between post-positivist vs. situational paradigms, using the latter as an umbrella term for interpretivist, critical, and postmodern paradigms (2008, p. 165). I present these four paradigms in the table below, which is a synthesis of similar tables from three

sources: Koro-Ljungberg and Douglas’s paper for an engineering education research publication viewpoint, Glesne’s introductory textbook on qualitative research (2011, p. 7) as a discipline-independent attempt to be paradigmatically neutral, and Lather’s paper on postmodern “paradigm talk” (2006, p. 38-40) as an explicitly postmodernist methodological voice. Paradigm names in the table are taken from the first listings in Koro-Ljungberg and Douglas; following the table, I discuss each paradigm more extensively in turn and list alternative/associated paradigm names in parentheses at the start of each discussion.

Table 2.2 Qualitative paradigms in engineering education research

	Post-positivist	Interpretivist	Critical	Postmodern
View of reality	Single objective reality, objective and falsifiable	Multiple subjective, constructed realities	Multiple subjective political realities constructed on the basis of power	Multiple, fragmented, unknowable
View of truth	Truth is one	Truth is many	Truth is many and constitutes a system of socio-political power	Contains the signs of its own contradiction
Purpose of research	Prediction, cause and effect	Describe and understand	Emancipate, socio-political critique	Deconstruct “grand narratives”
Methods of research	Defined in advance, hypothesis driven, ex: experimental or quasi-experimental, causal comparative	Preliminarily defined in advance, emergently adjusted during the study, ex: grounded theory, ethnography	Designed to capture inequities, ex: participatory action, critical discourse analysis	Generated during the study, “theory as methodology,” ex: deconstruction, genealogy, rhizoanalysis
Role of researcher	Detached	Partners	Activists	Various changing roles
Outcome of research	Context-free generalization	Situated description	Critical essays, policy changes	Re-conceptualized descriptions

Post-positivism (related to: positivism and logical empiricism) is the paradigm used by mainstream scientific research, according to Popper's (1959) definition of science as the usage of empirical falsification. This paradigm assumes a pre-existing and objectively knowable reality. Consequently, using a post-positivist paradigm, inquiries as to the truthful nature of this reality can be conducted by formulating and testing falsifiable hypotheses via experimental procedures defined in advance of their execution. Knowledge produced by this style of research builds linearly

upon itself as researchers approach the “truth” of how the world works as closely as possible. The purpose of research is to determine cause and effect and predict future results, since experiments for testing falsifiable hypotheses should be repeatable. Researchers are therefore interchangeable components who serve as neutral, detached observers. Furthermore, research outcomes are expected to be generalizable across contexts; under such a paradigm, transferable knowledge is privileged.

Since engineering training typically includes a great deal of scientific background, post-positivist paradigms are commonplace among engineers to the point that they are sometimes assumed to be the only paradigms available. Such assumptions can cause conceptual difficulties for engineering researchers transitioning towards education research and suddenly encountering the existence of other paradigms (Borrego, 2007). Additionally, post-positivist habits from engineering training may influence epistemological misalignments in qualitative engineering education work; for instance, a researcher may claim to be using an interpretivist paradigm, but methodologies that support the generation of post-positivist knowledge instead (Koro-Ljungberg & Douglas, 2008).

Interpretivism (related to: constructivism, phenomenology) is a common non-post-positivist qualitative research paradigm in engineering education. It might be used, for instance, to articulate the experiences of engineering students in mathematics courses, or to describe the culture of a first-year engineering program. From an interpretivist point of view, reality is subjective and constructed, and therefore leads to multiple truths. The focus turns away from prediction of an absolute reality and towards understanding of a co-constructed one, with researchers and participants acting as partners in creating that understanding. The result is often thick description, situated in a contextually-dependent environment; it is no longer required to be generalizable and transferable in order to count as valid knowledge (Koro-Ljungberg & Douglas, 2008; Glesne, 2011).

The critical paradigm shares interpretivism's assumptions about the social construction of reality, then adds an emphasis on the sociopolitical power relations of those constructs (Lather, 2006). These power structures create oppression; therefore, the goal of research is to liberate (Glesne, 2011). By capturing and proclaiming inequities and injustices, researchers and participants become activists who can affect policy change (Koro-Ljungberg & Douglas, 2008). Projects employing critical paradigms are also often associated with a focus on marginalized

groups. Within engineering education research, a good deal of work using the critical paradigm focuses on aspects of diversity: gender, race, sexuality, disability, etc., and the power dynamics that lead to under-representation from particular demographics within the engineering field. Feminist theory, critical theory, and critical discourse analysis are examples of theories that might be employed within this paradigm.

The critical perspective "springs from an assumption that we live amid a world of pain, that much can be done to alleviate that pain, and that theory has a crucial role to play in that process" (Poster, 1989, p. 3). Consequently, projects within the critical paradigm move beyond understanding to demand action. Their research outputs move beyond disseminating knowledge to an academic elite and often frequently aim towards positive impacts on the research participants and their communities. This might take the form of political initiatives, the design and manufacture of products, performance art, or other action-oriented approaches.

Postmodernism (deconstruction, poststructural, postcolonial, and the other "posts") is the paradigm utilized in this project, and both draws from and works against each of the other perspectives. Like positivists, postmodernists acknowledge the utility of prediction and control, but question how they are pursued and the ends to which they are used, and whether such pursuits, dependent on the assumption of an impossible level of objectivity, can ever ultimately be successful. Like interpretivists, postmodernists acknowledge the social construction of reality and the unique positionality contributed by researchers and participants; unlike many interpretivists, postmodernists do not seek a convergence, stabilization, or taxonomical ordering of this constructed understanding. Like critical inquiry, postmodern inquiry is concerned with power, but "instead of having the critical theorists' goal of eliminating the oppressive acts of society, postmodernists seek to delineate the multivocal relations of power that exist in order to understand differences" (Tierney and Bensimon, 1996, p. 15).

As previous sections of this chapter have described, the postmodernist emphasis is on play and disruption of assumptions made within a variety of paradigms. Lather's (2006) analogy of the postmodernist paradigm is of a carnival; there is no single reference point, and reality is ultimately unknowable and self-contradictory. Instead of settling within one paradigm, postmodernism proliferates paradigms. In a sense, a postmodern paradigm creates, uses, and attempts to shift between multiple paradigms; in the case of this project, the primary shift is between interpretivist and postmodernist paradigms. Shifts between paradigms disrupt existing ways of thinking and

dominance relationships, and provide opportunities for new ways to take hold— not a specific new way, but a constant stream of ways not yet imagined. Inasmuch as it can be said to have a particular goal, postmodern projects aim towards reconceptualizations of phenomena (Koro-Ljungberg & Douglas, 2008), or to borrow a title from one of Lather's (2008) papers, to work with, within, and against the world so that it may "appear other to itself anew."

Koro-Ljungberg and Douglas's meta-review of qualitative engineering education research exposed theoretical misalignments that they hypothesized might be due to a lack of familiarity with paradigmatic work. In the conclusion to their paper, they call for "more informed use of qualitative methods" and "[c]ontinuous and systematic exposure to the methodological tools available to study complex problems and socio-cultural phenomena" in order to "strengthen the field methodologically" (2008, p. 172-173). Beddoes and Borrego found similar missed opportunities for deeper theoretical engagement in a separate meta-review of feminist theories in engineering education research, including theories explicitly framed as postmodern. They call for more conscious and explicit recognition of these theories and a deeper level of engagement with them, recognizing that the "ways in which engineering strives to be scientific, objective, and quantitative" resist such discussions (2011, p. 295).

Postmodernism's inherent multi-paradigmatic nature creates a hyperconsciousness of paradigmatic work ideal for this sort of theoretical and methodological engagement in engineering education. By positioning this work as postmodern, I commit to engaging the elements on the right side of the table, including working with multiple, fragmented, and unknowable conceptions of truth – in this case, multiple true-and-yet-conflicting notions of faculty roles in curricular change. I also commit to pointing out how this work contains the signs of its own contradiction (for instance, in the previous sentence that is effectively a claim to know that truth is unknowable) as a way to work against any of my analyses being used as a totalizing metanarrative. My methodology was generated during the study, as the next chapter will detail.

Finally, by explicitly engaging in postmodernist research, I contribute to reconceptualizations at two levels. The first and most straightforward one is a reconceptualization of faculty roles in curricular change, as per the research question addressed by this project. The second is a larger-scale, longer-term effort of which this work is a very small and initial part: a reconceptualization of qualitative paradigms and methodologies in engineering education

research, so that our research practices may mature in their ability to engage theories in the ways described by Koro-Ljungberg, Douglas, Beddoes, and Borrego.

Four theoretical tools from the postmodern turn

In the paragraphs that follow, I will briefly present four theoretical tools from postmodernist philosophy as developed during the postmodern turn in other fields and/or as present in current engineering or engineering education practice. These four theoretical concepts will recur in the next chapter as methodologies as part of a demonstration of how to use theories as methodologies. In order, the four tools are metanarratives, deconstruction, slippage in semiotics, and the idea of writerly approaches to texts.

As previously mentioned, metanarratives are totalizing narratives that exclude the search for other explanations. Skepticism and “incredulity towards metanarratives” is the basis of Lyotard’s loose “definition” of postmodernism (1984, p. xxiv). This incredulous stance can be a challenging one to take, as it denies postmodern interrogators the comfort of settling into an undisturbed way of making-sense of the world. The notion of metanarratives and their disruption are visible in popular culture in the disciplines of literature and theatre. For instance, a popular children's book, "The True Story of the Three Little Pigs," retells the story of the Three Little Pigs from the perspective of the Big Bad Wolf. Typically portrayed as a purely evil character who blows down the houses of pigs in order to eat them, the Wolf in this version insists he is no villain but rather a misunderstood neighbor whose allergies accidentally blew the houses down (Scieszka, 1989). Similarly, in the book and later Broadway musical "Wicked," the classic story of the Wizard of Oz (Baum, 1900) is inverted, with the enmity between the "good" and "wicked" witch characters uncovered as a political fiction maintained for the public benefit by two old college friends (Maguire, 2007). These and other works of art are delightful because they ask the audience to reconsider the stories they *thought* they knew.

Any narrative can become a metanarrative; it is not any intrinsic quality of a narrative that makes it a metanarrative or not, but the manner in which it is used. Since I conceptualize narrative as a way of sensemaking in this study, a metanarrative is the insistence that a specific sense be made of a specific narrative. For instance, one narrative of curricular change is the tale of the stodgy, resistant faculty who refuse to try new things. This narrative can sit alongside many other explanations: faculty are afraid of penalties if their experiments fail, student amotivation is

affecting them, administrators do not provide teaching opportunities, and so forth. However, if the “stodgy faculty resistance” narrative becomes *the* explanation for why curricular change is slow, and people refuse to question it (how could it possibly be anyone else’s fault but the faculty, how could this refusal be anything but stodgy unreasonableness on their part?) then it becomes a metanarrative. The notion of metanarratives and the challenging of metanarratives are important concepts for this work, since I engage with narrative data not to create a single explanation, but to *counteract* single explanations via the production and usage of multiple conflicting ones.

The second idea is deconstruction, which has to do with the blurring of categories within taxonomies. Deconstruction uncovers the subjective and arbitrary nature of the “slices” we make that divide the world into differentiated items. It asks what binaries and categorizations exist, what those boundaries suppress/prohibit, and whether they contradict each other (Saukko, 2003, p. 135-152). By using language, we describe the world as if it had cleanly separated components: for instance, one might say that a man is not a woman, or that blue and red are different colors. However, the line between “male” and “female” or the line between “blue” and “red” and “purple” is not necessarily clear. It’s not that there are no differences or distinctions among things; quite the opposite. The distinctions and separations are real because they are decisions made by thinking beings who decide and determine where the differences split to make seams between items, and could also decide to split them differently.

Engineering practice also engages in deconstruction; for instance, refactoring a technical project sometimes involves a rethinking of taxonomies. The decision of how to separate a technical system into interacting subcomponents is a form of categorization; regrouping those subcomponents into different groupings can be an act of deconstruction. Or, to draw an example from engineering education, take the division of engineering into sub-disciplines and majors, which varies across universities: one university might have separate “electrical” and “computer” engineering programs, whereas another might lump them together into “electrical and computer engineering.” Transdisciplinary work, transfer students, and other phenomena that do not fit neatly into these boundaries serve as stimuli for deconstruction via questioning of categories. After all, what determines the boundary between bioengineering, materials engineering, mechanical engineering, etc. when studying the design of a medical device? How is the separation between computer engineering and electrical engineering determined – and are they two separate programs,

or a unified degree in "electrical and computer engineering"? These boundaries are not only socially constructed and contested; they wobble simultaneously in many places at once.

The third idea I present here is the notion of “slippage,” which borrows the terminology of “signifieds” and “signifiers” from semiotics (Saussure, 1986). Signifiers within a text (roughly: words, shapes, colors, movements, or whatever is being used as a reference to something else) point towards signifieds (roughly: meanings, interpretations). To investigate slippage means to interrogate the ways in which the relationships between signifiers and signifieds are not fixed; they "do not embody specific meanings or concepts" and only "become meaningful when they are decoded according to cultural conventions" (Cavallaro, 2001, p. 15-16).

In computer science terms, the signifier and signified can be loosely thought of as the pointer and the memory location, respectively; neither has an innate meaning on its own – it must be assigned one by the author, and its meaning draws from its relationships to other variables at play in the program. Just as a pointer can be renamed and reallocated in a computer program, the link between signifier and signified is arbitrary, socially constructed, and forever shifting. Multiple signs might refer to the same signifier, as with synonyms. Similarly, one sign might refer to a variety of signifiers, depending on the context; for instance, two faculty members may use the signifier "curriculum" to refer to very different signifieds (loosely, "ideas" or "meanings.")

It may be tempting to diagnose this as a problem of insufficiently precise language; if we had more words for "curriculum," we would not need to repeat it to signify slightly different meanings. However, the repetition of the word "curriculum" is entwined with its representation; a sign obtains meaning only when it's used in multiple contexts, since community adoption is what distinguishes a "nonsense" word from a "real" one. Because of this, when we speak, write, or use any other sign system such as language, we represent — re-present — our signifieds with signifiers that already exist, and the way we choose to do so can be illuminating to examine.

Finally, there is the concept of “writerly” approaches as opposed to “readerly” ones. As noted earlier, postmodernism plays extensively with ideas of power and agency, as part of its quest to disrupt structure and authority. The notion of “permissions” is one way to play with ideas of power and agency; who has permissions to modify what aspects of the world, and how? Permissions for modification are a familiar idea in engineering, particularly in computing. The entire concept of file permissions is built around the notion of granting or denying various people access to read and write to various areas on the computer. In the case of a large software project,

one engineer might have the permissions to examine a piece of code and see what it does, but not have the permissions to modify it. This is called "read access," because it lets the engineer read the file, but no more. A different engineer might be able to not only read that piece of code, but also edit it and change what it does. This is called "write access," since the engineer has the power to write (or re-write) the file in question.

The notions of "read access" and "write access" to software files in the technical realm map to the notions of "readerly" and "writerly" approaches to a text in the philosophical realm. The terms writerly and readerly were coined by Roland Barthes in his 1973 book *Le Plaisir du Texte* (which the 1975 English translation renders as "The Pleasure of the Text") in order to refer to the role of a text's reader. Here again, a text refers not just to printed words on paper, but more broadly to include other things that convey meaning, such as software code, videos, dance moves, and so forth. A readerly text treats readers only as readers, passive recipients of knowledge. Readerly texts place readers in the epistemological position that Baxter-Magolda calls "following formulas" (2001) and Kegan calls the "third order of consciousness" whereby external voices serve as privileged authorities (1994). In a sense, if expertise is the ability to independently create and navigate within a complex context, readerly texts restrict readers from reaching for higher levels of expertise (S. Dreyfus & H. Dreyfus, 1980) By noticing and naming the "readerly" approach to texts, postmodernists draw attention to them and remind readers of their agency with regards to interpretation of the texts that they encounter.

A postmodern viewpoint is that *all* texts are writerly – that we do, in fact, have the power to reshape the reality. In engineering education, this manifests in slogans like "engineers shape the future," emphasizing the writerly power engineers have to reshape the world they live in (NAE, 2008). The theories of Barthes and other postmodernist philosophers who wrote about power and agency can be used to illuminate the discipline's aspirations for empowering its practitioners.

2.2.3 Revisiting the four concepts in light of the postmodern turn

In the final section of this chapter, I return to the four concepts introduced in part one: curricular change, faculty roles, narrative, and ontologies. However, I now do so in light of the postmodern turn. Having spent time discussing postmodernism and what it is and how to put it into action, I now demonstrate what each concept can look like when engaged from a postmodernist perspective.

Keeping in mind the ethos of multiplicity/proliferation and intersubjectivity, each of these conceptual explorations is *an* example of what it can look like from within the postmodern paradigm, not *the* way it must look. This means that in examining curricular change, faculty roles, etc. from a postmodern perspective, I am not trying to find the “truth” of how they “really are,” nor co-construct that truth with them or “liberate” them into a larger truth. Instead, I simultaneously draw upon and challenge all these intellectual traditions in order to challenge the very idea of a coherent, pragmatic “truth” about these concepts.

A postmodern approach to curricular change: the lifeworld

First and foremost, postmodern notions of curricular change embrace rather than problematize the rich ferment of conflict and diversity in terms of scope, scale, aims, measures, approaches, and so forth that are part of the conversation. It also embraces the history of those conversations, explicitly rejecting ahistoric metanarratives of “it has always been this way” or “it all started here; nothing existed prior.” Knowing a history, and knowing that a history exists, is a powerful way to engage in changing how that history unfolds into the future, and practitioners step into, inherit, and learn from and within a tangle of curricular change stories with no clear beginning or end (or rather, with beginnings and ends that are subjectively marked). This history can be conveyed through stories of curricular change that are told, retold, and re-enacted by faculty narrators in their telling and their teaching.

A postmodern engagement of curricular change also includes a postmodern engagement with the notion of “curriculum” as something with fluid boundaries. At the start of this chapter, I raised a broad conceptualization of “curriculum” that encompassed student learning environments and experiences both inside and outside the classroom and course learning objectives – in other words, a “world” within which learning takes place. This notion of curriculum-as-world raises questions about the boundaries between the world and actors (such as faculty members) within that world.

This boundary has been explored by many philosophers in the past century; to cite two influential examples, Husserl engaged it epistemologically with his concept of the “lifeworld” (the subjective experience of reality) (1936/1984), and Heidegger engaged it ontologically as “being-in-the-world” (1927/2010). Although these explorations vary, they all see the self-world boundary as fluid rather than fixed. Rather than separating the observing self and the world that is being

observed, Husserl, Heidegger, and other postmodern philosophers saw the existence and nature of the self as inextricably embedded in the world it shapes and describes. In such a viewpoint, there is no intrinsic exteriority or objectivity; one creates exteriority and objectivity by separating what is "self" from what is "not-self" (Barad, 2007).

As a more concrete example of this kind of boundary blurring: the curriculum is partially made manifest by the physical bodies and actions of the faculty. This assumes a flexible definition of the curricular world that incorporates a wide variety not only of things, but of *kinds* of things, both forms of content ("material forms") such as books, slides, furniture, and lab materials, as well as forms of expression ("incorporeal enunciations, acts, and statements") such as lectures, gestures, and conversations. For instance, faculty hands holding books and working with tools are material forms, and the gestures and sounds of their hands and speech are immaterial forms. Faculty selves and the curricular world are intertwined, similar to how choreography is enfolded and inseparable from the bodies of the dancers performing it. They are not the same thing, but inform and co-construct each other; a dancer may perform different choreography, and the same choreography can be set on different dancers, but a person is not a dancer in that moment unless they are performing choreography (even improvised), and choreography cannot be embodied in the world without being performed by a dancer. Similarly, the boundary between the faculty self and the curricular world is hardly clear; they are the same thing and not the same thing at the same time.

As a "world" that can be variously conceptualized and "sliced" into different components, curriculum acts as a boundary object for the various interacting agents in curricular change narratives. To borrow the theatrical analogy, the curriculum acts as a stage upon which the characters of faculty and students play out their roles (as scripted largely by the faculty narrators). In effect, the curriculum becomes a site for negotiating and making-visible these roles in action. As a component that is at least somewhat separated from both faculty and students, it becomes a reference point for relationships; instead of distinguishing agents into pre-determined "faculty" and "student" (and other) categories, the question becomes: how does this person relate to the curriculum? What are they doing with the curriculum, or in response to the curriculum, at this point in time – and what others are acting as they are?

A postmodern approach to faculty: diverse, shifting selves under tension

A postmodern engagement of faculty roles similarly focuses on a panoply of conceptions rather than a singular one. For instance, faculty are acknowledged to be a non-homogenous group. They have different personalities, interest, skills, and desires from one another, and sometimes these personalities, skills, interests, and desires conflict within themselves, as when a faculty member wishes they had more time to spend on both research and teaching (not to mention being at home with their family).

Furthermore, they have different expectations at different parts of their career: for instance, at Alverno College, "beginning assistant professors... are expected to bring disciplinary expertise and a concern for students to their teaching," whereas "associate professors... actively serve as resources for other teachers," and "full professors... extend the range of perspectives they integrate... [and] provide direction in identifying and addressing significant teaching concerns" (Mentkowski, 2000, p. 261-264). Such a progression of expectations also presupposes an assumption of the faculty member as a self that learns and grows over time, meaning that what we know about adult learners (Vella, 1997) can also be applied to faculty-as-learners. This points to an underlying quality of a postmodern conception of faculty – namely, that the identity of faculty "selves" are constantly evolving, rather than static and fixed. This conception is in keeping with postmodern emphases on movement and change. The notion of the self and identity as fluid is also reflected in modern narrative psychology research that portrays people as not only the authors of the narratives of their own lives, but the constant revisers and editors of their autobiographies (Josselson, 2009).

Thirdly, faculty are expected to exhibit independence both in terms of deciding where they will go (autonomy) and getting themselves to that destination (motivation). In doing so, faculty need to be reflective and conscious of their own viewpoints regarding, and practices of, teaching. In effect, this is an application of Schoen's (1983) ideas regarding the "reflective practitioner" and "reflection-in-action" (thinking about something while you're doing it) to the context of faculty teaching practice. Examples of this in the literature include Brookfield's (1995) book titled "Becoming a Critically Reflective Teacher" and Weston & McAlpine's 1996 paper on how outstanding professors view teaching and learning. The faculty self is not only a thinking self, it is a critically reflexive thinking self that is self-aware and at least periodically examines its own

actions so it may decide how to do things in the future, which meshes with the critical reflexivity and tongue-in-cheek self-critique of postmodern thinkers.

Fourthly, faculty have both individual and collective identities. The word "faculty" can be used to refer to both one ("a faculty member") or more ("several faculty") of what we would typically refer to as "individuals." This happy accident of language reflects a postmodern construction of the "self," where the boundaries between individual and group identities are not clear, since boundaries are generally under question and disruption in a postmodern framing. Moreover, the smallest unit of the faculty "self" is not the individual; a particular individual faculty can have multiple "selves," for example one's "engineering self" as opposed to one's "artist self," or one's "faculty self" as opposed to one's role as a parent, or a faculty member's self in the present-day as opposed to their narration of their younger teenage selves. Faculty expect and are expected to achieve a high degree of individual autonomy and accomplishments in their job, but also belong to collaborative communities (such as departments) with their own expectations and goals, and the two ways of seeing faculty (individually and collectively) can be at odds with one another, including in the academic rewards system faculty operate within (Fisher, Fairweather, & Amey, 2001).

Finally, faculty work with a great number of tensions and pressures that pull them in opposite, contradictory directions. The tension between individual and collective work just described is a good example of such a tension: are individual and collective goals always in opposition, and when they are, which one gets chosen? Sometimes these forces can be stressful; at other times, they can be generative. Dall'Alba (2009) presents five generative tensions that appear in the process of learning to become a professional: routine vs familiarity, continuity vs change, possibility vs constraint, openness vs resistance, and individual vs other. Each of these tensions is played out in the roles that faculty take in curricular change, and the questions implicitly asked through their actions, and the paradoxes lived by their answers: in the curriculum, what should we maintain and what should we revise? (continuity/change) What is it that we are able to do with what we have? (possibility/constraint) What should we allow, and what should we hold firm to? (openness/resistance). Both individually and collectively, faculty struggle with these tensions and continuously decide how to navigate them – decisions that they constantly (or at least periodically, in an ideal world) reflect upon. Again, this reflects a postmodern emphasis on fluidity,

change, and embrace of the tension and contradiction that come with proliferation/multiplicity and intersubjectivity.

A postmodern approach to narrative: disrupting/deconstructing metanarratives

A postmodern approach casts narrators and their narratives as “polyphonic texts that challenge dominant ideologies by articulating diverse discourses... thus resisting the notion of a unified viewpoint” (Cavallaro, 2001, p. 19). The hermeneutic and communal nature of narrative sensemaking leads directly to its plural nature. Communities of practice serve as a context within which a multiplicity of narrators engage in sharing their narratives and interpretations of a practice (in this case, curricular change). Since every reader makes their own meanings from engaging with a narrative, the presence of multiple readers means there are a multiplicity of meanings that can be made from the "same" narrative. In other words, postmodern narratives are plural, situated in community, and intersubjective.

Acknowledging this plurality leads to an expanded perspective on the part of both narrator and reader. Bruner (1991) writes about how narratives have context sensitivity and negotiability. By seeing that we and others may have different contexts, we are able to accept these differences. We recognize that we can immerse ourselves, like anthropologists, into someone else's process for constructing meaning (p. 16-18). Belenky (1997) describes the process from the perspective of a constructivist, where participants engage in "...becoming and staying aware of the workings of their minds... [seeking] to stretch the outer boundaries of their consciousness — by making the unconscious conscious, by consulting and listening to the self, by voicing the unsaid, by listening to others and staying alert to all the currents and undercurrents of life about them, by imagining themselves inside the new poem or person or idea that they want to come to know and understand" (p. 141).

In keeping with a postmodern viewpoint, contradictions, paradoxes, and tensions in narrative sensemaking are seen as generative rather than signs of error to be eliminated. Participants in this sort of dynamic communicate their multiple truths and meanings to each other. It is not about finding "the meaning," as if there were a single one; it is about finding a plurality of meanings and exploring what kinds of meanings might be made. It is as if each viewpoint were a different set of glasses one could wear – 3D vision, night vision, bifocals, macro lens – the object is not to create a single pair of glasses that fulfills all functions, or to rank-order

which set of glasses is the "best," but to examine what sorts of glasses might exist, and what each might be used for, and also to acknowledge there is no "neutral" view equivalent to "not wearing glasses" – even if the lens in question are your retina, they are still lens.

Engaging with this sort of intersubjective debate with and within narrative accruals is a political act, by which I mean that acts of narrating participate in reifying and transforming structures of power and authority within communities. As I have earlier discussed, acts of narrating include the active co-authorship of readers making sense of narratives with which they are presented. Engaging with narratives from a postmodern writerly perspective can be a powerful role to take.

This project engages with faculty narratives of curricular change under the assumptions that any such engagement will also engage with privilege and power dynamics ingrained in the social constructs of engineering curricular change. The objective is not to "empower" faculty with agency, but to show them multiple possible ways that they can see themselves as already having great narrative (and thus world-changing) agency. The objective is not to prescribe a certain way of privileging certain facets of the narrative accrual of curricular change, but to investigate which facets might be seen as privileged under particular circumstances, and how they might have come to be so. Faculty narrators in this project (and elsewhere) are active participants in constructions of their reality – not simply understandings of their reality, but their curricular reality itself, since they are the ones with the authority to make many curricular decisions real and thereby change a small part of the nature of engineering education.

With this sort of framing, narratives become a tool for collaborative sensemaking that may not necessarily be convergent, and in fact may be deliberately divergent as a way to avoid the metanarrative trap. Postmodern narrators and readers develop hermeneutics of suspicion regarding metanarratives, and actively work against them through plurality and interruption, breaking the fourth wall, and other techniques that remind readers of their roles as co-authors and fellow makers-of-sense of the worlds within the texts they read.

This means that as a reader of a postmodern narrative work, your beliefs about faculty roles in curricular change will interact with our narratives and interpretations. As the (co)author of a postmodern narrative work, I acknowledge and plan for our beliefs to interact. I will periodically break the fourth wall to deliberately disrupt your reading flow and ask you to consciously engage in reflecting on your role in co-creating meaning in this text. For instance, you may want to take a

moment to pause and reflect on the assumptions and experiences you have regarding faculty roles in curricular change, as well as the assumptions you have about your role as a reader of this document, as it will inform the experience you have in reading the remainder of this work.

A postmodern approach to ontology: multiplicity, fluidity, and the ontological turn

A postmodern approach to ontology likewise engages multiplicity/proliferation, intersubjectivity amongst that multiplicity, fluidity in moving between and within those multiplicities, and constant melting and reforming of the options that comprise that multiplicity. One of the benefits of ontological multiplicity – a plurality of realities and ways of being – is that it affords examination of realities themselves. A single ontology is nearly invisible, as water is invisible to the fish swimming within it. When one version of reality is taken to be the only version of reality, there is no need to examine assumptions about the nature of reality. They are simply taken to be true; no alternative is present. However, bringing multiple ontologies into play allows each ontology to be examined from within the others, as an ontology becomes an object within a world rather than the singular, all-encompassing world that cannot itself be questioned. Engaging ontology as pluralistic and postmodern methodology becomes one example of a "multiple perspectives methodology" that could broaden engineering education's vision into a "more inclusive problem formulation space... a space of conflict and confrontation, as different modes of inquiry interact to enable transformative knowledge" (Adams et. al., 2011, p. 50).

Postmodernism's emphasis on continuous disruption means that it does not seek a particular ontology; it does even not seek to settle on any arbitrary set of ontologies. Instead, it works against ontological ossification, performing a fluidity between multiple options. There are many ways the world might be, and there are many ways engineering education might be; the emphasis is on exploring possibilities rather than rank-ordering or narrowing down on a particular "right" option. Dall'Alba describes this sort of investigation as "stepping back from everyday practices to allow scrutiny... a mode of practice that distances us from our ways of thinking, knowing, and acting for the purpose of critical examination... research *about* the object of study that is simultaneously *for* the object of study" (emphasis in original) (2009, p. 6).

One technique for maintaining ontological fluidity is a constant noticing and questioning of binaries, boundaries, and categories that are being assumed. Binaries, boundaries, and categories are about defining and setting-apart: math is not physics, and a faculty member is not a student.

Postmodernism breaks apart these categories and proliferates them, as with an integrated math-physics course or the case of a faculty member who is also studying part-time for their PhD. Proliferating categories makes it more difficult to place them in opposition to each other; it is easier to discuss "electrical engineering majors vs. mechanical engineering majors" when they are two separate ABET-certified degree programs, but harder to compare and contrast 300 individually-designed concentration programs within a single "general/multi-disciplinary engineering" concentration. There are simply too many distinct things to fit neatly into an overarching story or structure unless a much simpler categorization is overlaid on top of them.

A postmodern approach of ontological fluidity does not imply that particular ontologies are good or bad. Instead, it explores what affordances various ontologies might have, and why they might be used. Sometimes a particular ontology is helpful towards one's goals; sometimes it hinders motion towards them. Sometimes the ability to simplify, compare, and place things in contrast and opposition is helpful towards one's goals; sometimes it is not. Boundaries, binaries, and categorizations are not in and of themselves bad or harmful; in fact, they're very useful for thinking and communicating. However, we want to examine where they might come from and what else they might be and why we might choose to use them, instead of making those choices unconsciously. Postmodern ontologies are echoed in the generative aspects of design thinking practice: what else could have been, and what else could still be?

3. METHOD AND METHODOLOGY

This chapter covers methods and methodologies for the project. A method is "a technique for (or way of proceeding in) gathering evidence," whereas a methodology is "a theory and analysis of how research does or should proceed" (Harding, 1987, p. 2-3). The word "methodology" literally means the study-of-method (method-ology) and includes the paradigms, philosophies, and theories that underlie choices of method. Method presupposes methodology; a researcher's theoretical philosophies and paradigms shapes their research questions and defines the boundaries of allowable moves and domains. Methodology shapes method: what questions are allowable to ask, what counts as knowledge, what is validated as a process of fruitful knowledge creation, why one might focus on knowledge instead of other things (such as being), and so forth. In other words, method is the how and what; methodology is the why and what-for. Taken together, method and methodology serve as a site for me to communicate and explore how this project came to be.

This chapter is divided into several parts:

1. The places, people, and projects involved in the study
2. The data collection process – from individual interviews to the full data corpus
3. Making the ontologies
4. Using the ontologies to create the analysis chapters

3.1 Making the data: Selecting places, people, and projects

In this part of the chapter, I introduce and explain the places, people, and projects involved in the study. In selecting where and with whom I wanted to situate the project, I had several goals in mind that informed my actions while developing a narrative interview protocol to engage this question and recruiting faculty narrators to participate in it. These goals shaped the criteria for method design, narrator selection, and institutional site selection, namely:

2. I was looking for faculty narrators who had directly been engaged in a significant curricular change project and were willing to narrate their own participation in those projects.

3. Additionally, I sought narrators willing to engage in an iterative and intersubjective interview process, meaning that they would read and respond to portions of each other's interview transcripts.
4. I was looking for *teams* of three such faculty narrators; that is, groups of three narrators who had been deeply involved as teammates in the same curricular change project.
5. I was looking for two such teams, each from a different undergraduate engineering/technology institution, to facilitate cross-team/cross-institutional sensemaking. At the same time, the curricular change projects at each institution needed to have enough commonality that narrators and I could easily enact sensemaking across projects and institutions.

In the sections that follow, I first expand on the rationale behind these four criteria. I then describe TAD and Olin, the two institutional sites that I chose to address these criteria. Secondly, I describe the process of narrator recruitment at both institutions. Following this, I provide the introductions that each narrator gave for themselves, along with an introduction for myself as the interviewer. Finally, I describe the five curricular change projects these six narrators centered their curricular change storytelling around.

3.1.1 Criteria for method design and institutional/narrator selection

In the paragraphs that follow, I expand on the rationale behind each of the selection criteria listed above. For the first criteria, I describe why I chose to conduct narrative interviews with faculty. For the second criteria, I explain perspectival proliferation as the rationale behind those narrative interviews being conducted interactively and intersubjectively. For the third criteria, I explain why three faculty teammates were a minimum number, and for the fourth, why I chose to work across two institutions.

The first criteria was the result of situating my research question on faculty roles within faculty perspectives of curricular change. In order to elicit those faculty perspectives, I chose to conduct narrative interviews with faculty who had participated in significant curricular change projects. In this way, faculty narrators could speak about their direct experiences and decisions in curricular change projects instead of theorizing from secondhand knowledge. I designed an interview method wherein faculty narrators told autobiographical narratives of curricular change

– in other words, narrators appeared as characters in their own stories. I was interested in how they would narrate their roles as faculty within these stories.

For the second criteria, I was informed by the postmodern principles of proliferation of perspectives. As a postmodernist, I sought a plurality of ways to understand the complexity of faculty roles in curricular change from the perspective of the faculty themselves. Furthermore, as a postmodernist, I wanted to deliberately construct the study such that I would not be the data's sole interpreter. In other words, I was not only interested in faculty perspectives on faculty roles in curricular change, but in *faculty perspectives on faculty perspectives* on those roles, implying an intersubjective dataset and process. If the project was to illustrate the complex interplay of sensemaking within a community, the sensemaking within the project itself would need to occur within that community. At the same time, the sensemaking processes I employed within my research method would need to encourage individual voices to develop in rich counterpoint rather than converging to a consensus.

Thus, I designed an iterative interview method wherein faculty responded to each other's narratives within their own individual narrative interviews. Individual interviews meant both ease of scheduling and encouraging the development of distinct perspectives, while bringing narratives across interviews put these perspectives in conversation with each other. The resulting dataset is both intersubjective and intertextual, exhibiting a plurality of viewpoints and the interwoven nature of texts and sensemaking.

The third criteria was informed by perspectives of situated learning in community. In continuing to search for interacting perspectival plurality, I realized that I needed groups of narrators who had been teammates on the same curricular change project, rather than single narrators who each narrated a different curricular change project. Recruiting teammates was an intentional choice to create perspectival plurality; a single narrator from each project would mean collecting only a single person's perspective(s) on each project, whereas recruiting teammates would mean that multiple interpretations of the "same" situation and the "same" characters would come into play. Narrators would not only appear as characters in their own autobiographical narratives as the narrating Self, they would also appear as characters in each other's narratives as a narrated Other, further entangling multiple perspectives on the same phenomenon. Three narrators from each team was the minimum number that would allow for a within-team version of the intertextual technique of asking one narrator to compare and contrast narratives from two others.

Finally, the fourth criteria came about because I wanted representation from at least two curricular change project teams. With two teams, intersubjective sensemaking could occur both within and across teams. Therefore, I decided to select curricular change project teams from two separate institutions as a way to create separation between the two project teams.

However, the projects could not be too separate. Since I would be asking faculty narrators to make sense of each other's narratives both within and across institutions, I wanted their narratives to have enough commonality across institutions that they could use their own experiences to make sense of the narratives of others. Therefore, I sought two institutions with similar curricular change projects and faculty narrators from those institutions who had participated in those change projects. The specific commonality of experience was not important; the important part was that there would be a commonality. By bounding narrators such that they shared a common experience, I increased the likelihood of hermeneutical richness – that is, a crossover of stories that would resonate with narrators in such a way that they would be likely to have rich commentary/thoughts on the other narrators' data.

3.1.2 Institution and curricular change commonality selection: TAD (Berea College), Olin College, and design thinking curriculum revisions across both

The criteria listed above developed in parallel with my consideration of two institutions that seemed like particularly apt sites for an investigation on faculty roles in curricular change: the TAD (Technology and Applied Design) division within Berea College, and Olin College. These were the sites I ultimately selected as the places to draw faculty narrators and curricular change stories from. Both TAD and Olin had recently engaged in substantial curricular change projects, and are situated at small (<2000) suburban undergraduate-only campuses with a strong teaching focus and scholarship policy (100% tuition at the time of the curricular revisions described).

Not only had TAD and Olin undertaken significant curricular change projects, they had done so around the same topic: including design thinking across the four-year curriculum. This fulfilled the fourth criteria of project commonality across institutions. Matt Jadud, one of my committee members, was a TAD faculty member at the time of data collection. He had previously been a visiting faculty member at Olin. His suggestion to explore both as research sites was instrumental in my selection of Olin and Berea's TAD division as the research sites in this study, and Matt's presence in TAD facilitated access to the faculty within it.

TAD (Technology and Applied Design) is a technology division (department equivalent) within Berea College, a small liberal arts teaching college in Berea, Kentucky with approximately 1,600 undergraduate students. Founded in 1855 as the first interracial and coeducational college in the South, Berea awards a full-tuition scholarship to all students, who are required to have a certain level of economic need in order to be admitted. At the time of data collection, the Technology and Applied Design (TAD) program had 5 faculty members (2 of whom were on 50% appointments split with other departments) and offered concentrations in Technology Management, Artisan Studies, and Engineering and Technology Education. At the time of data collection, TAD had recently completed a self-study that led to a departmental renaming and curricular redesign emphasizing “design thinking” across the entire 4-year curriculum.

Olin (Franklin W. Olin College of Engineering) is a small engineering college in Needham, Massachusetts with approximately 350 undergraduates. Olin provided full-tuition scholarships to all students prior to the class of 2014, and has a nearly even balance of male and female students, which is rare in engineering. There are fewer than 40 total faculty members. Olin was founded in 1997 in response to calls for engineering education reform, explicitly establishing itself as a lab for pedagogical experimentation. Olin built its engineering curriculum “from scratch” before the first students arrived in 2001, a year prior to the start of classes. These student “partners” had a substantial impact on the development of the design components of their engineering curricular, which emphasizes user-centered design. At the time of data collection, many of the original founding faculty were still at Olin and approaching mid-career (promotion to full professor, first administrative positions, etc.), since a substantial portion of them had been recent PhD graduates when they joined the institution.

Again, the choice of “design thinking curriculum revisions” as a narrative focus was semi-arbitrary and based on the commonalities of the two institutions selected. The commonality could have been another shared experience such as “mentoring senior capstone projects” or “integrating writing across the curriculum” while still addressing the research question of faculty roles in curricular change. In other words, the point of commonality is an incidental contextual factor rather than the topic under inquiry or the focus of analysis, as this project focused on understanding faculty roles rather than on how faculty make sense of design thinking curriculum revisions.

Additionally, I had a history of personal involvement and connections at both institutions. I had visited TAD several times for extended stays with Matt and his family while Matt was

revising the electronics course in TAD to incorporate design thinking. I was also an alumna of Olin's second graduating class. I considered TAD and Olin faculty to be role models, mentors, and in some cases, friends. In fact, my interest in curricular change and faculty narrators had been sparked years earlier by conversations with Olin and TAD faculty about just those topics, so I knew their narratives would be bursting with possibilities for exploration.

Instead of framing this personal knowledge as a negative bias detracting from an end goal of objectivity, I framed it as a positive contribution to an inevitably subjective process. Instead of framing this personal knowledge as a negative bias detracting from an end goal of objectivity, I framed it as a positive contribution to an inevitably subjective process. In doing so, I situate my work amongst the ongoing discourse among junior scholars regarding authenticity as an alternative framing of "bias" in one's scholarly work (Jacobs/Four Arrows, 2008).

In working towards, rather than away from, what one might call "bias," I was specifically inspired by Mary Catherine Bateson's "Composing a Life" (2001) where she chose several her closest friends as her informants for a study on women's work and lives. I was also inspired by Patti Lather and Chris Smithies' "Troubling the Angels" (1997), where they obtrusively wove their voices as researchers throughout their text on women living with HIV/AIDS. Alongside Bateson, Lather, Smithies, and the young scholars in Jacobs/Four Arrows's edited collection, I situate my situatedness as not only inevitable, but positive. Personal knowledge and connections at each campus meant that my probes during interviews would be based on a rich store of shared background knowledge. I could refer to specific historical events and individuals from the beginning when asking for more details in the narratives. Furthermore, each institution's narrators had ready points of personal connection with the other institution, which aided in the narrators' abilities to make sense of each other's stories.

3.1.3 Narrator recruitment

During the process of iterating on these study design boundaries, I used my existing relationship with the three more experienced TAD faculty members (Alan, Gary, and Mark) and reached out informally for feedback on the ongoing rough versions of the study design. I also inquired if they might be willing to participate as narrators, since all three had participated deeply in the recent "design thinking curricular revision" within TAD. All three gave an informal yes to

my informal ask, meaning that I potentially had my minimum number of three teammates from a curricular change project from one institution.

Three narrators from TAD meant I needed to find three narrators from Olin to provide a parallel. Taking the commonalities of the TAD faculty – heavily involved in the curricular revision, taught curriculum affected by it, and still at the institution – I translated them into the Olin context, which I knew from firsthand experience as an alumna. If “design thinking curriculum revision” was the common thread, Olin narrators would have to have been at Olin since before the current design curriculum was started, which meant prior to the first year of undergraduate enrollment for the class of 2006. Using the faculty directory on Olin’s website, I gathered the emails of all the current Olin faculty who had been there at that time, and emailed those 11 people a similar informal and personal request. Three (Jon, Lynn, and Rob) responded with an immediate yes; they became the Olin narrators.

Because of the small size and unique nature of their institutions, I realized early on that faculty narrators would be highly identifiable. The conventional practice of anonymizing both participants and institutions would destroy the narrative particularity emphasized by Bruner (1991, p. 6-7). Consequently, part of the study design draft I discussed with potential narrators was the idea of radically transparent research, an approach I had developed for earlier projects based on my experiences working in the open source software world. Adopting a radical transparency approach means taking the usual practice of anonymizing interview data and flipping it on its head, publicly identifying narrators by their real names and institutions (Chua, 2013).

I initially worried that narrators would be uncomfortable with removing anonymity, but all of them said they were willing to be part of a public research process where their names would be released alongside their data. I needed to know if all six narrators would be comfortable with that part of the study design, because it would determine how I collected, shared, and worked with data. If even one narrator was not comfortable with transparency, I would have designed the study differently to protect confidentiality. Since they were all willing, the transparency criteria stayed in place and I designed the protocol accounting for it.

Having gotten a preliminary gauge of interest around the study and an informal willingness to be publicly identified within it, I wrote up the protocol and the remainder of the proposal and submitted it to Purdue’s IRB. After being approved, I sent out the “official” recruitment emails

and got formal consent on paper from all six narrators. In many ways, this felt like a formality after the months of intermittent discussion with the narrators and their colleagues about the study design.

3.1.4 Introducing the six faculty narrators (and one researcher/interviewer)

At the end of the recruitment process described above, I had six faculty narrators: Mark, Gary, Alan, Jon, Rob, and Lynn. In keeping with my postmodern stance of perspectival plurality over the sovereign perspective of the researcher, the paragraphs below are condensed versions of how each narrator preferred to introduce themselves, drawn verbatim from their first interview transcripts. Different narrators emphasized different aspects of identity in their introductions, and varied widely on formality and level of detail.

In using the participants' words rather than my own summaries of their identities, I attempt to show them as they would show themselves, not as I would. However, this introduction is also inevitably "how I would show them." As the author of this document and thus the curator of the words displayed, my editorial tampering is also a form of authorship of these character introductions. My inclusion of my own introduction in the same format is an attempt to acknowledge this and to (at least in some ways) place myself alongside, rather than above, my narrators, and to call attention to my positionality as the interviewer.

“Mark” - Mark P. Mahoney, Assistant Professor of Technology and Applied Design at Berea College:

“I am an Assistant Professor at Berea College. I have primarily have been teaching courses that deal with materials, energy power, drafting and electricity over my 5 years of being here. I was a high school, middle school teacher for years. I was very happy at that position. I saw where the current technology education curriculum was going and wasn't happy with it. I wanted to move to a level where I had an impact on it. I went into Ohio State and I studied technology education and STEM education as far as presenting the curriculum and multiple disciplines to improve the students' education. Berea invited me down... the mission of the college was exceptional.... it is a rarity to find that kind of combination. So, I have been here.”
(Mark 1)

“Gary” - Gary S. Mahoney, Professor (and former Chair and alumnus, no relation to Mark) of Technology and Applied Design at Berea College:

“I’m a graduate [of Berea’s TAD program] and came back for teaching in 1989. I have a doctorate in education. I teach the design and production [in wood]. I teach [computer] aided design classes. I teach the computer integrated manufacturing.” (Gary 1)

“Alan” - Alan D. Mills, Professor (and Chair) of Technology and Applied Design at Berea College:

“I’m a little older than Gary, about nine years. I’m heavily entrenched. I came out of the really strong period of industrial arts in the '70s, when it was really, really thriving. It’s been a big adjustment to pick up on the new technology and design concepts that we didn’t have when I was in college. I can remember building a bookcase and we found a great drawing in a book that I liked a lot, but it was a little oversized for me. So I shrank all the measurements down and did some tweaking of it. In some sense, that’s designing. But that would usually be the extent of it. We pretty much got our designs from somebody who had already designed something that we’re trying to build.” (Alan 1)

“Jon” - Jonathan Stolk, Professor of Mechanical Engineering and Materials Science at Olin College:

“It is important for me to communicate to people that I arrived before students arrived at Olin... I always have to get that into my introduction... one of the things I oftentimes say is I design nontraditional learning experiences for a group of undergraduate engineering students.” (Jon 1)

“Rob” - Robert Martello, Professor of the History of Science and Technology at Olin College:

“I am currently a professor of the history of science and technology. I have a bachelor’s degree in a science discipline and a master’s degree in engineering before I entered my Ph.D. program in history... [so] by training I have sampled science, engineering... [and] the social sciences. I’m sort of weird... in my intellectual vitality space... in the sense that I have... [a] history side and [an] education side.” (Rob 1)

“Lynn” - Lynn Andrea Stein, Professor of Computer and Cognitive Science (and Associate Dean and Director of the Collaboratory) at Olin College:

“My background is in computer science and in cognitive science. I speak of myself as [a] broadly interdisciplinary person... I spend a lot of my life thinking about things at disciplinary boundaries. I was... one of the people with design background,

particularly from my HCI (human-computer interaction) experience and cognitive science experience. I was a professor at MIT for 10 years before I left to help create a brand-new college. I've been at Olin since before there were students... I was here a year before Rob and Jon." (Lynn 1)

“Mel” - Mel Chua, PhD candidate at Purdue University:

“I'm a PhD student in engineering education with a penchant for narratives and a fascination with postmodern qualitative methodology. I identify as a hacker and bricoleur, a scholar and artist, and an (electrical/computer) engineer and teacher. I have personal connections to TAD as a visitor and short-term peripheral curricular design collaborator, and to Olin as an early alumna who was working on campus as a research staffer during the second half of producing this dissertation. The faculty narrators in this projects are people who I consider mentors and in many ways models for the scholar and teacher I want to grow into.” (Created for this document)

Several inadvertent areas of narrator commonality came up after all participating narrators had been selected. Although not part of the narrator selection criteria, they also influence the dataset by coloring the background experiences and interpretative frameworks/habits of participants. All participating narrators happen to be cross-disciplinary. Each of them has both a formal academic background in engineering or technology and either a formal credential or current research focus in engineering or technology education. The cross-disciplinary and education-related backgrounds of participants was an unforeseen advantage that allowed our conversations to delve deeper into shared meaning-making than may otherwise have been possible, because narrators had theoretical vocabularies for learning that they then used to describe the learning of both their students and themselves.

3.1.5 Projects featured in the narratives

Although the six faculty narrators were chosen for their participation in a “design thinking curriculum revision” project at their institution, these large-scale curricular change projects were so large and complex that they ended up being discussed as multiple connected projects. Narrators told stories that clustered around five curricular change projects, two from TAD and three from Olin. This list of projects was not defined ahead of time, and narrators were not asked to restrict themselves to talking only about these five projects; indeed, most of them mentioned other courses and curricular change projects at various points in the conversation. However, these five projects

were most frequently emphasized and referred back to across narrators, and thus crystallized as the major ones discussed. I will briefly summarize each project as it appears across multiple tellings by multiple narrators.

"TAD self-study"

As previously mentioned, TAD (Technology and Applied Design) is a division and undergraduate major program at Berea College. This particular round of the self-study project, as told by TAD faculty narrators, refer to the 2013 round of the curriculum re-examination periodically required by the Berea of all divisions. All three TAD narrators (Alan, Gary, and Mark) participated in the process, though Alan was on sabbatical for a portion of it. Prior to 2013, the TAD program was called Industrial Arts and had been a program of study at Berea College for many decades. This round of self-study timing came shortly after recent retirements and hirings in the division, and came in the aftermath of a national trend of Industrial Arts programs at other schools updating their names to reflect changing trends in technology education (Herschbach, 1997). The TAD faculty took the self-study as an opportunity to re-examine their division's identity, including its pedagogy, content, and name.

Documentation and Design (D&D)

Documentation and Design is a foundational TAD course intended for new students to the major, but open to other years and majors. It is abbreviated "D&D" in this document, but was often referred to as "TAD 130" by the narrators, after its course number. The course teaches the design process, including the ideas of revision and iteration, as "habits of mind" that subsequent TAD courses will be able to build on. The current version of the course was originally designed by the entire department prior to the 2013 self-study, then primarily taught by a single faculty member. In the meantime, several faculty who had co-designed the course retired, and new faculty were hired.

Shortly after the self-study, the faculty member responsible for teaching D&D left abruptly at the start of the summer. Faced with the urgent need to fill an instructional slot in the fall, the remaining 4 TAD faculty decided they would all take a teaching overload to co-teach both sections as a unifying faculty experience, so that each faculty member would have direct experience with

the department's foundational course. They paired teaching teams such that each section had a more experienced TAD faculty member paired with a newer faculty member, and met weekly as a group of 4 to update and revise the course, often just ahead of where the students were encountering it. All three TAD narrators (Alan, Gary, and Mark) were involved in this co-teaching process.

"Olin's early days"

Olin was founded in 1997 and graduated its first class in 2006. The "early days," as told by the Olin faculty narrators, span approximately 1999-2003 when the first faculty were arriving and preparing for, and then with, the first classes with the first students. There was a strong emphasis on "doing things differently" and "starting from a blank slate," with no departments, no tenure, and an expectation to create a curriculum that looked radically different from "conventional" engineering programs. Design, or what would eventually be given the label of "design," was a prominent feature of curricular discussion during these years. All three Olin narrators (Jon, Lynn, and Rob) were involved in the "early days" of Olin's curricular development.

User-Oriented Collaborative Design (UOCD)

User-Oriented Collaborative Design is a foundational Olin course required of all second-semester sophomores. It is abbreviated "UOCD" in this document, which is how the faculty members referred to it in their narratives (pronounced "you-oh-see-dee"). UOCD teaches user-centered design by having teams of 4-5 students conduct interviews, observations, and co-design sessions with user groups in the local community; past user groups have included firefighters, drag queens, and urban farmers. User groups change yearly and are generally unfamiliar to both student teams and the course faculty.

UOCD's curricular design is largely attributed to a single faculty member who, as a new arrival, was assigned to develop a sophomore-year design experience with less than a semester before the first class of sophomores would begin to take it. That faculty member brought in a visiting colleague with design experience to co-design and co-teach the first round of the course, but they required more studio instructors to cover the entire sophomore class. The additional faculty who offered to be UOCD studio instructors that first year had never formally encountered

user-centered design themselves prior to teaching a course on it; two of the Olin narrators (Jon and Lynn) were part of that faculty group, and the third (Rob) taught courses significantly influenced by it. UOCD is now considered a core part of the Olin curriculum and has been presented in workshops and adapted to other engineering programs such as UIUC (University of Illinois at Urbana-Champaign).

Stuff of History (“SoH”)

Stuff of History was a combined history/materials science course that was one of the first team-taught and interdisciplinary projects at Olin, paving the way for subsequent team-taught and interdisciplinary courses there. It is abbreviated “SoH” in this document, and the narrators generally referred to it either as “Stuff of History” or “Stuff” in their interviews. SoH was not a required course, but served as an option to students for fulfilling both humanities (history) and science (materials/chemistry) course requirements. It was established by two of the Olin faculty narrators (Jon and Rob) after Rob visited Jon's classroom for an interdisciplinary unit during the first year of classes ever taught at Olin; both faculty enjoyed the interdisciplinary visiting experience so much that they agreed to experiment with co-creating a full course. The course ran for over a decade (2004-2014) before both faculty moved on to other projects, and became a common curricular example to use when describing Olin's curriculum to other institutions, such as in faculty workshop settings.

3.2 Making the data: From individual interviews to the full data corpus

This part of the chapter describes the step-by-step process by which individual transcripts in the narrative dataset were created and assembled into the full data corpus. I begin by detailing the process for an individual interview, first with a Gantt chart overview, then with an expansion on individual steps.

Table 3.1. Gantt chart: Single interview process overview

Before the interview	During the interview		After the interview
I schedule the narrator and captioner			
I prepare the prompt			
I load the prompt into Google Docs for collaborative editing, and send the link to the narrator and captioner			
	Skype/phone call active		
	Asking permission to record	Ongoing recording and realtime transcription of the interview into the Google Doc	
		Narrator tells curricular change stories	
		I probe the narration with questions as needed	
I annotate/edit the Google Doc to flag questions or do cleanup			
			Transcript approval process

Expanding on the table above, the process ran as follows:

1. Prior to the interview, I prepared the prompt for the appropriate prompt progression and put it into Google Docs, a collaborative web-based document editor (see 3.2.1, “Prompt creation process”).
2. I scheduled a specific interview time with the narrator and booked a captioning service for producing a realtime transcript. I briefed the captioner and narrator on process and special terminology via email as needed, and sent the collaborative document URL to both parties ahead of time (see 3.2.2, “Data capture via realtime transcription”).
3. At the appointed interview time, I started a multi-way audio call with all remote participants (in most cases, both the narrator and the captioner) and ensured that all three of us could view the prompt in the collaborative document (see 3.2.2, “Data capture via realtime transcription”).
4. The captioner began to transcribe all subsequent interview conversation directly in the collaborative document, below the prompt. I began to read the live transcript in the document and contribute spelling corrections and annotations (see 3.2.3, “Probing during the interviews”).

5. Once the captioner was transcribing, I asked the narrator to begin reviewing and responding to the prompt, probing and using the shared document and live transcription as needed to elicit their narratives (see 3.2.3, “Probing during the interviews”).
6. Some captioners needed breaks in the middle of longer interviews; in this case, we simply paused the call for a few minutes, then resumed when they were ready again.
7. After the interview concluded, I thanked the narrator and captioner, disconnected the call, and wrote a brief reflection on the interview.
8. Shortly afterwards, I sent the transcript file to the narrator for review and open-licensing. After receiving transcript approval from the narrator, I formatted the transcript for analysis, lightly editing it for clarity: fixing spelling errors, expanding acronyms, etc. If the narrator open-licensed their transcript, I placed a copy of it online with licensing information. When a narrator had not yet sent the documents for open-licensing a specific transcript but had given general permission for me to work with the data, I kept the copy in my private files for analysis (see 3.2.4, “Reviewing transcripts after the interview for dataset inclusion”).

The first four sections that follow expand on various aspects of the process for individual transcripts listed above: prompt creation, transcription, probing techniques during the interview, and transcript review. After explaining the production of individual transcripts, I step back to show the progression of individual interview prompts that built the full data corpus. Finally, I give an overview of the full corpus and discuss transcription conventions for its usage in this document.

3.2.1 Prompt creation process

Each interview began with a prompt to give the narrator a starting point to draw from. This section outlines the prompt creation process for both initial and subsequent interviews. Following an explanation of the prompt creation process, I explain how my actions of “linking into discourses” differ from the interpretivist portrayal of emergent themes.

Prompt creation for the first interview

For each narrator’s first interview, the prompt consisted of two questions:

1. How would you like to introduce yourself as a character in the stories you're about to tell us about curriculum design/revision? (Note that the short autobiographical character introductions in section 3.1.4 were drawn from narrators' answers to this question.)
2. As you know, I'm focusing on faculty narratives around curricular change, and I'm talking with you because you were involved in bringing design thinking into your curriculum. Tell me the story of what happened during the curricular changes you were a part of.

Interviewing each narrator multiple (3-6) times gave them multiple opportunities to iterate on their narratives. The sequence of interviews is detailed later in section 3.2.5. This iterative approach speaks to Schoen's concept of "reflection-in-action" (2005), or a metacognitive awareness of one's thoughts in the moment, as well as the importance of reflective critique in the practice of scholarship (Glassick et. al., 1997).

Prompt creation for subsequent interviews

Prompts for each narrator's subsequent interviews consisted of remixed excerpts from other narratives. I curated these prompts, which varied between 1-7 pages in length, from the data pool that existed at the time of each interview. The specifics of which pieces of data were used for which prompts are detailed in section 3.2.5. Using remixed narrative excerpts as prompts meant that narrators were repeatedly asked to make sense of both their own perspectives and the perspectives of their fellow narrators, producing an intersubjective and intertextual dataset.

My process for prompt creation is a new methodological contribution, and the next few paragraphs illustrate it via walking through a partial example. This example begins with Lynn's response to one of her first interview prompts, "tell me the story of what happened during the curricular changes you were a part of." She responded, in part, as follows:

[If I were to write a book about the curriculum revision,] Chapter 1 [would be called] "We need a design experience in the fourth semester." (Lynn 1, 310)

Rob's third interview occurred after Lynn's first interview, and the above fragment of text was presented to Rob as part of his third interview prompt. In response to this section of his prompt, Rob responded:

Chapter 1, she is saying there is some need for design experience. That is fascinating for me to hear. I wasn't aware of any of the details of that discussion. (Rob 3, 45)

Jon's third interview occurred after Rob's third interview. The fragments above were included in the same section of Jon's third interview prompt. In other words, Jon's prompt contained *both* Lynn's transcript and Rob's reply to Lynn's transcript. Jon responded to both these sections during the course of his interview:

So what Lynn said is exactly what I remember. I think I described this in my last interview or maybe the first one... It's interesting to see Rob's comments too that he wasn't aware of the detail... (Jon 3, 62)

Jon's interview transcript was then taken and remixed into future prompts and discourses, and so forth. As the above example begins to show, this process for prompt creation blurs the distinction between data collection and analysis. It also blurs the distinction between researcher and subject, since using these prompts for the interviews leads to faculty narrators co-analyzing their data. The resulting emerging narrative accrual consists of interlinked narratives that overlap, intertwine, and make-meaning-of each other.

“Linking into discourses” as a process of prompt creation

I call this prompt creation process “linking into discourses” as a postmodern contrast to the more common interpretivist portrayal of the emergence of themes. “Emergent themes” are a common “building block” for inductive analysis (Williams, 2008) and are often depicted as being passively allowed to emerge before being categorized. They are also often verified via practices for inter-rater reliability, presupposing a desire for some form of objectivity; the more researchers agree on themes within a dataset, the more those themes are validated as “real.”

In contrast, postmodern texts are full of “pastiche, montage, collage, bricolage, and the deliberate conglomerizing of purposes,” and linking into discourses is in keeping with this paradigm by “[encouraging] a multiplicity of readings by demonstrating how we cannot exhaust the meaning of the text, how a text can participate in multiple meanings without being reduced to any one, and how our different positionalities affect our reading of it” (Lather, 1991, p. 145). Far from being a “failure of interpretive responsibility” to “analyze... what [the narrators' words] really meant” (p. 2), it highlights the pluralities of ways we can constantly make and re-make our understanding. Linking discourses endlessly weaves and re-weaves a dataset into and within the massive fabric of the world's information, which leaves us with an overwhelming Library of Data

We Haven't Analyzed Yet, to adapt a phrase from Italo Calvino's *If On A Winter's Night A Traveler* (1982).

Speaking of “linking into discourses” also highlights my agency and actions as the person doing the linking, and the inevitable influence of a researcher's individuality on what they create. The links and discourses I created are different from the ones another researcher would create, and this diverse perspectival quality is something to be celebrated rather than converged into inter-rater reliability. Linking into discourses includes the idea of subjectivity as a generative thing to be sought, rather than a reluctant admission in the face of the impossibility of pure objectivity.

3.2.2 Data capture via realtime transcription

Having covered prompt creation, I now turn to the topic of data capture, which in this case means transcription. Qualitative data is typically audio-recorded and transcribed after the fact by a listening researcher. Since I am deaf, I use realtime transcription to provide both interview access for myself and a transcript for the research. This section outlines the usage of realtime captioning for qualitative research and the affordances and methodological implications of such a choice.

Realtime captioning transcription setup overview

Realtime transcription is a skilled service, not an automated software tool. Far more accurate than modern-day speech recognition software, captioners can handle accents, technical terminology, homophones, laughter and other non-word noises, speaker changes, and other auditorily difficult situations — such as my data collection, which features academics speaking rapidly and using technological, pedagogical, and psychological terms. I have written elsewhere about the benefits of using realtime transcription for qualitative research more generally (Chua & Adams, 2014).

The setup consists of a trained provider, typically with a stenographic keyboard, listening to the discussion and transcribing it in realtime onto a display for clients to view. It can be conducted with any number of remote parties. Most interviews were conducted via a 3-way conference call with myself, the narrator, and the captioner in separate locations. Three interviews were conducted in-person, with myself and the narrator face-to-face and the captioner calling in.

Benefits of realtime transcription: turnaround time and transcription conventions

A choice to use realtime transcription has the additional benefit of providing transcript access with a 5-second rather than 2-week or longer turnaround. At \$60-120 per hour as of 2016, the cost is comparable to current rates of outsourced after-the-fact transcription. The process can be thought of as similar to hiring an interpreter for foreign-language interviews; a realtime captioner is essentially a speech-to-text interpreter.

Using realtime transcription also meant that I could specify and negotiate transcription conventions with the captioner ahead of time. There is not a strict standard format for realtime captioning output, but it tends to be similar to subtitle tracks for movies. Captioners do not typically note things that would require additional description, such as tone of voice, but they will use punctuation and note relevant non-verbal sounds such as long pauses, sighs, and laughter, as well as environmental noises that impact the conversation, such as ringing phones in the background. I also gave the captioner a list of anticipated vocabulary (acronyms, proper names, specialized terms, etc.) in advance to aid with understanding and correct spelling.

Exceptions to realtime transcription within this project

During the course of data collection for this project, there were two exceptions to the usage of realtime transcription for interview transcript production. The first exception was Lynn, who preferred to type her interviews rather than speak and be transcribed. Consequently, Lynn's interviews were conducted over Skype text chat; she and I are fast typists who can produce text at close to conversational speed. Lynn's transcripts occasionally contain features such as creative use of punctuation, parenthetical asides, smileys, and so forth, reflecting our usage of this medium.

The second exception occurred the few times realtime captioning did not work out. In one case (Alan's 1st interview), we had connectivity issues where the captioner was not receiving audio. In the other case (Jon's 5th interview), the narrator requested an interview date with short notice and I could not find a captioner available to work at our scheduled time, since realtime captioners are in short supply and typically require scheduling at least a week in advance, if not two. Consequently, those interviews were audio-recorded and transcribed by a professional service and reviewed by both myself and the narrator for accuracy. The tradeoff was that I was cognitively

exhausted for the remainder of the day, since it is hard work to participate in a conversation I can't fully understand. The only visible hiccup was during Jon's 5th interview:

JON: Wait, can you ask that – When I said I – What did I say? I didn't have a lot of –

MEL: I think I heard you saying that, "I'm an engineer. I don't have a lot of respect for students."

JON: Oh, maybe I said that, I don't know. Did I say that earlier when I was commenting to Mark or did I just say that?

MEL: Oh, just now. Maybe I misheard you.

JON: I think you might have misheard me.

MEL: I think I misheard you. My gut – That didn't sound like something Jon would say.

JON: No.

MEL: And actually, now I have a transcript, or soon to be a transcript record, of the reason why I typically try to use real time transcription.

(Jon 5, 82-89)

This particular interview with Jon still worked in terms of yielding insightful data, since my probes were enough to continue eliciting narratives from him. Due to a lifetime of practice bluffing my way through hearing environments, I was typically able to keep the conversation going even if I didn't have a full idea of what was being said. This meant that I didn't have a clear picture of the stories he was telling me until a few days later when I got the transcript back and was able to understand our full conversation for the first time. However, except for the hiccup quoted above, the interview does not read differently from other interviews with realtime captioning, in terms of my apparent level of conversational understanding in the transcript. This is an indicator that the data quality of the transcripts without realtime captioning are equivalent to the ones with realtime captioning.

3.2.3 Probing during the interviews: Realtime transcript annotation and grounded indigenous coding

As the interview progressed, I responded to the narrator's storytelling with probes intended to elicit further detail, such as "what do you mean by..." or "could you tell me more about..."? Such probes are typical of open-ended interview practice. As previously discussed in section 3.1.3, my personal knowledge of the narrators and their campuses enabled me to draw on knowledge the narrators had not explicitly brought up within the interview.

In addition to the conventional interview probes just described, I was also able to engage the data and participants in two novel ways: realtime transcript annotation and grounded indigenous coding. Both techniques were enabled by my usage of realtime transcription, illustrating ways in which that technique can be read as a methodological innovation rather than framed with the deficit model of disability accessibility (in this case, deafness). Both techniques illustrate ways to blur the line between data collection and analysis.

Realtime transcript annotation

Realtime transcript annotation is the simpler technique of the two. Since the transcript was produced in real-time in a collaborative document, I was following the conversation by reading the transcript and could edit and annotate it as it was produced. In practice, this meant I was able to correct simple transcription errors such as spelling, punctuation, and incorrect homophone guesses on the fly. I was also able to flag specific parts of the transcript with highlights and comments.

I consider realtime transcript annotation as a probing variant that is simultaneously a data analysis technique and a data collection technique. Its classification as a data analysis technique is straightforward; the realtime annotations represent my preliminary interpretation and note-taking on the interview. Its classification as a data collection technique comes from its visibility to the narrator. If narrators chose to look at their transcript in realtime as well, they would occasionally see my highlights and annotations and utilize them like probes, responding to them verbally during the interview. Typically, the narrator would read out the annotation so that it became part of the verbatim transcript rather than my annotation on the verbatim transcript, which further blurred the line between data and analysis.

Grounded indigenous coding

The second technique, grounded indigenous coding, is related to this usage of realtime annotation as a probe. For more on grounded indigenous coding, see (Chua & Adams, 2014). Briefly, grounded indigenous coding builds on Holstein and Gubrium's concept of *indigenous coding*, or analyzing data while generating it (1995). Indigenous coding occurs any time a narrator metacognitively reflects on and analyzes their own words from the present conversation. It occurs

naturally in everyday speech; phrases like “you mean...” or “to sum it up...” or “one way of thinking about it...” are typical signals of indigenous coding (p. 56). Typically, these analyses are drawn from short-term memory, or what the narrator remembers about what they said several minutes ago. Using realtime transcription turned indigenous coding into *grounded* indigenous coding, where the analysis could be grounded in the verbatim transcript rather than only short-term memory.

An example of grounded indigenous coding in this project can be found in Jon’s first interview transcript. Towards the beginning, he introduces himself:

My name is Jon Stolk. I have been at Olin since 2001... I got to Olin a little bit before students arrived. (Jon 1, 15)

Approximately 40 minutes later, during the same interview session, Jon read the above line in his own transcript and began a self-analysis with the following comment:

It is important for me to communicate to people that I arrived before students arrived at Olin. I notice that I always do this. I always have to get that into my introduction. (Jon 1, 138)

Jon’s realization that “it is important for [him] to communicate to people that [he] arrived before students arrived at Olin” was driven by seeing his verbatim transcript from earlier, where he introduced himself as having “got[ten] to Olin a little bit before students arrived.” Having the transcript as a concrete boundary object allowed precise, detailed analysis of phrasings and re-phrasings, specific vocabulary, and things the narrator may not have realized they said. By reducing transcript turnaround time from several days (or weeks) to 5-10 seconds (the average remote captioning delay), I removed the tradeoff between immediacy and precision. As an interviewer, I was also able to scroll back and tell a narrator exactly what they or I had said earlier in the conversation, and would sometimes use this ability as a probe technique. Jon later commented on the power of seeing his own transcript, noting that...

[It prompted] thinking about what I meant when I said the words. In one case I am thinking, ‘Oh this is great,’ and the next paragraph I am thinking ‘Oh, I’m terrified, and oh shit, I don’t know what I am doing.’ And yeah, seeing that... it definitely had an impact. (Jon 2, 147).

Methodological implications of realtime annotation and grounded indigenous coding

In addition to fostering awareness, both realtime annotation and grounded indigenous coding highlight several postmodern methodological design elements. By naming these techniques

as moments of co-analysis, I subvert the usual researcher/subject power dynamics and frame narrators as “fellow researchers” rather than “subjects.” Even if all the narrators for this study had done educational research as a non-trivial part of their faculty jobs, the fluidity of narrator/researcher roles enabled by these methods was a unique experience for many of them.

Rob expressed it most concisely:

I never get to do this kind of analysis, because when I read things from other faculty, it's usually the finished final product. But here is the raw stuff, and it's fascinating to see the raw stuff when it's not done yet, and to be able to comment on that as it is unfolding, and hear a response [from the other narrators] to my comment or observation. (Rob 6, 166)

Furthermore, by making transcription an important study design element, I uncovered it as a component of research methodology whose effects on data often go ignored and unthought-of (Lapadat & Lindsay, 1999). Finally, these techniques also uncover the line between “data collection” and “data analysis,” another distinction in research methodology whose socially constructed nature is easily overlooked. For the purposes of this project, I consider the narrator reflections elicited by grounded indigenous coding as part of their interviews, and thus part of the dataset under analysis; they are part of the data generating technique instead of the data analysis technique. By not temporally and spatially separating “data collection” from “data analysis,” I point out the arbitrary nature of the slice researchers often make to separate the two.

3.2.4 Reviewing transcripts after the interview for dataset inclusion

The use of realtime transcription results in an interview transcript being generated during the interview and a rough transcript complete at the end, rather than having to wait for transcription as a separate process. However, there were several more steps in turning this rough transcript into one that could enter the dataset. The paragraphs that follow detail the mechanics and considerations for narrator review and editing of transcripts that I employed to address the ethical considerations of publicly identifying narrators within a dataset.

I began the narrator review process by formatting the transcripts for readability (correcting stray spelling and punctuation errors along the way) and emailing the full transcripts to narrators so that they could review and edit it. During this part of the process, there were no restrictions on the edits a narrator could make; they could remove entire passages without noting for the public record that they had done so. From a postmodern perspective, “preserving the truth of the record”

is not a meaningful goal; the narrators' desires to edit and shape their transcripts are as truthful an account of their voices as the words they earlier uttered and later decided to change. In practice, narrators tended not to edit their transcripts at all. After conducting the interview, they were typically able to say that there was not anything in those conversations that they would mind going public.

The major exception to this was one of Jon's 5th interview, where he referenced Lynn as a comparison point as a way to describe his own personality. Although it was not a negative mention by any means, at the start of his next interview, Jon mentioned that he felt uncomfortable with that reference and wanted to edit it: "Can I take out the reference to Lynn, and just keep the stuff in about myself?" (Jon 6, 47) Consequently, Jon and I spent the first part of his 6th interview editing out that section of the transcript until he was comfortable with it. The conversation we had while editing – what to leave in, what to take out, how to make the remaining fragments make sense again – became part of the transcript for Jon's 6th interview. I asked Jon if he wanted to leave the editing conversation in the public dataset, and he said yes. This means that the traces of our removal process are clearly visible in the data.

This focus on narrator empowerment and editing was driven by ethical considerations related to narrator identifiability. Since narrators would be associated with their real name and institution in the resulting research publications, it was vital for them to be comfortable with what would effectively be published under their name. Even if consent for this identification had been obtained beforehand, individual transcript approvals after the fact were still necessary. Since people rarely know in advance exactly what they will say during an interview, narrators were not be required to commit to releasing specific portions of a transcript before that transcript was generated. Instead, narrators were given the opportunity to make that decision after the interview was over and they had an opportunity to review and edit specific transcripts.

The legal mechanics of open-licensing were methodological contributions in and of themselves, worked out over the course of a year with the help of a copyright lawyer, open-licensing experts, and Purdue's IRB. Briefly: immediately after each interview, I digitally signed a statement that transferred copyright of the transcript to the narrator only, since current copyright law does not clarify whether an interview transcript belongs to the interviewer(s), the interviewee(s), or both. Having the narrator hold the copyright served as a protective mechanism for them, since only the copyright holder can apply a license to a work. This ensured the transcript

version released would be a version the narrator was comfortable with and placed narrators in control of whether, how, and when to open-license their data.

For this study, I suggested that narrators release their transcripts under a Creative Commons Attribution Share-Alike license (Creative Commons, 2013), and all narrators who opted for open-licensing took this option. This specific open license enables sharing and reuse under the conditions that original work be fully attributed and any remixes be released under a similarly open license. As of this writing, 20 out of the 26 transcripts (77%) are open-licensed and available at <https://github.com/mchua/facultyaslearners> for any kind of future work with proper attribution. The six transcripts that are not open-licensed were due to non-response to my queries, and I decided to hold off on further requests until after completing, defending, and depositing this dissertation so that narrators could see what their data had been used for and how open-licensing had worked for other narrators. Data that has not been open-licensed is quoted in this document with narrator identification as agreed upon before the study, but the full transcripts are not available for public reading or further research usage.

3.2.5 Expanding progression of prompt sources

In an earlier section on prompt creation, I described the process for creating the prompt for a single interview by linking prior interview transcripts into discourses. The selection of which prior transcripts to draw on to create which prompts was driven by a desire to scaffold narrators through increasing levels of intersubjectivity as they progressed through the interview sequence. Prompt progression for an individual narrator was as follows:

1. Solo interview
2. Reflection on solo interview (transcript #1 from self)
3. Reflection on same-institution colleague interviews (transcripts #1-3 from narrators at the same institution)
4. Reflection on cross-institution interviews (transcripts #1-6 from narrators at the other institution)
5. Reflection on any interviews (transcripts #1-6 from narrators at any institution)
6. Same as #5, plus a preview of preliminary results

Essentially, as a narrator progressed through the interview process, I drew their prompts from an increasingly wider pool of transcripts. This allowed narrators to start by reflecting on topics closer to their own experience. I designed the prompt progression to move narrators from responding to themselves (interviews 1-2) to responding to familiar colleagues from their institution to (interview 3) to responding to unfamiliar colleagues from a different institution (interviews 4 and beyond). Each narrator participated in at least 3 interviews and up to 6, depending on schedule considerations. This guaranteed each narrator's stories would be actively intertextual since they would, at minimum, reach the point of reflecting on the stories of colleagues at their institution.

3.2.6 Data corpus size and scope

This section looks at the data corpus as a whole. The data corpus represents around 42 hours of data collection (26 transcripts x 1.5 hours each + 0.5 hours additional for each of 6 first interviews). This number is approximate rather than exact; some interviews featured short breaks, some interviews ran over at the narrator's request when they wanted to finish telling an extended story, some interviews started late because narrators were running late from a previous meeting, etc.

Interviews took place over the course of approximately one year. Each session was scheduled to last 90 minutes (1.5 hours). The only exception to this was the first session for each narrator, which had an additional half-hour at the start in order to give me time to explain the study, answer questions, and do IRB paperwork.

As previously noted, each narrator completed between 3-6 narrative sessions depending on their schedule. The narrators from Olin (Lynn, Jon, and Rob) all conducted 6 interview sessions. The narrators from TAD (Alan, Mark, and Gary) all conducted 3 interview sessions due to an unexpectedly hectic semester and the schedule constraints therein; every member of their department was teaching a severe overload that term in order to execute the curriculum design I was interviewing them about.

In total, I conducted 27 individual narrative interviews. However, one transcript (Jon's 4th interview) was lost to technical failure, so the final data corpus consisted of 26 interview transcripts. However, even if I did not successfully capture it, that 4th conversation with Jon influenced our 5th and 6th interviews, as can be seen by Jon's references to the 4th interview at the start of his 5th

interview transcript. Another transcript (Rob’s 6th interview) experienced technical failure but was reconstructed collaboratively by Rob and Mel immediately afterwards, and is included in the corpus.

Table 3.2. Interviews in chronological order

Interview	Date	Modality	Open-licensed?
1 Rob	1/10/2014	remote realtime transcription	yes
1 Lynn	1/28/2014	started with remote realtime transcription, transitioned to text chat	yes
2 Rob	1/31/2014	remote realtime transcription	yes
1 Alan	2/20/2014	in-person lipreading with audio recording and post-hoc transcription	no
1 Mark	2/21/2014	in-person realtime transcription	yes
1 Gary	2/21/2014	in-person realtime transcription	no
3 Rob	2/28/2014	remote realtime transcription	yes
1 Jon	3/4/2014	remote realtime transcription	yes
2 Jon	4/1/2014	remote realtime transcription	yes
3 Jon	4/15/2014	remote realtime transcription	yes
2 Lynn	4/28/2014	text chat	yes
3 Lynn	7/29/14	text chat	yes
2 Mark	9/1/2014	remote realtime transcription	yes
3 Mark	9/15/2014	remote realtime transcription	yes
2 Alan	9/19/2014	remote realtime transcription	no
2 Gary	9/22/2014	remote realtime transcription	no
3 Alan	9/22/2014	remote realtime transcription	no
4 Lynn	9/26/14	text chat	yes
4 Rob	9/29/2014	remote realtime transcription	yes
5 Rob	10/6/2014	remote realtime transcription	yes
4 Jon	10/7/2014	remote realtime transcription	yes
5 Lynn	12/9/2014	text chat	yes
6 Rob	1/23/2015	remote realtime transcription	yes
3 Gary	1/27/2015	remote realtime transcription	no
5 Jon	2/5/2015	Skype with audio recording and post-hoc transcription	yes
6 Lynn	2/11/2015	text chat	yes
6 Jon	2/12/2015	remote realtime transcription	yes

Table 3.2 lists the interviews in the order they were conducted, along with their modality for communication and transcription (in-person lipreading, realtime captioning, text chat, etc.) as well

as their open-licensing status (for future researchers wondering what data is available to them to use). Interviews are denoted by interview number and then narrator name. The number indicates where the interview falls in that narrator's interview sequence; for instance, "1 Jon" refers to Jon's first interview, whereas "3 Alan" refers to Alan's 3rd interview.

3.2.7 Transcription conventions used in this document

The full data corpus of interview transcripts is stored in flat text files for ease of parsing and conversion to other formats. All transcripts are of individual interviews. Interview transcript file names are denoted by interview number and then narrator name, as in the table from the preceding section. Different narrators progressed through the interview sequence at different rates and times, so numbering is sequential within-narrator, but not necessarily across narrators. For example, Rob started the interview process before Alan, and was interviewed twice before Alan's first interview.

Transcription notation conventions were designed to be as familiar as possible to users of the APA citation format, and have already been used throughout this document when data excerpts are directly quoted or indirectly referenced. Within transcripts, and in quotations used in this document, narrators (including myself as an interviewer) are identified by preferred first name (ex: Gary, Lynn, Mel). Generally speaking, the transcript number will also be included as the source of the quote or paraphrase. Similar to APA citation format, this may happen inline (ex: "In his second interview, Gary said that...") or in parentheses at the end of the quote or paraphrase (ex: "She described herself as a computer scientist (1 Lynn).").

Short excerpts: Direct quotations

Direct quotations also generally include a reference to the specific transcript and line numbers they are from, in order to enhance methodological traceability. In these cases, transcript line numbers are referenced like page numbers in APA citation format. For example, (1 Mark, 24-30) or (Mark 1, 24-30) both refer to lines 24-30 from Mark's 1st interview transcript, and (24-30) at the end of an excerpt would refer to lines 24-30 of whatever transcript was being referenced. If an excerpt comes from multiple lines in a transcript, the list of line ranges are comma-separated.

For example, (Mark 1, 24-30, 40-42) refers to lines 24-30 and 40-42 in Mark's 1st interview transcript.

Long excerpts: Theatrical conventions

For longer excerpts involving multiple speakers, these conventions are sometimes combined with blockquotes in the style of a theatrical script. For example, the excerpt below, featuring both Gary and Mel speaking, is taken from lines 4-6 of Gary's 1st interview.

GARY: My name is Gary Mahoney.

MEL: And how long have you been at Berea?

GARY: I'm a graduate and came back for teaching in 1989.

(1 Gary, 4-6)

3.3 Handling the data: Making the ontologies

Having described “making the data,” I now turn to “handling the data.” I focus on the production of the four ontologies featured in Chapters 4-7. Described as theoretical framings in Chapter 2, these ontologies emerge from my engagement with the data corpus. The four subsections that follow narrate a postmodern qualitative approach that emphasizes emergent methodology. In section 3.3.1, I explain what this looks like as “thinking with theory” and using “theory as methodology,” giving concrete examples of what four postmodern theories look like in the form of methodological tools. In the second section, I explain the “seed method” approach and how I used character tracing as a method-to-break. In the third section, I show how tracing characters began to point out places where character tracing became difficult or impossible. In the final section, I discuss how these breakdowns in method led to methodological generativity, the identification of ontological components, and the crystallization of the ontological taxonomy presented here.

3.3.1 Postmodern theory as methodology: Four tools to think with

The “theory as methodology” approach involves “plugging in” theories to data without a pre-set series of research method steps to execute. As introduced by Jackson and Mazzei (2012), this kind of “plugging in” focuses on allowing theories to shape one’s habits of mind as a reader of data, then letting method emerge during the process. In doing so, I work against the expectations

of pre-defined research methods for a study, which limits the kinds of studies that scholars can "legitimately" carry out. By questioning the idea of established methods, postmodern methodology points out "the limits of our received practices" while simultaneously acknowledging that this "does not mean that we reject such practices; instead, we work the limits (and limitations) of such practices" (Jackson & Mazzei, 2012, p. ix). The goal of highlighting complexity and tensions is not to "get over them" in order to move on to a clean answer, but precisely to not "get over it" and to stay within the liminal space as an intellectual exercise.

I contextualize this approach against historical developments in research methodology. Methods from the interpretivist paradigm introduced the notion of emergent research results as a contrast to (post)positivist assumptions of pre-defined result formats. However, they continued to use pre-defined methods, such as grounded theory, to generate these emergent results. Postmodern methodology takes this one step further, exploring emergent methods for generating emergent results. A comparison of methodological paradigms is given in the table below.

Table 3.3. Emergent methods and results in methodological paradigms

Methodological paradigm	Nature of method	Nature of result format
(Post)positivist	pre-defined	pre-defined
Interpretivist	pre-defined	emergent
Postmodern	emergent	emergent

In order to illustrate what "theory as methodology" looks like and make it more accessible for others to join me in it, I created a set of four "tools to think with" from some of the postmodern theories discussed in 2.1.2.3. These methodological tools and operations were used throughout the project. In order, the theories that I "methodologized" were metanarratives, deconstruction, slippage, and writerly approaches, described below.

Metanarrative as method: When you spot a metanarrative, interrogate it

Utilizing metanarrative as method involves sensitizing oneself to "totalizing narratives" (Lyotard, 1984, p. xxiv). When you see something claimed to be truth or a story told as if it were the only one to be told, start hunting for indications of different truths and stories that contradict it. This is not in an attempt to prove the first metanarrative "wrong" and the different story "right," or even an attempt to find a larger encompassing of both stories as "right." Rather, the aim is to

highlight and interrogate assumptions about finding “truth” or being “right.” This technique is about making-visible the acceptance of metanarratives and building the habit of questioning those metanarratives to see what sorts of complexities they may be rendering invisible.

For example, Mark tells the story of TAD previously having been scattered due to high turnover, but that now they are coming together into a cohesive unit (Mark 1, 21-34). However, this story isn’t as simple as it seems. Where might one find indications that TAD faculty had been unified before and/or scattered now? The objective in these searches and proliferations is not to find “the truth” or to create a larger, all-encompassing metanarrative that includes all these stories, but to hold multiple conflicting truths in tension at the same time.

Deconstruction as method: When you spot a categorization, proliferate it

Lather (1991) simplifies deconstruction into a three-step method, worth quoting in full:

While impossible to freeze conceptually, deconstruction can be broken down into three steps: 1) identify the binaries, the oppositions that structure an argument; 2) reverse/displace the dependent term from its negative position to a place that locates it as the very condition of the positive term; and 3) create a more fluid and less coercive conceptual organization of terms which transcends a binary logic by simultaneously being both and neither of the binary terms. (p. 13)

Utilizing deconstruction as method involves troubling the boundaries between categories, especially binaries. This includes, for examples, finding cases that smear across those categories and refuse to simply fit one or the other. It also includes proliferating categorizations until there are so many categories that it becomes impossible to simply place them in opposition.

For example, Lynn, Mark, and Rob all debate the question of whether students can contribute usefully to curricular design. A binary framing would be to say that either students (1) can contribute or (2) cannot contribute; these two perspectives (that they can, and that they cannot) can be placed against each other in debate. A categorizing framing would be to say that some students, at some times, can contribute – and then proceed in trying to delineate and define which students contribute in which ways under what circumstances. Deconstruction walks deeper into tension by asking where in the narratives we see professors describing students being simultaneously helpful and not-helpful towards curricular design; this calls into question whether “helpful” and “not-helpful” are the only ways to look at it.

Both the binary and categorizing approaches presuppose an aim of finding or creating clean separations for convenience. Separating components at least partially relieves complexity and tension, which can be both useful and limiting with regards to thinking and communication. In contrast, the postmodern/deconstructive approach ruptures these boundaries and challenges the reader to constantly unmake and remake different ones, like snapping a glow-stick tumbles separate chemical compartments together to create illumination. In a similar way, rupturing theoretical boundaries illuminates prospective explorations into deeper complexity.

Slippage as method: When you see signs, trace the slippages of their signifiers and signifieds

Utilizing slippage as method involves sensitizing oneself to multiple possibilities for meaning. In the context of text narrative transcripts, signs most often mean words and phrases, and signifiers most often mean the meanings and definitions of those words and phrases. Signs are given meaning by their repeated use in different contexts (Saussure, 1916) and therefore from the differences and variants and contradictions that pop up in those contexts. When a term occurs repeatedly and there seems to be a tension in the definition, resist following the impulse to remove the tension by chopping the term into sub-variants and pinning fixed meanings to them. Instead, pursue the differences that cause that tension as a way to gain and portray a richer appreciation for the term and how it shifts and moves in time and space.

For example, all the narrators give different definitions of the word “design.” Some give different answers that are more or less aligned with each other. Some attempt to specify different sub-variants of design (a form of categorization, which can also be challenged via the technique of category proliferation outlined in 3B.3b). How can we find these differences, attempt to proliferate and extend them, and present them as a partial picture of the constantly shifting dance of negotiating meaning and communication?

Tracing signifiers and signifieds does three things. First, it frames faculty as narrators who use the semiotic conventions of their culture to put together language that simultaneously assembles them (Parker, 2004, p. 90) as they weave their personal meaning-making into the narrative accrual. Secondly, tracing the signs and signifiers narrators use to refer to themselves – often pronouns – highlights their portrayals of themselves as characters situated within the culture of their communities of practice. This subsequently makes-visible narrators’ portrayals of the cultures of their communities. Finally, it helps portray the narrators’ – and by extension, our own

– narrative construction of reality as intersubjective and constantly in question, cutting identities loose for exploration and revision. Since faculty are iterating between telling and reading each other’s narratives of shared experiences, they appear frequently as characters within each other’s stories and reshape those characterizations as they go. “Wait, that’s how she sees me? Wait, that’s how he sees her? Let me rethink the way I see us all again.”

Writerly approach as method: Approach methods as explicitly emergent

Utilizing the theoretical notion of “writerly texts” as method involves sensitizing oneself to techniques such as banality and narrative seduction that might disguise opportunities for co-authorship (Lather, 1991, p. 10; Bruner, 1991, p. 9-10). A postmodern analyst seeks a writerly attitude towards the world at large. Nothing is sacred truth that must remain untouched. All analysis is destructive in some way; the best one can do is to leave traces of the violence done so that others can trace their own understandings of it. Since understanding between persons is a hermeneutical process, precise retracing and recovering identical understandings is impossible. One implication of this is that adherence to a specified method is no longer an ideal. In other words, postmodern methodology does only generate theories, it generates methods and methodologies – processes for doing things along with the hows and whys that underpin them.

One example of this in the data corpus can be found in Rob’s 6th interview transcript. Unlike the other transcripts, it is not the direct transcription of the audio recording; without my knowledge, the recording setup failed partway through the interview. (I normally bring multiple physical recorders to an in-person interview, but since I was conducting this interview via Skype, I only used a single piece of software to record the call.) I discovered the mistake at the end of the call. After a few minutes of panic, I sat down and immediately reconstructed the dialogue between “Rob” (“Remembered Rob”) and “Mel” (“Remembered Mel”) as best I could, with commentary from my present self (“Narrator Mel”) filling in the gaps and pointing out places where I wasn’t sure. I sent the reconstructed transcript to Rob, who edited “Remembered Rob” and added commentary from “Narrator Rob” on the reconstruction process.

This was not my intended interview method. I could have framed it as an error that resulted in a “less true” transcript. However, the resultant transcript got both Rob and myself to reflect in intriguing ways about his stories, our relationship to them and each other, and the assumptions we tend to make about transcripts and the “truth” of research. We had inadvertently stumbled our way

into creating a methodological variant, and I used that to investigate further. Instead of discarding this data as wrong or broken because it “broke protocol,” I included it as part of the intriguing and complex mess that happens in the research process.

A writerly attitude towards texts is a natural outgrowth of an epistemological viewpoint wherein “individuals cannot divorce themselves from being within the universe itself,” as Michael Weinstein said. “It is impossible to be an external observer. Engaging the world is no longer by Cartesian observation, but by active engagement” (Barad, 2015, Preface, p. 31). Engaging the world, including in unintended and unpredictable ways, is not an error to be minimized, but an art to be explored. Instead of presenting themselves as somehow distinct or objectively separated from the process and data, researchers explicitly present themselves as inextricably meshed within it and heavily affecting it.

3.3.2 The “seed method” as a prototype to break: Tracing characters and play settings

I initially began “plugging in” postmodern theories – that is, utilizing the four postmodern “tools to think with” – to the dataset in the context of a promiscuous method (Childers, Daza, & Rhee, 2015) that I call a “seed method.” The notion of a seed method is another postmodern methodological contribution I developed for this project, and fits in with the postmodern emphasis on disrupting and revealing cracks in existing ways of thinking and being. A seed method is a research method whose main function *is to break*. Success, for a seed method, looks like the success of a fuse in an electronics circuit or a canary in a coalmine. In other words, through showing its own points of failure, it points towards areas for further investigation. This section describes the seed method for the project.

The “seed method” for this project was the process of character tracing. Character tracing involves taking each transcript and tracing the voice in which the narrative was being told and who it was being told about, two separate analytical procedures drawn from a 2008 Doucet and Mauthner study. Tracing voice consists of attending to the narrator and “how this person speaks about her/himself... [we use] a coloured pencil to trace the ‘I’ in the interview transcripts. This process centres our attention on the active ‘I’ who is telling the story... It also identifies those places where the respondent shifts between ‘I’, ‘we’, ‘you’ or ‘it’, which can signal varied meanings in the respondent’s perceptions of self” (p. 405-406).

For example, in the fictionalized public transcript excerpt given below, we hear the narrator shift from a present-tense singular pronoun (“I don’t know”) to externally describing a hypothetical alternate-universe self (“if I would have necessarily gone...”) to speaking with the voice of that hypothetical alternate-universe self (“This is what I will do this week.”) to the sudden use of a plural pronoun (“we didn’t really have the resources.”)

NARRATOR: I don't know if there was a big book of like, “this is how to teach the class.” If I would have necessarily gone ah, you know, here is the recipe. This is what I will do this week. This is what I will do next week to kind of see the big story so that I could confidently do it... we didn't really have the resources.

Tracing characters is an initial stage of using the “slippage as method” tool. In this case, the characters are the signifieds being pointed-to, and their names and pronouns are among the signifiers that narrators use to point to them. By tracing characters, I am performing a “reading for social networks... and close and intimate relations” (p. 406). The character-tracing process can be thought of as attempts to answer the following question: If this were a theatre monologue from a full play, what would the “cast of characters” on the playbill read? Using another fictionalized public transcript excerpt for illustration, we might see one character as an unnamed “Prior Professor” who taught the class last year then suddenly and unexpectedly was unable to teach it at the start of term.

NARRATOR: So it's been an interesting story in terms of not having a fair amount of information about what was done in the past, and not knowing why he chose the things that he chose to read, and not really seeing the pattern and not really even seeing a, you know, a set of questions that he might have had in his mind. It was just wide open. You know, the downside of that is I didn't really feel comfortable just saying I will do exactly what he did because I don't know exactly what he did. [Laughter] ...then the old TAs (teaching assistants) started getting e-mails [from me] about can you tell me how he used time in class...

The presumed outcome of the “seed method,” if executed as described, would be a cast of characters with short descriptions – in this case, given that “Prior Professor” is a character in the narrative, what can one say about him based on this narrative excerpt about his abrupt departure? I could say that he has left a reading list (“the things he chose to read”) behind, but no explanation for the logic behind their design (“not knowing why he chose the things that he chose”). Since the narrator is emailing Prior Professor’s teaching assistants (“the old TAs started getting e-mails about can you tell me how he used time in class”), I might hypothesize Prior Professor can no

longer be contacted. Further mentions of Prior Professor would contribute to fleshing out his character sketch, and Prior Professor would become an example of one portrayal of a faculty role. Other characters from this narrative could also be fleshed out in this manner. For example, the TAs could be taken as another character (or group of characters) in the story, with a character sketch of their own. Character sketches intertwine as they are written; the TAs used to work for Prior Professor, the narrator is taking over a teaching responsibility from Prior Professor, the narrator is trying to contact the TAs, and so forth. These relationships between characters could then be connected to faculty roles in order to define them – for instance, the nature of the faculty role includes relating to TA characters in particular ways, to other faculty in particular ways, and so forth.

Again, this analytical procedure was intended as a starting point for modification, the same way a curriculum is intended as a starting point before the students arrive and the semester begins. However, to use one narrator's evocative phrase, once the "rubber meets the road," all bets are off. Postmodern analysis does not expect to be able to use the same tool throughout all the data in order to create predictions, understanding, or liberation. Instead, it is paying particular attention to how analytical tools can break... and break they did.

3.3.3 From character tracing to clusters

Having explained the "seed method," I now turn to explaining how it broke. In this case, the salient "cracks" appeared in my attempts to use character tracing to delineate faculty roles. As I began to trace the characters in the narratives, I found that I could not cleanly do so. In other words, I could not create a "cast of characters" with character boundaries that would cleanly persist across all the narratives unless I constantly made subjective, inconsistent choices as to where to draw those boundaries.

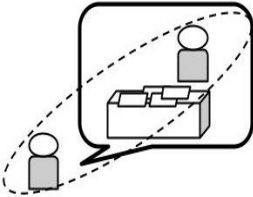
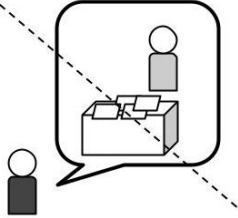
As this realization dawned, I began to resist the act of drawing clean boundaries around each character. Postmodern methodologies emphasize pointing to and troubling the act of boundary-drawing itself. Viewing this complex dataset through a postmodernist lens, my attention kept being drawn to the multiplicity of decisions I could make regarding how to draw boundaries around the narrating "selves" generating the transcript.

For instance, since the initial interview prompts asked narrators to tell stories about curricular designs they were involved with, they often told stories about their past selves. As a

concrete example, during Jon's first interview, he told a story about how he went home with a headache after his first day as an Olin faculty member after trying to synthesize many competing curricular ideas. Jon ended this story by saying that he did not get headaches from trying to do that anymore (Jon 1, 155-168).

I could choose to frame this story as if first-interview-Jon and first-day-at-Olin-Jon were part of the same character of the narrating self. I could also choose to frame the story as if first-interview-Jon was telling a story about first-day-at-Olin-Jon as a separate character. In effect, I was deciding whether to create one "Jon" character or two: Jon as the narrator in the interview's "present," and his younger version in the past.

Table 3.4 Two (of many) choices for framing character “selves”

	
<p>Jon telling a story about “himself” on the first day of being an Olin faculty member.</p>	<p>Jon telling a story about “the person he used to be” when he started as an Olin faculty member; this person is not who he is now.</p>
<p>One character spanning both past and present.</p>	<p>Two characters, one in the past and one in the present.</p>

Had I stopped there, I would have created a binary: either I could frame Jon as a single character, or I could frame Jon as two characters. Applying the postmodernist imperative to question binaries and proliferate them, I realized that I wasn't just deciding between portraying "Jon" as one character versus two. Instead, I was deciding between portraying "Jon" as one character, two characters, three characters, or more. As a few examples, there could be:

- Jon in the past (relative to the time of the narrating act) as a college student (in stories Jon told)
- Jon in the past (relative to the time of the narrating act) during his first day at Olin (in stories told by Jon, as well as in stories told by his Olin narrator colleagues Rob and Lynn)

- Jon in the past (relative to the time of the narrating act) teaching co-teaching "Stuff of History" with Rob (in stories told by Jon, as well as stories told by Rob)
- Jon in the present (relative to the time of the narrating act) during his interviews
- Jon in the future (relative to the time of the narrating act) when he speaks to future aspirations for what he hopes to do as a faculty member

This is obviously not an exhaustive list; it would be easy to generate dozens more from the narratives alone. Furthermore, the characters listed above (and others generated) can be separated and combined to create yet more possibilities for defining “Jons.” For example, any or all of these "Jon" variants might become part of a plural character called "the Olin faculty," or the "Jon in the present during his interviews" could be split into "Jon during his 1st interview," "Jon during his 2nd interview," "Jon in all his interviews preceding this one," and so forth.

The point of this list of “Jons” is to illustrate how attempting to trace the character of Jon quickly turned into the question of "what do we mean by the-character-of-Jon?" because of the postmodern technique of using boundaries as a flag that invites a proliferation of categories, another of the four “tools to think with.” The proliferation of categories is intended to call into question not only the specific boundaries (one-Jon-character vs. two-Jon-characters) that served as a flag, but, by extension, to call into question more general practices of creating bounded categories. In the context of this project's inquiry into faculty roles, it calls into question the ways we curate the boundaries around those roles.

Slippage around faculty roles was echoed by slippage in student roles as portrayed by the faculty, as well as in the boundaries of the curricula they were engaging in changing. Narrators spoke of courses in their curriculum evolving, changing, weaving into each other, being influenced by the courses they'd taken in their youth, spilling outside the classroom into things like office hours, transferring between faculty, and so on. At this point, the fractures in my "seed method" were numerous and visible; the next question was what to do with them.

3.3.4 From clusters to postmodern theories

Having described the slippage/breakage of the "seed method" of character tracing, I now turn to how this slippage led the formation of the four ontologies appearing in this project. The slipping roles – faculty, curriculum, and students – corresponded to Self, World, and Other respectively. This meant that slippage around faculty roles mapped to philosophical explorations

of the complex nature of the Self, and so forth. Furthermore, slippage in the separations of roles and the relationships between them mapped to the corresponding philosophical explorations. For instance, the boundaries and relationships between student/faculty roles mapped to explorations of the relationship between Self and Other.

These roles were implicit in my framing and assembling of the dataset as a narrative dataset. By definition, narratives always have "worlds" and "selves," and they often have "others" as well. Stories need to happen in some sort of space of existence, even if that existence is "imaginary." This space of existence is equivalent to the postmodern notion of a "world." Additionally, stories are told by some sort of narrator, in this case the faculty. This means that a narrating "self" is present in all narratives, whether the narrator explicitly portrays themselves as a character in the narrative or not. For this project's dataset, narrators were asked to tell autobiographical stories. In such stories, says Bruner, "the narrator and the central figure in the narrative are the same (1987, p. 693), and the characterization of the narrating "self" is explicit. Any characters appearing in the story who are not the narrator take the role of "other," in this case, students.

This process was a continuation of the approach of "theory as methodology." In questioning the boundaries of these three roles, I was moving towards questions about being and existence, such as:

- Narrators are (narrating Selves are) faculty members. What kind of thing is a faculty members?
- Narrators portray themselves in curricular environments that they are also parts of (Worlds). What kind of thing is a curriculum, and how does that sort of thing relate to the kind of thing that is a faculty member?
- Students are characters that are narrated, but not narrating (Others). What kind of thing is a student, and how does that sort of thing relate to the kind of thing that is a faculty member, and the kind of thing that is a curriculum?

Slippage and tensions occurred not only within faculty, curriculum, and student roles, but between them as well. The slippages reconfigured possibilities of these roles and their relations. Slippages often danced in the tensions between distinguishing and combining roles. Why would I assume, for instance, that curriculum was separate from faculty? Which narratives might challenge the distinctions between them?

Logically speaking, with a three-component/role ontology, there are 4 possible configurations for examining slippages between roles while still distinguishing at least 2 separate "components" so that their interactions can be described: all three roles separated, and each role on its own with the other two roles combined. Just as the legs of a geometric triangle mutually determine each other – each angle or side constrains aspects of the other angles and sides – the roles of faculty, curriculum, and students give meaning to each other through their relationships. For instance, students are the people faculty teach; faculty are the people who teach students.

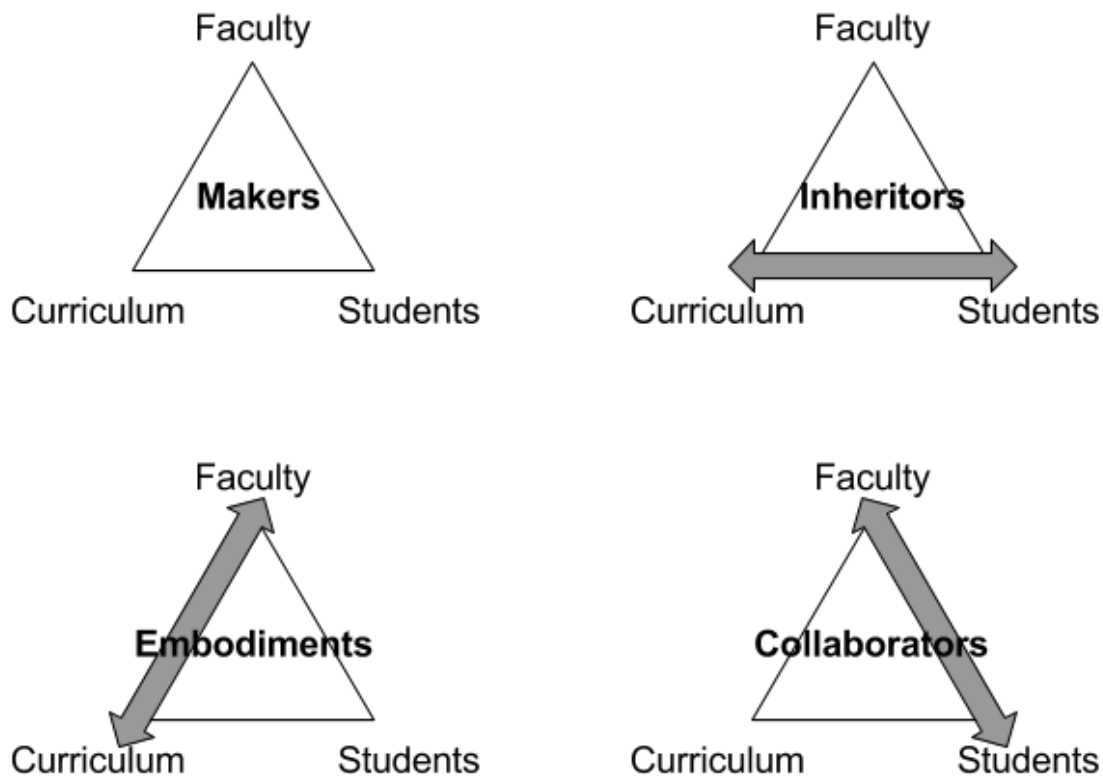


Figure 3.1. Four ontological configurations with the three roles

As I plugged in my emergent understandings of these four ontologies into the dataset, I began identifying stories that illustrated specific ontological role relations. Eventually, I gave the four ontologies evocative names based on how faculty roles showed up in the curricular change narratives that matched them: makers, inheritors, embodiments, and collaborators.

There are, of course, far many more possible roles such as administrators, parents, prospective employers, and so forth. However, these three components gave me one simple way,

out of many possible ways, to discuss the complexities of curricular change and some of the slippages I saw. Additionally, these ontologies do not represent a comprehensive taxonomy of curricular change ontologies; indeed, such a taxonomy would be infinite in size.

The four ontologies serve as tools to think with. The analysis chapters that employ the four ontologies (Chapters 4-7) are not there to prove that the ontologies come “from” the data or are “really in” the data. In fact, the ontologies could just as well have been a priori theories and categorizations. Rather, I made the ontologies with, within, and against the data in order to use them to make things visible within the data, and thus disrupt and challenge ways of thinking about the curricular change context the data is centered around.

3.4 Handling the data: Using the ontologies to create the analysis chapters

Having explained the formation of the four ontologies, I now turn to their usage in creating the analysis chapters (Chapters 4-7). Continuing the process of “plugging in” theory to data, I worked the ontologies and the data together in a process that I have split into four steps for clarity. Again, this narration is inevitably an oversimplification of the complexities of the research process.

The first step is to work within the narrative dataset to define a narrative for analysis. The second is to map the role/ontology equivalents of faculty/Self, curriculum/World, and student/Other within the world of that narrative. The third is to explore which ontology (or ontologies) might fit that narrative’s portrayals of faculty/Self, curriculum/World, and student/Other and their relationships. The fourth step looks for ways to challenge that ontological fit and to examine reasons why an ontology might be employed. There is no defined “final step.” After an initial run-through of all the steps in order, any step can be taken in any order until the set of narratives and their ontological mappings (or the set of ontologies and their narrative mappings) and the discussions therein have made-visible a sufficient mass of things to call an end to the process.

3.4.1 Step 1: Define a narrative for analysis

The first step in the process is to pull out a narrative from the dataset. Generally speaking, a narrative is an episode that could be told from a single narrator's point of view with a beginning, middle, and end. It might be contained within a single transcript, or span several transcripts.

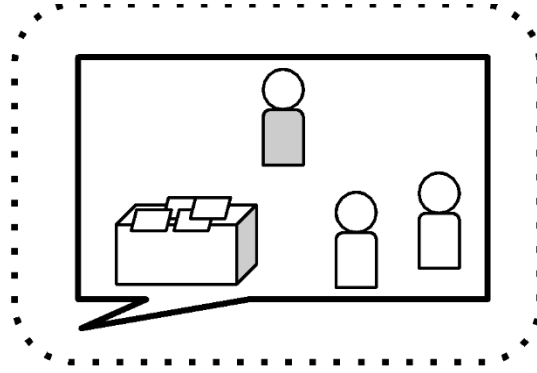


Figure 3.2. Defining the boundaries of a single narrative

The example I’ll be using in this walkthrough is Lynn’s narrative of her first time being a UOCD instructor. I could create many narrative variants of “Lynn’s first time instructing UOCD” by drawing on a variety of transcripts. However, enough material is contained in Lynn’s first interview transcript that I can craft a brief narrative from that transcript alone. Summarizing it might run something like this:

“[The founding Olin faculty] knew that [they]’d have integrated experiences in the first two... semesters [of the student experience], and that by the end of the fourth semester the shared foundation would be largely complete. Clearly this culminated with some sort of tie-it-together design experience.” They “need[ed] a design experience in the fourth semester,” but “[the] design prof [was] leaving,” and so a newly-hired professor was appointed to “save the day” and design the new curriculum at the last minute. Lynn and other faculty volunteered to help staff the studios, since there weren’t enough instructors to cover all the students – but they had no prior exposure to the course concepts and material. “Well, here we are,” they said to the students. “Er. Um... yes, we do know what we’re doing. Why do you ask?”

The UOCD studio instructors managed to survive a frantic semester. Afterwards, they “start[ed] talking about things like ‘generative thinking’” and using design terminology in their everyday conversations on campus. As they continued to teach subsequent rounds of UOCD, user-centered design concepts from the course began to grow more and more familiar. As Lynn put it, “We start figuring out what we did... We start to incorporate what we learned into how we think,” not only about the UOCD course, but about the Olin curriculum more broadly. (1 Lynn, 308-324)

Methodologically, starting by pulling out and shaping a narrative from the dataset illuminates several things. First, it highlights my inevitable authorial fingerprints as a researcher; there is no such thing as purely letting the data speak for itself (Jackson & Mazzei, 2012, viii). Which data to present and how to present it are choices I have made, albeit constrained by the

contents of the existing datasets. Second, this acknowledgement of researcher fingerprints ties in with the idea that this method does not search for an external, objective truth; my argument is not that that curricular change "is" a certain way. Rather, I am aiming for multiple sensemaking options via which the dynamics of curricular change may be understood. Another way of putting it is that the burden here is not one of proving one or more of the ontologies to be "correct," but to show that they can be useful in illuminating possibilities for exploring the phenomenon of curricular change.

3.4.2 Step 2: Identify Self/World/Other roles in the context of the narrative

The next step in the process is to identify the roles of faculty (as Self), curriculum (as World) and students (as Other). This identification takes place in the context of the presented world (Ruthrof, 1981), or the world of the specific curricular change narrative being told. In the walkthrough example, Lynn is the narrating faculty Self. She speaks for herself individually, but also occasionally speaks as part of a plural Self that includes the other first-time UOCD instructional faculty. The curricular World, in this case, is the early-stage creation and prototyping of the UOCD course.

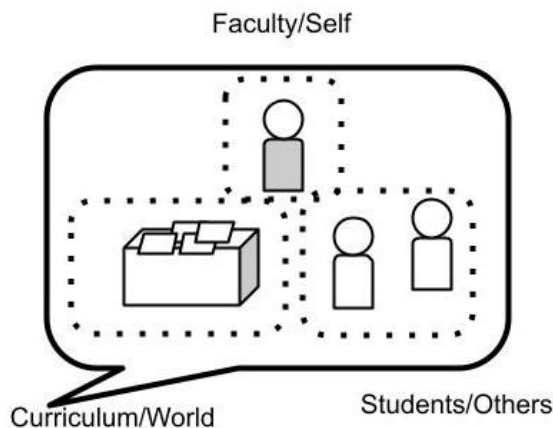


Figure 3.3. Identifying roles performed within the narrative

The presence of students as Others comes via direct address in Lynn’s narrative, which was largely told in the first person. At one point in her narration, Lynn voices (a caricatured version of) her past self in the classroom: “really, when we say we can’t tell you what to do, we’re not just

being snarky. And yes, we do know what we're doing. Why do you ask?" (1 Lynn, 317). Here, her past self is addressing a (similarly caricatured) audience of UOCD students from the first run of the course. A third-person reframing of the story, guessing at some implied details, might look like this: "The students asked why we faculty members couldn't tell them what to do, and wondered if we knew what we were doing. We responded that we weren't just being snarky, and that yes, we did know what we were doing."

The result of this step in the method is a mapping of Lynn and her colleagues to the narrating faculty Self, the first run of the UOCD course to the curricular World, and the students from that first class as Others in the narrative. Methodologically, this operation makes-visible the labeling and sectioning done in order to perceive and discuss realities, and highlights the active role of authors such as myself in the construction and articulation of the ontologies we both discuss and inhabit.

3.4.3 Step 3: Play with ontological identification

Having identified the three ontological components of faculty/Self, student/Other, and curriculum/World within the specific narrative, the next step is to identify the ontologies themselves. Doing so journeys beyond the presented world and into the presentational process, which attends to the world of the narrator (Ruthrof, 1981). Specifically, the exploration here is of *how* the narrator is articulating the roles and relationships of those components.

Since identification of the four ontologies in the taxonomy happened in parallel with early iterations of running through this process, earlier iterations of analysis leaned more towards playing with clusterings and portrayals of various ontological possibilities. Later rounds of analysis leaned more towards working the narrative's ontologies up against the four ontologies that had already been solidified, to see whether and how they illustrated, shifted, or illuminated the ontological taxonomy. This is similar to the constant comparative process from grounded theory, where researchers develop themes inductively and constantly compare new incoming data with their prior analysis of existing data.

In the walkthrough example, Lynn's narration of the first round of UOCD can be cast into the "faculty as heirs" ontology. Lynn portrays herself and her fellow studio instructors as new to the material they are teaching, learning the course content themselves while they attempt to guide students through learning it. After the course is over, the faculty realize how much they have

learned, and how they can apply the course's ideas of user-centered design to other projects they are involved with. This fits the "faculty as heirs" pattern that portrays faculty as learners who engage in learning experiences and contexts that they did not originally create (in this case, an unfamiliar curriculum created by their lead instructor).

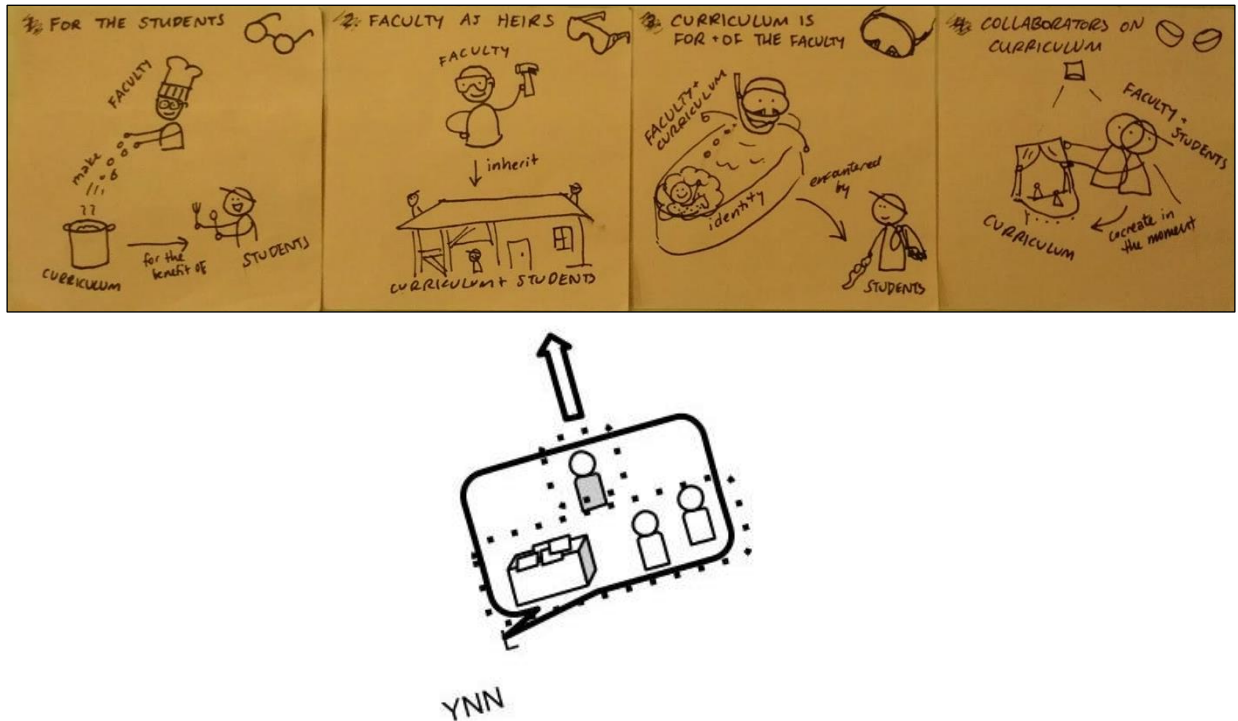


Figure 3.4. Identify one or more ontologies matching the narrative

The "faculty as heirs" ontology combines the student/Other and curriculum/World components, which also fits Lynn's narration. She and the other faculty learned the course content in the context of teaching it to students. The students, and how to teach them this particular course, become part of the global learning environment that the faculty are learning within.

From a methodological perspective, visibly working and modifying ontologies further points out the non-objective, non-external, and plural nature of ontologies. In matching a narrative with one or more ontologies, I often found that each illuminates the other. Narratives provide concrete embodiments for an ontology and illustrate concrete variants of how its philosophical constructs can manifest in the curricular change context. For instance, Lynn's UOCD narrative provides an example of the sorts of curricular experiences faculty might inherit and learn within. Simultaneously, ontologies can provide ways to make-sense of the complexities of a narrative,

such as the "for the students" ontology's combination of student/Other and curriculum/World suggests a way to explore how the faculty engaged the relationship between the UOCD curriculum and the students enrolled in its first run.

3.4.4 Step 4: Examine affordances and alternatives

The next step in the process is to engage in questioning and proliferation. Why might the narrative have been told this way, and who else might have told it this way? Are there any other ways this narrative might have been framed, especially ways that seem to contradict existing framings?

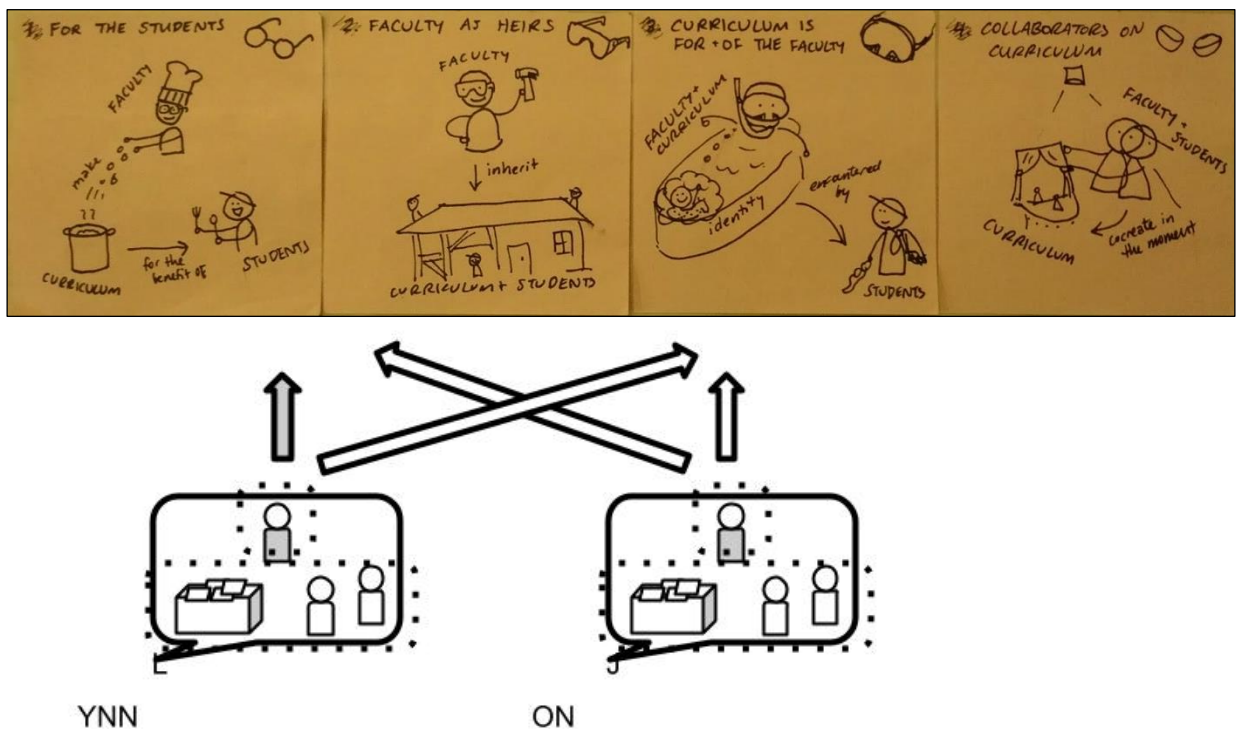


Figure 3.5. Identify ontological alternatives

To give a few (non-exhaustive) examples using Lynn's UOCD narrative, the "faculty as heirs" ontology I matched with it also matches portions of Jon's telling of his own first-time UOCD instructor experience. For instance, Jon describes his experience of watching the lead instructors lecture for the course he was assigned to co-teach:

"I attended the lectures as an instructor, right, but I was really just another student, because I would listen to Chris Heape talk and I would be just as confused as most of the students in the class... it would take me forever to figure out what in the world is he saying, I don't understand his words, I don't know any of this jargon, I don't know what he's expressing." (2 Jon, 111)

Jon's narrative here also matches the "faculty as heirs" ontology. Like Lynn, he narrates himself as a faculty member learning by encountering unfamiliar topics in an unfamiliar environment that includes the students they are teaching. However, Jon's telling of being "just another student" also indicates another possible ontology that blurs the roles of students and faculty together, or the "collaborators on curriculum" ontology. I can now examine whether this ontology would work for Lynn's narrative as well. For instance, I could say that a faculty encountering an unfamiliar curriculum by teaching it, Jon and Lynn were not only learning from their students, they were also learning alongside their students in a role that was not wholly unlike the students' experiences themselves.

I have now explored at least two ontological options for Lynn's UOCD narrative; I could explore more, but will pause here for now with just the "faculty as heirs" and "collaborators on curriculum" ontologies. Why might Lynn (or Jon) choose to use either of these ontologies? What does each ontology afford, and how might those affordances benefit the narrator?

Some possible answers are that the "faculty as heirs" ontology and narrative pattern allows Lynn to explain the initial unfamiliarity and chaos as a positive opportunity for learning, rather than a negative failure to fulfill an expert role from the start. Similarly, the "collaborators on curriculum" ontology and narrative pattern allows faculty to use insights they have about student learning to illuminate their own learning, and vice versa. Areas of confusion for faculty translate into a sensitization towards possible challenges for students, allowing faculty to better prepare to teach them. Again, these are not necessarily the specific reasons Lynn (or Jon) had in mind while narrating; we cannot know what they were thinking, only what they said. Rather, these are ways of making sense of the possible tradeoffs linked to different ontological and narrative choices, presented as ways of exploring multiple possible ways of conceptualizing and narrating curricular change.

Methodologically, this sort of operation highlights narration as an intentional act of communicative presentation. Narrators are constantly revising and performing their narratives to have particular effects on their audiences and themselves, and presenting someone else's narrative

(as I present Lynn's here) is also to re-author and represent (re-present, or "to present again") it through my own interpretations. It also illustrates not only ontology as methodology, but ontological proliferation as a methodology. Tensions and contradictions between ontologies coexisting within the same narrative are seen as interesting and generative spaces for further exploration, not as errors that need to be resolved.

3.4.5 Step 5 and onwards: repeat and continue

I have presented the steps of the method sequentially, but they can be revisited and explored in any order from here on out. For instance, at this point I could go back to Step 1 and pull out another narrative; I could go to Step 2 and cast or re-cast the ontological components either on this narrative or new one, I could go to Step 3 and explore other ontologies that might fit the narrative, and I could stay in Step 4 and search for other complementary or contradictory narrations.

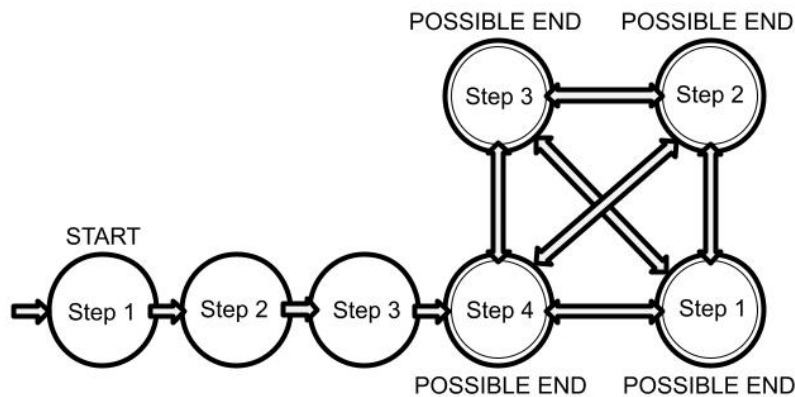


Figure 3.6. Allowable sequences of steps

These steps are more like possible chord transitions in a musical improvisation than a set sequence in sheet music that must be repeated in a certain order. After visiting steps 1-4 in order the first time to build a starting seed for analysis, exploration can continue with any of the steps in any order from that point onwards. In this way, my method is a rhizomatic one, meaning that it follows a nondeterministic and non-hierarchical order, with multiple possible start, end, and intermediary points within the exploration of data and analysis (Deleuze & Guattari, 1987).

The above examples were only a brief demonstration of a method that could be theoretically infinitely extended. There are many more narratives and ontologies that could be explored even only using Lynn's brief UOCD narrative as a starting point. The four analysis chapters following this one (Chapters 4-8) are presentations of these sorts of explorations, focused on one ontology at a time, and extended through more narratives from the narrative data corpus.

3.5 Postmodern methodological validity

In this last part of the chapter, I look at the validity of this project from the vantage point of postmodern paradigms. In her paper on paradigm proliferation, pioneering postmodern qualitative researcher Patti Lather described validity as “more than a technical issue solved via correct procedures,” critiquing approaches that try to establish a “recipe for establishing legitimacy” (2006, p. 52). Instead of “proving” that my project was postmodern, I will instead discuss how I remained true to my postmodern commitments throughout.

I discuss this by first going through how my work interacts with each of Lather’s four guidelines for post-qualitative (postmodern qualitative) validity: triangulation, construct validity, face validity, and catalytic validity (1986). While none of them are unique to postmodernism as considerations of validity, each is something to be considered in a discussion of postmodern qualitative validity. After touching on each of Lather’s guidelines, I return to my four explanations of postmodernism in Chapter 2 to highlight how each one showed up in the project’s execution.

3.5.1 Triangulation

Lather described triangulation as the use of more than one data source, method, and/or theoretical schema (1986). This description would be recognizable by most if not all of the other research approaches in Lather’s own later comparison of multiple research paradigms (Lather, 2006). A straightforward response to the triangulation guideline includes noting that I sourced my data from interviews with six faculty narrators across two institutions. Additionally, although this was not part of my formal dataset, my process was informed by personal knowledge and prior conversations from having known and worked with each of the narrators at their home institutions, as elaborated upon earlier in this chapter. Finally, I used multiple “theories as methodologies”

(Jackson & Mazzei, 2012) by operationalizing postmodern theories into methods (earlier in this chapter) and using them throughout the study.

3.5.2 Face validity

Lather (1986) describes a postmodern take on face validity as being about whether study participants consider the study's analysis to be valid. This concept is not unique to postmodernism. Sullivan (2009) describes this sort of intersubjectivity and participant/researcher dynamic as a general commonality between postmodernist paradigms and qualitative research approaches more generally.

I built aspects of face validity into my research design. Part of my interview method involved bringing my ongoing analysis, including interim results, to narrators for critique. Additionally, I did some of the analysis alongside the narrators themselves during their interviews. Since all but the initial interview prompts for each narrator were comprised of transcript excerpts from previous interviews, narrators were looking at data alongside me, serving as both participants and co-analysts within the project. I cannot know for sure whether participants would consider the entirety of my final analysis valid, and no participant had time to read the full 300+ page document before my defense. However, I was working at Olin at the time of my defense, so the three Olin narrators were all able to see a summary of the four ontologies presented in this final draft, and commented that the ontologies seemed accurate and that the insight that these ontologies could both conflict and be compatible was valuable. I was not able to reach the Berea narrators before defending.

3.5.3 Construct validity

Lather (1986) conceptualizes construct validity as a systemized reflexivity regarding the theories we operate within, our preconceptions about them, and how we critique and transform them in response to our actual data. Again, reflexivity is not a value unique to postmodernism as a research paradigm. Actions common across multiple research paradigms assisted me in maintaining an ongoing reflexivity. For instance, I discussed my data and process with research colleagues along the way, including conversing with scholars from very different disciplines that

forced me to constantly reexamine and re-explain disciplinary perspectives and norms I had taken for granted. Responses from my narrators also shaped my ongoing theorizing, such as when their reactions made me reconsider assumptions I'd made about what was important, or their use of unfamiliar terms pointed me towards further readings.

Cross-linguistic influences were another strong driver of reflexivity in my work. Many of the terms I used do not yet have conceptually and linguistically accurate American Sign Language (ASL) signs, which I have explored elsewhere as both a challenge and an opportunity for signing researchers (Chua et al., 2019). Since fingerspelling out each word/phrase in English would be cumbersome (and a use of manually coded English instead of ASL), any discussion of the project with other signing researchers required parallel discussions scrutinizing what specific theoretical words meant so that we could come up with conceptually accurate signed shorthands amongst ourselves. These acts of translation forced me to constantly revisit how my theorizing was expressed in either language, whether it was about what visual/spatial relationship most accurately reflected my actual (text-based) data or about what English words most accurately reflected the theoretical insights I first found in ASL. Some examples of these are given in Appendix B.

3.5.4 Catalytic validity: transforming reality

Lather's fourth and final guideline is catalytic validity, or the extent to which the project "reorients, focuses, and energizes participants toward knowing reality in order to transform it" (1986, p. 67). While it is logistically impossible to follow up on every possible ripple effect of a project, there was evidence in the data that catalytic validity was present. Most were small and subtle, such as narrators being reminded of forgotten details in their own narratives when they read the narratives of others. The two examples I give below are clearer and easier to spot.

The first example illustrates something that was learned about a relationship that subsequently opened up an opportunity to transform it. At one point in her 3rd interview, Lynn was reading Jon's responses to her statements and realized "...Jon has no idea of when I am being sarcastic. [I] wonder whether this is a fundamental misunderstanding in how Jon and I have been relating for the last decade or so... and I think that this is actually very important outside the context of your dissertation... Seeing Jon's read of my text, I am wondering how often I intend things one way and Jon hears them another. In life, not just in this project" (Lynn 3, 133-147). This realization went on to open up a dialogue between Lynn and Jon outside the context of the project.

The second example has to do with self-knowledge and awareness of identity. During his 6th interview, Rob described the effect of his participation on his understanding of not only his colleagues, but himself.

Having those conversations of, “I thought I knew you, but now I really know you.” That’s how you really get to know your colleagues. And then maybe this is a smaller discussion that happens off to the side, but there’s also “I thought I knew me, but now I really know me.” It isn’t until you have to articulate to an outsider what you do that you solidify your own identity and go “Oh, wait. I actually believe that.” Having to explain things to other people helps me to say “Oh! Look, this is me.” (Rob 6, 192)

Rob’s statement of “I thought I knew me, but now I really know me” expresses what I might call the opportunity to “appear other to oneself anew” (Lather, 2008). Hearing others’ viewpoints on a topic can be a powerful thing; when that topic is *you*, it becomes a powerful catalyst for self-knowledge.

3.5.5 Staying true to my four explanations of postmodernism

In my second chapter, I explained postmodernism in four different ways: as a response to modernity, as deconstruction, as slippage, and as incredulity towards metanarratives. With regards to my first explanation, postmodernism positions itself relative to modernity’s scientifically-driven quest for progress, knowledge, and betterment (Tierney, 1993, pp. 11–15). In conducting this study, my central research question and methodological approaches were not about the best or most optimal ontology for faculty roles in curricular change, but about questioning our understandings of faculty roles themselves. This focus on understanding things differently is not unique to postmodern paradigms, but is in keeping with them. While the results of my study could be used to enact someone else’s ideas of progress, such an enactment would take place outside the bounds of this project.

I operationalized the latter three explanations (deconstruction, slippage, and incredulity towards metanarratives) as methods earlier in this chapter and used them throughout the project, often in combination. For instance, a portion of appendix B discusses how I employed incredulity towards metanarratives (Lyotard, 1984) to spot the potential metanarrative of curriculum (and curricular change) being “for the students,” then a deconstructive technique of proliferating alternatives rather than just finding a single new answer.

3.5.6 Limitations

All projects and method/ologies have their limits, and this one is no exception. This project took place at specific sites (2 colleges) and with specific people (the 6 faculty narrators and myself) during a specific time; it cannot be replicated, only retraced. As such, the results may not be generalizable to other narrators, times, places, curricular change efforts, and so forth.

While I conducted nearly all the interviews remotely, I had uneven access to participants and sites during the course of writing up the project, and they had uneven access to me. Specifically, I was working at Olin as a research fellow on an unrelated project, meaning that I had more access to the Olin narrators than the Berea ones while finalizing my analysis - in fact, Lynn (one of the Olin narrators) was my direct supervisor during that time. In practice, everyone's busy schedules meant that this proximity only led to a few conversations with the Olin narrators about the final ontologies presented here. However, those are conversations I did not similarly get to have with the Berea narrators.

Being "neutral/unbiased" or "objective" were not goals for this project. In fact, I have drawn most of this discussion on validity from Patti Lather's paper on "openly ideological research" (1986). Instead of neutrality and objectivity, I have tried to be up-front about my own relationships and positionalities with respect to the narrators and the curricular changes they worked on, as detailed earlier.

The Q3 framework, or "Questions of Quality in Interpretative (Qualitative) Research," is a five-part (later, six) typology of validation based on engineering quality management (Walther, Sochacka, and Kellam, 2013). In this section, I discuss the quality of the data corpus with respect to the six elements in the current version of the typology: theoretical, procedural, communicative, pragmatic, and ethical validation, as well as process reliability.

INTERTEXTS: INTRODUCING THE ANALYTICAL/ONTOLOGICAL CHAPTERS

The four chapters that follow (Chapters 4-7) are my answers to this project's research question: *In what ways might we make sense of faculty roles in their narrative ontologies of curricular change?*

This segment of three intertexts serves as a place to pause and step back before launching into the analytical/ontological chapters that serve as four different answers to that research question. Much of this material should feel familiar to those reading the document in chapter order. This intertext revisits several topics already covered in Chapters 2 and 3, which provide more expanded theoretical and methodological explanations, respectively.

In the first intertext, I contextualize the roles and relationships of the four analytical/ontological chapters (Chapters 4-7). In the second intertext, I then give a map for navigating those chapters; although they each cover a different ontology, the underlying structure of each chapter is the same. In the third and final intertext, I shift modalities to a visual format that affords a wide variety of interpretations. This final intertext section presents one-page graphical/comic abstracts for each of Chapters 4-7, in order, and is the last thing readers will encounter before diving into the chapters themselves. These comic abstracts serve a dual purpose: they give readers a preview of the four ontologies as background context before moving to focus on one at a time, and they encourage readers to shift into a whimsical, playful mode of encountering the work that follows.

Intertext 1: **Introducing the ontologies and their relationships: same components, different arrangements**

The four chapters that follow (Chapters 4-7) answer this project's research question not with a single answer, but with a postmodern proliferation of answers that echoes the multiplicity of voices and perspectives present in the discourse of engineering education researchers and practitioners. These answers come in the forms of four ontologies and analyses of the roles within them. Each of these analytical/ontological chapters presents one of four ways in which we might make sense of faculty roles (in their narrative ontologies of curricular change). Each of the ontologies described below will later be put to work on the narrative data in Chapters 4-7; in the

process, they will show the kinds of things each ontology makes-visible and provides a structure for making-sense of the world.

These four ways of making-sense do not constitute an exhaustive list. Rather, they are a generative starting point illustrating some of the infinitely many ways of making-sense there might be. Each ontology is embodied in multiple curricular change narratives within this project's dataset, told by multiple narrators about multiple courses. They also correspond to ontologies underlying narratives outside the dataset, both within engineering education and outside of it in related fields. This first intertext gives an overview of the four ontologies and their relationships. I first name the four ontologies and show how they span a space covering different combinations of the three roles discussed in chapter 2: faculty, students, and curriculum. I then give a brief overview of each the four ontologies in preparation for the four later chapters that make up the bulk of this work, summarizing the combination of components in each and briefly discussing where it fits in the context of curricular change.

Intertext 1.1 How the four ontologies span different combinations of the three roles

Each analytical/ontological chapter focuses on a single way of making sense of faculty roles. I call them analytical/ontological chapters rather than “results” chapters because each of them comes from a different ontology of curricular change and analyzes faculty roles from within that ontology. Within each chapter, I turn to data from the narrative accrual to show these roles played out in the curricular stories the faculty narrators tell. Their stories give flesh to these abstract definitions and show several things that the ontology in question can illuminate faculty roles in curricular change. The goal of the analytical/ontological chapters is not to “prove” the “correctness” of the ontologies, but rather to use them to show ways we might understand (and disrupt our understandings of) the narratives, of other ontologies, and of themselves as ontologies.

Each ontology and its corresponding chapter is named after the role that faculty take within it: they are Makers (Chapter 4), Inheritors (Chapter 5), Embodiments (Chapter 6) and Collaborators (Chapter 7). The four ontologies are related through their use of the same three components: the faculty as narrating self, the curriculum as world, and the students as agential others. Each ontology places the faculty role in a different set of relationships to students and curriculum. The "Makers" ontology presents faculty as makers of curriculum for the benefit of the students, the "Inheritors" ontology presents them as inheritors of curriculum and students, the

"Embodiments" ontology presents them as embodiments of curriculum encountered by students, and the "Collaborators" ontology presents them as collaborators on curriculum with students.

Each ontology also represents a different clustering combination of those three components, as seen in the image below (also presented in Chapter 3). The "Makers" ontology separates all three components from each other. The "Inheritors" ontology merges the curriculum and student components, treating them as an intertwined and inseparable assemblage that faculty (as a separate entity) interact with. Similarly, the "Embodiments" ontology merges the faculty and curriculum components, and the "Collaborators" ontology merges the faculty and student components. Merging components is a way to challenge boundaries and distinctions between roles in an ontology, and to explore what kinds of design tradeoffs happen as a result. Note that a fifth combination (all three components merged together) is logically possible, but not analytically useful, as I cannot discuss interactions between items unless I have at least two items that can interact with each other.

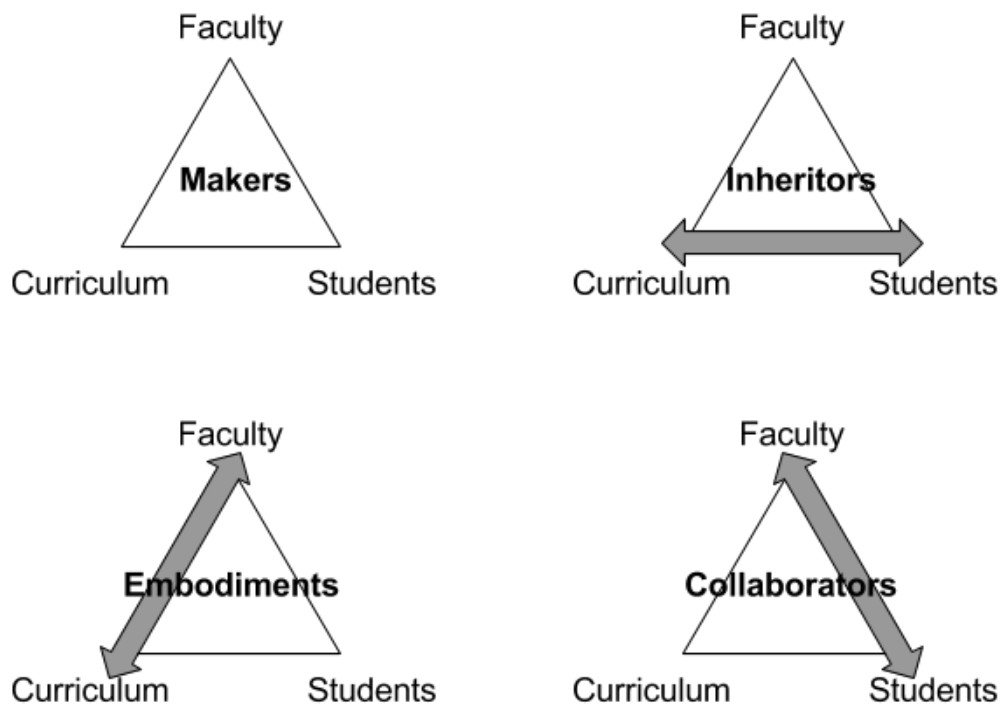


Figure INT.7. Component clustering in the four ontologies

As shown in the diagram above, these three components can be arranged into four ontologies of curricular change. They are by no means the only curricular change ontologies possible; there are an infinite number, and this is simply a set of four that utilize the three components of faculty/self, students/other, and curriculum/world. However, a set of four is sufficient to demonstrate the "more and different" things that can be done with a multiplicity of ontologies rather than just one. In the remaining sections of this intertext, I will briefly summarize each ontology in turn.

Intertext 1.2 The “Makers” ontology

The first ontology positions faculty as Makers. Specifically, faculty make curriculum for the benefit of the students, a role I will unpack more in Chapter 4. In the Makers ontology, the three roles of faculty, curriculum, and students are portrayed as distinct and with defined roles in relation to each other. It is a crisp, clear, and (on the surface) untroubled look at how the reality of curriculum change could be, or perhaps even "ought" to be. On a philosophical level, this ontology inquires into what happens when an obviously oversimplified view is adopted as "good enough" – the simplicity can be problematic in its inaccuracy and inability to capture more complex dynamics, but what are the tradeoffs that can now be done because those roles and relationships are considered to be set (enough) in place?

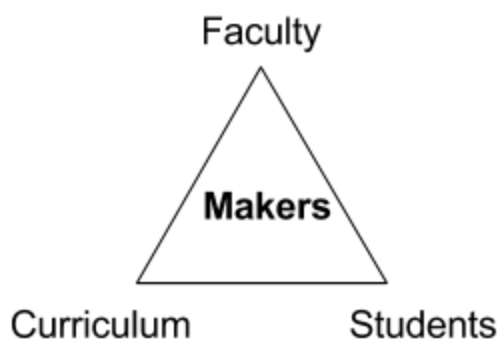


Figure INT.8. Makers ontology components

In the context of curricular change, this ontology looks at the unification and motivation of faculty as they work together to create a curriculum for students. It examines how such a view of curricular change can lead to a broad view of curriculum that can in turn drive experimentation

and innovation. The faculty role resonates with ideas of helper, teacher, servant-leader, and formator of people that carry through more recent, student-focused, curriculum design literature.

Intertext 1.3 The “Inheritors” ontology

The second ontology positions faculty as Inheritors. Specifically, faculty inherit a pre-existing and intertwined assemblage of students and curriculum, a role I will unpack more in Chapter 5. In the Inheritors ontology, the roles of curriculum and students are intertwined into a single component. On a philosophical level, this ontology addresses the role of the self by setting it in contrast and opposition to a combined other and world. This combining of self and world also highlights the mixed nature of the assumed reality as an assemblage, consisting of both agential subjects and non-agential objects and material and non-material things.

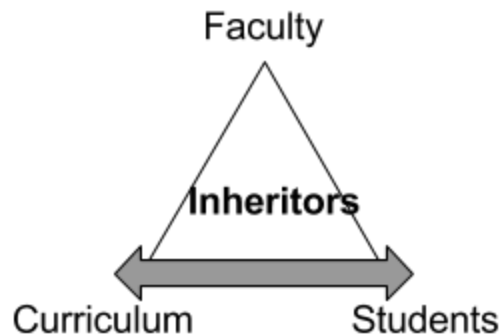


Figure INT.9. Inheritors ontology components

In the context of curricular change, this ontology highlights students/others and curriculum/world as carriers of history and culture. In doing so, it allows the faculty role to be positioned explicitly as one that learns, rather than only one who facilitates the learning of others. This ontology allows curricular change to be framed as beneficial to not only the growth of students, but the growth of faculty.

Intertext 1.4 The “Embodiments” ontology

The third ontology positions faculty as Embodiments. Specifically, faculty embody curriculum encountered by students, a role I will unpack more in Chapter 6. This ontology pulls

together the roles of faculty and curriculum into a single component and portrays faculty and curriculum as co-constructing one another. In other words, it frames the faculty who are designing and teaching courses as also being part of the courses – they are no longer designing and teaching something separate from themselves, but are creating and shaping and offering themselves to students as part of the curriculum. On a philosophical level, this ontology addresses the boundary between self and world.

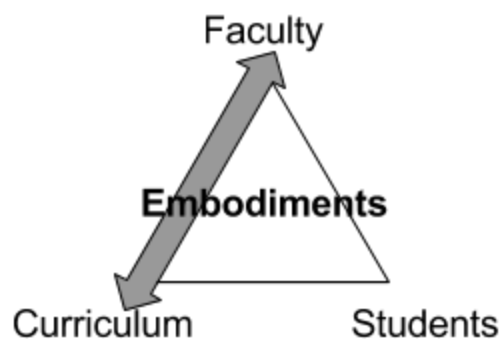


Figure INT.10. Embodiments ontology components

In the context of curricular change, this ontology touches on how faculty are shaped by the curriculum, both formal and informal, that they have experienced in the past as both teachers and learners. It also explores how the curriculum is uniquely shaped by the specific faculty involved in its design and execution; their personal identity, values, history, skills, personalities, and so on are deeply embedded in the learning environment they create and partake in. In so doing, this ontology highlights the particularity and situatedness of faculty selves and the curricular world. Course experiences and instructors are not seamlessly interchangeable objects; it matters who designs and teaches a course. Curriculum is highly personal, both as an expression of self, and as an experience of formation for the self.

Intertext 1.5 The “Collaborators” ontology

The fourth ontology positions faculty as Collaborators. Specifically, faculty collaborate on curriculum with students. This ontology brings together the student and faculty roles, which challenges the way they are usually separated in academia. In this ontology, the role of students as

an "other" is called into question. On a philosophical level, this ontology addresses the boundary between self and other, which brings up questions about when, why, and how groups individuals choose to define their identities, roles, and actions in contrast or opposition to others, and what the tradeoffs of doing so might be.

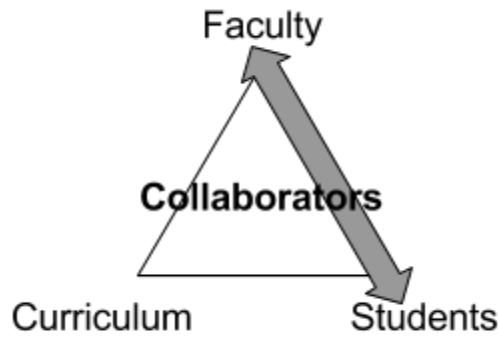


Figure INT.11. Collaborators ontology components

In the context of curricular change, this ontology queries assumptions about the roles of students in that context – that is, as participants in curricular change initiatives. The other ontologies position student roles as recipients and beneficiaries of curriculum ("for the students"), as part of the curriculum inherited by faculty ("faculty as heirs") but not necessarily primary coauthors in deliberately designing it, or that they are incidental to stories of curricular change that center around faculty identity and its expression in curricular design ("for and of"). In contrast, the "collaborators on curriculum" ontology frames students as partners in active design and realization of curricular change, raising questions about how students can be seen as collaborators in the curriculum, and what this might mean – what sorts of collaborators they can be perceived as.

Intertext 2: A map for Chapters 4-7

Chapters 4-7 each work within a different ontology, but each of these chapters shares the same underlying map. This section describes that map so that you know what to expect from each analytical/ontological chapter. Each of these chapters has three parts: first I describe the ontology, then I use it, then I examine it.

If you think of each ontology as a set of lenses or eyewear, the first part of each analytical/ontological chapter is a description of a specific kind of eyewear (eyeglasses, safety goggles, diving masks, contact lens). The second part involves "looking through" those lens – putting on the eyeglasses or the safety goggles and describing what the curricular change narrative dataset looks like through it. The third part involves "looking at" the lens themselves – what sorts of things do eyeglasses afford, what kinds of situations might one use a diving mask in, what are the benefits of choosing contact lens? In the paragraphs that follow, I briefly expand on what each part covers.

Intertext 2.1 Describing the ontology

The first part of each chapter describes the ontological "lens" it works within. I begin with a theoretical explanation of the ontology that explains how the three roles of faculty, curriculum, and students are related within it. Following this, I play with the "lens" analogy and deliberately work against abstraction by presenting an allegory for that ontology. Each allegory represents its ontology of curricular change as a literal set of lenses – a different kind of eyewear worn in a particular context. For example, the "Makers" ontology is represented by a pair of wireframe glasses worn by chefs in a busy restaurant kitchen; the "Inheritors" ontology is represented by a set of safety goggles worn by landlords in the midst of a home renovation, and so forth. The faculty equivalents (chefs, landlords, etc.) are the ones wearing the lens within each allegory.

The allegories are meant to be playful and evocative tools to aid in understanding what could otherwise be an abstract philosophical discussion. Just like I used the story of the elephant in Chapter 1 to explain the thrust of this entire project, I use these allegories in Chapters 4-7 to explain how the role relationships in that ontology play out in the curricular change space.

Intertext 2.2 "Looking through" the ontology

The second part of each chapter is about "looking through" that ontology at stories from the narrative dataset. I begin by summarizing each of the five main curricular change projects described by faculty narrators (TAD's self-study, D&D, Olin's early days, UOCD, SoH – see 3.1.5 for explanations of each) as portrayed within that chapter's ontology. This means that, by the end

of the four analytical/ontological chapters, the story of each main project has been told four times, once from within each ontology.

After this overview, I dive into 2-3 more detailed examples from the narrative dataset that exemplify a usage of that chapter's ontology. In keeping with the postmodern principle of disruption and my stated goal of explicitly challenging readers to engage in a writerly (co-authoring) relationship with this text, I also provide “exercises for the reader” matching each ontology in Appendix A.

Although the stories in the “looking through” section are drawn directly from the narrative dataset, they are not “pure” representations of the faculty narrators’ perspectives; such a thing is impossible. Instead, they are re-presentations that bear my fingerprints as a researcher narrating the narrators. The in-text citations of verbatim transcript excerpts, which point to specific locations in a largely publicly available dataset, provide a way to trace my bricolage process in creating these stories. These stories are not meant to prove what the narrator “actually” meant, or to explain the “Truth” of the curricular change projects they portray. Rather, my aim is to question and proliferate perspectives on what the narrators *could have meant*, and how these curricular change projects *might be understood*.

Intertext 2.3 “Looking at” the ontology

The third and final part of each analytical/ontological chapter is about “looking at” the ontology itself. I treat the ontology as a designed object with features and tradeoffs by highlighting 3-4 affordances that may affect its selection and usage. What does this ontology make-visible, what possible operations does it tend to highlight (or obscure), and what benefits (or disadvantages) might one consider when choosing and utilizing it (whether consciously or unconsciously)?

Intertext 2.4 Different ways of looking at... different ways of looking

The result of this three-part chapter structure is that each ontology – each conception of curricular change reality – is itself explored from multiple perspectives. “Looking through” an ontology roughly corresponds with Heidegger's concept of an object that is “ready-to-hand,” a thing being actively used without theorizing (Heidegger, 1927/2010). When I put on my own

eyeglasses in the morning, I don't spend a lot of time thinking about what eyeglasses are; I simply use them to achieve my goals of seeing other things.

In contrast, "looking at" an ontology roughly corresponds with Heidegger's concept of "present-at-hand," a thing being observed and theorized. Switching back and forth between "looking through" and "looking at," as well as switching between the four ontologies, highlights that ontologies are constructed, chosen, and designed. My intention is to illustrate that we, as engineering educators, have made choices about the nature of curricular change reality, and we can make different choices going forward.

Intertext 3: Graphical abstracts for Chapters 4-7

I end the series of intertext by shifting to a graphical format to give you (the reader) an overview of all four ontologies before plunging into reading chapters devoted to a single ontology. As mentioned earlier, my intent is twofold: I want to give you an informational overview, but I also want to intentionally shift your mode of engagement towards play and generativity by interrupting the written format we have been engaging in thus far. Therefore, the last four pages of this intertext consist of comics – one-page graphical abstracts – of each analytical/ontological chapter.

You should not expect to fully understand the comics at first viewing; they are appetizers and teaser trailers of what is to come. The chapters that follow will further unpack the information in each graphical abstract. If you look back at a graphical abstract both before and after reading the corresponding chapter, you will probably see the details in it with different eyes, and I encourage you to do so. These comics should raise questions rather than giving full explanations; their intent is to place you in a frame of questioning and generativity rather than a more passive, readerly stance of receiving information. As you finish looking at the graphical abstracts and begin to engage with Chapters 4-7, try to maintain whatever sense of curiosity these visual teaser-trailers evoke in you.

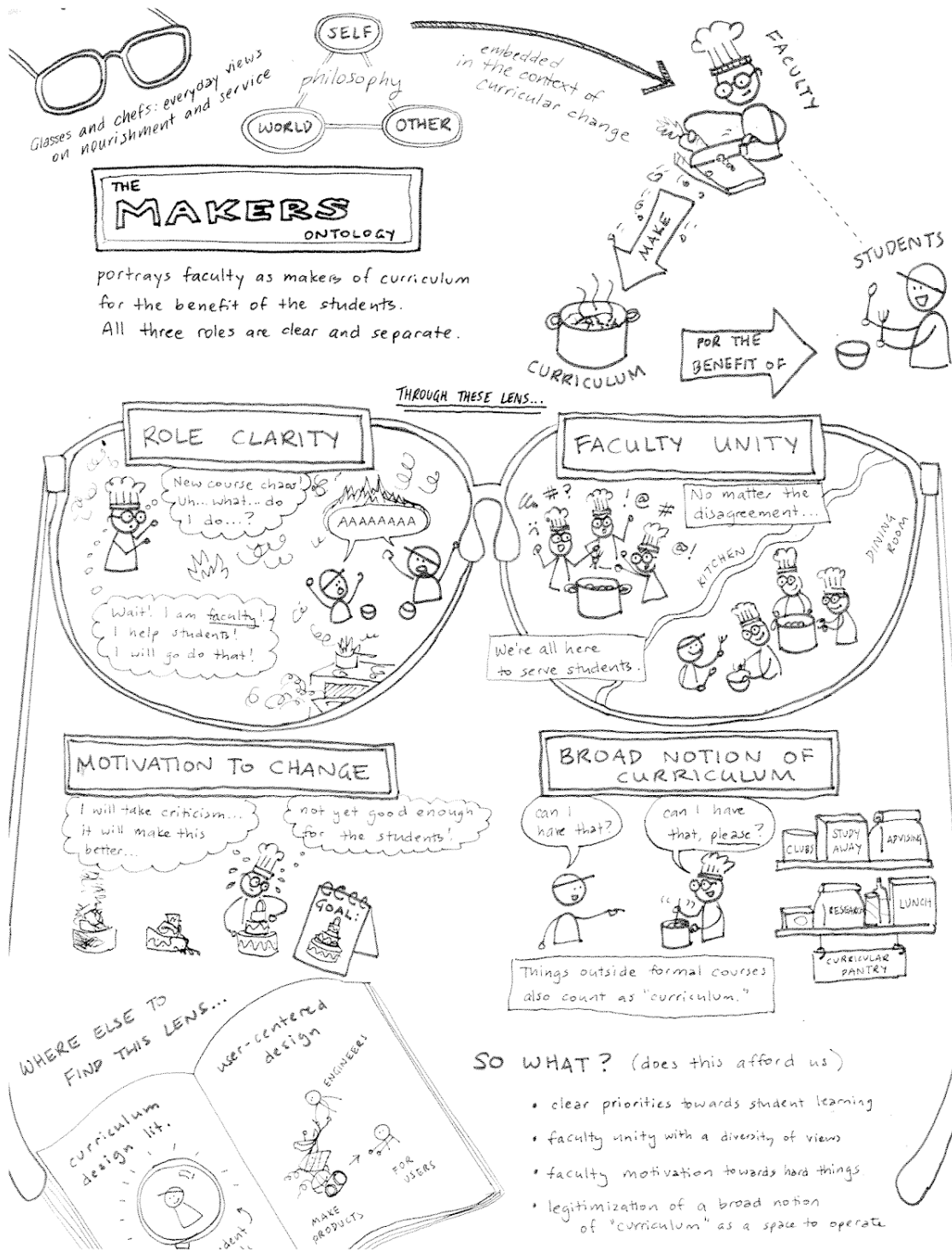


Figure INT.12. Makers ontology graphical abstract

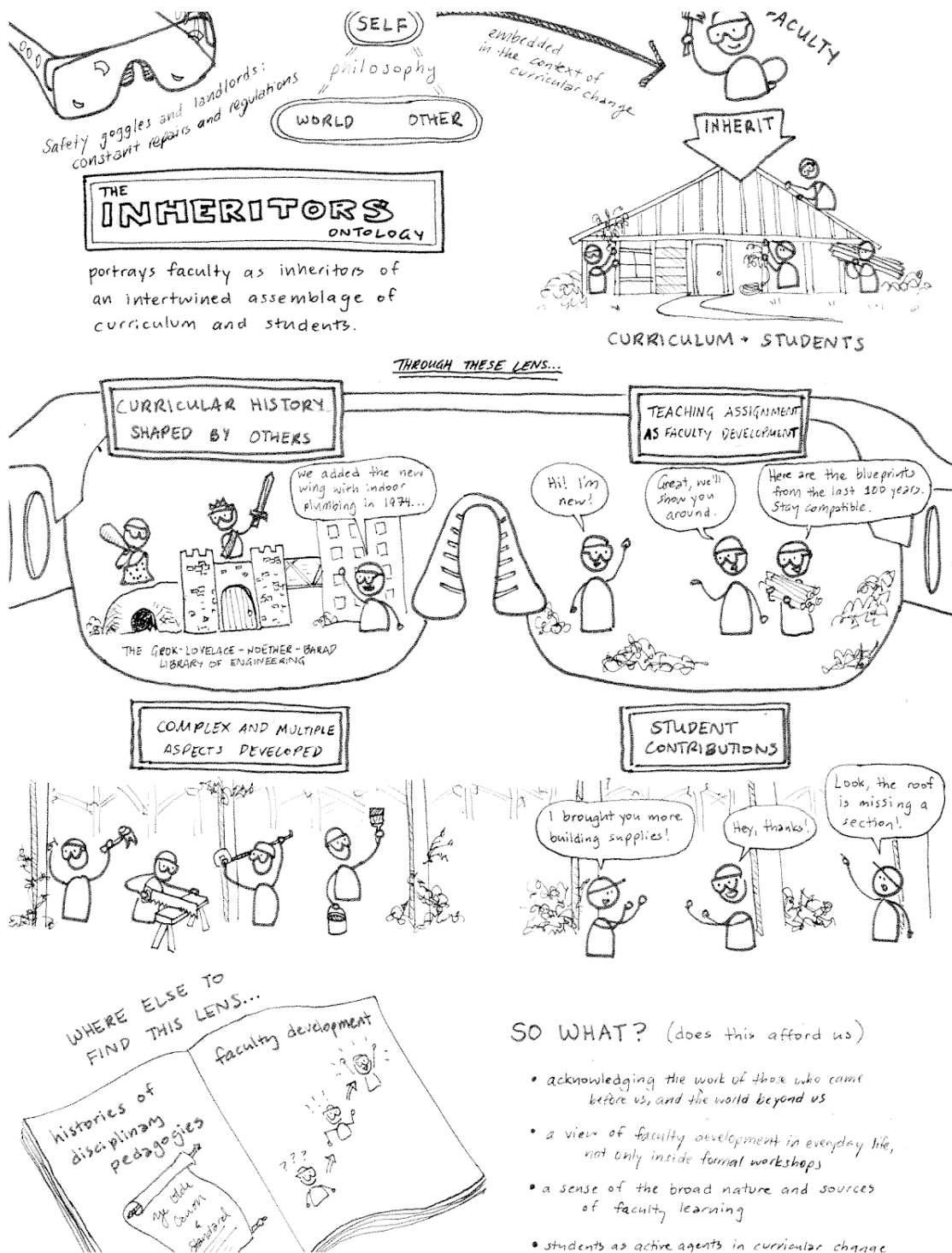


Figure INT.13. Inheritors ontology graphical abstract

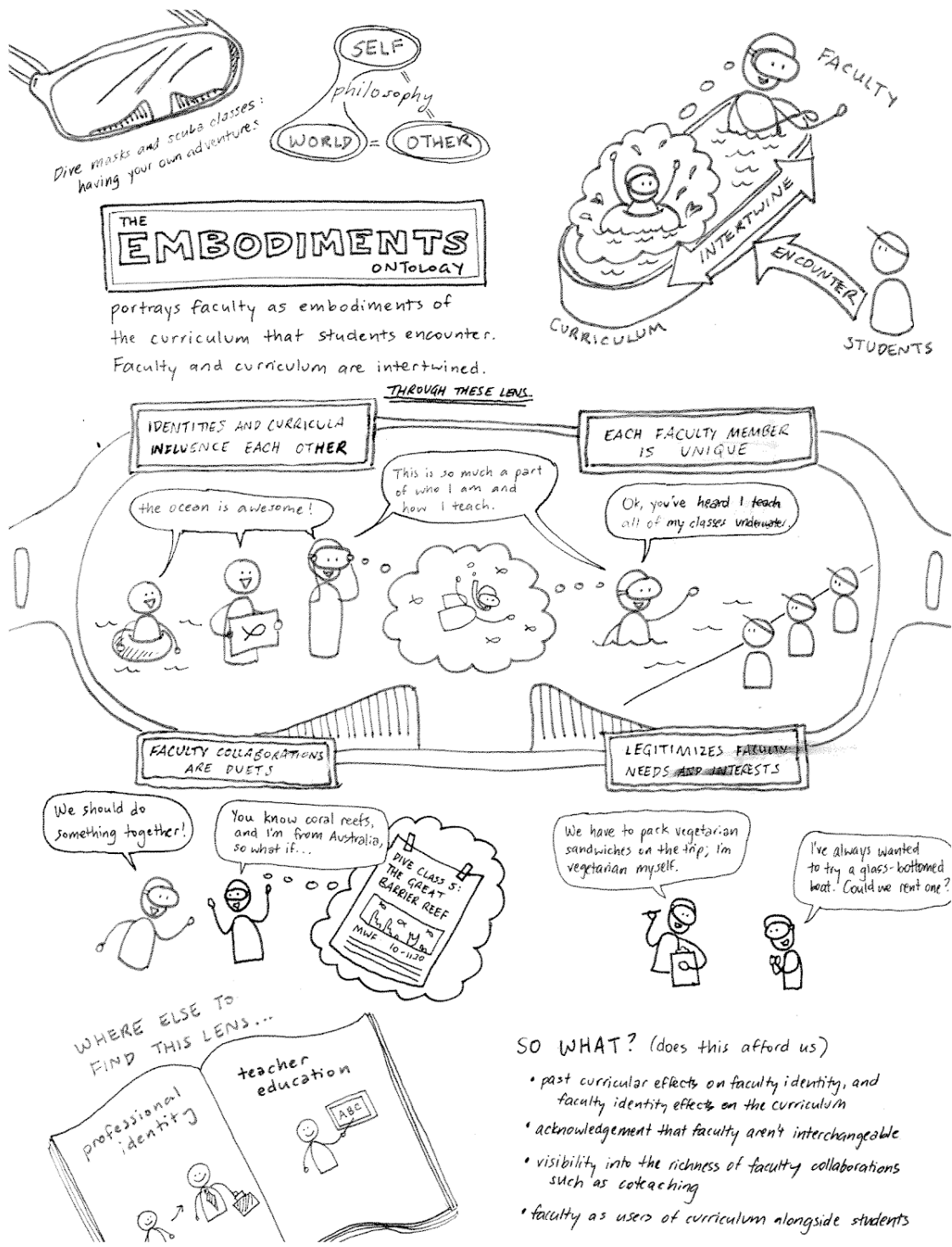
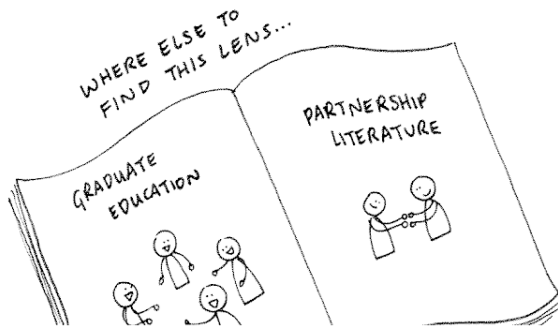
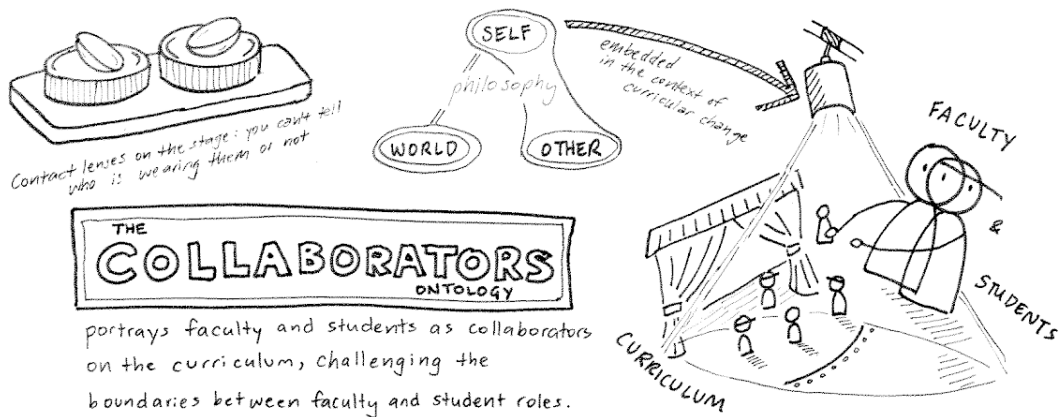


Figure INT.14. Embodiments ontology graphical abstract



SO WHAT? (does this afford us)

- allows faculty and students to share frameworks
- benefits student voices can add that faculty voices cannot
- variety of faculty responses for fostering student participation in curricular change
- faculty as live models of practice and metacognition on practice

Figure INT.15. Collaborators ontology graphical abstract

4. ONTOLOGY: FACULTY ARE MAKERS OF CURRICULUM FOR THE BENEFIT OF THE STUDENTS

Hopefully in the near future we [faculty] will be taking direction and initiatives to... make the changes across the curriculum to benefit the students. (Mark 1, 22)

I never teach my pupils, I only attempt to provide the conditions in which they can learn.

– Albert Einstein

The “Makers” ontology portrays faculty as makers of curriculum for the benefit of the students. Many everyday faculty comments can be interpreted within the "Makers" ontology. In other words, many faculty comments make sense if the reader presupposes that the role of faculty is to make curriculum for the benefit of the students. For example, within the narrative dataset:

1. Mark described himself and his TAD faculty colleagues as "doing the best we can for students now" (Mark 1, 18). This can be interpreted within the "Makers" ontology as a description of the TAD faculty role, which is as makers of a curriculum designed to benefit ("do the best we can for") the current students in their program.
2. Rob talked about "look[ing] more towards the future, what we want these students to do later and that kind of thing" (Rob 4, 213). This can be interpreted within the "Makers" ontology as a description of the Olin faculty role, which is as makers of a curriculum designed to benefit the future careers of students in their program. One reading of Rob's statement within this ontology is that not only should the students benefit now, their future selves should also benefit later.
3. Jon described himself as "able to... adjust on the fly to make for a better experience for students" (Jon 3, 116). This can be interpreted within the "Makers" ontology as Jon's description of his own role as a faculty member. Jon makes curricular decisions "on the fly" in order to benefit students by giving them a "better experience." One reading of Jon's statement within this ontology is that curriculum-making does not just occur once before students arrive; curricular re-making occurs continuously in response to their needs.

All the above examples make sense within the faculty (and curriculum and student) roles prescribed by the "Makers" ontology. Now, this is not the only way these narrator comments can be read; other interpretations and underlying ontologies are also possible. However, the above statements, along with the more extended examples given in the remainder of this chapter, are rendered legible via the role assumptions that faculty are makers of curriculum for the benefit of the students, and that these role assumptions are a fundamental part of the reality of curricular change.

This chapter is divided into three sections, as previously discussed in the intertexts. The first section introduces the ontology, the second section looks through it at the faculty narratives told for this project, and the third section looks at the ontology and discusses its features and affordances. Together, the three sections provide multiple angles on how the "Makers" ontology of curricular change makes sense of faculty roles.

4.1 Introducing the Makers ontology

In this section, I introduce the ontology in two different ways. First comes a theoretical discussion of the ontology, which consists of three roles that stand as separate philosophical components. Second, I provide an allegory of faculty "makers" as cooks making food in a kitchen for hungry diners, which provides a playful and concrete way to approach the ontology.

4.1.1 Theoretical introduction – separate faculty, curriculum, and students

As in all four ontologies, the "Makers" ontology correlates the faculty role with the philosophical concept of the Self, the curricular role with the World, and the student role with the Other. In this ontology, all three roles are separate components. Faculty are portrayed as creators of curricula, often in the form of courses or learning experiences within them. The curriculum these faculty create are separate from themselves. Faculty create curriculum as part of their role as supporters and facilitators of learning for their students, who similarly comprise a group of people who are distinct from faculty. The image below shows the separation of all three ontological components, and the paragraphs that follow address their corresponding roles in turn.

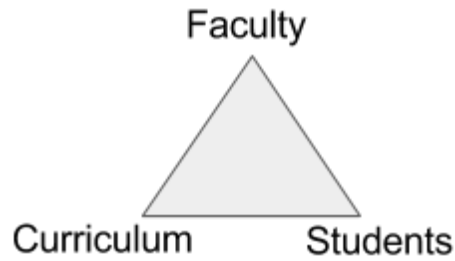


Figure 4.1. Component relations: All separate

In the "Makers" ontology, the faculty role carries a sense of individual identity. However, there is also a collective sense of identity consisting of individuals who are (or should be) aligning into a plural self, united towards the goal of helping students learn. The implication that students are the "other" to be served is something that unifies faculty members under the heading of the "self." In this ontology, faculty colleagues may have different personalities and preferences, but they are not framed as "other." Regardless of their differences, faculty are of the same underlying type because they share the same type of role in relation to students and the curriculum.

Furthermore, in this ontology, the curriculum is positioned as the learning experience or experiences that faculty are responsible for designing and/or teaching to students. The curriculum is created by the faculty, designed to be experienced by students, and should be made in such a way as to foster student growth. Regardless of the form it takes, this ontology always positions curriculum as an external object standing between separate parties.

Similarly, the "Makers" ontology positions the role of students in respect to curriculum and faculty. In this ontology, students are those who are served by faculty and who are the intended users and beneficiaries of the curriculum. Students typically engage in these relationships with faculty and curriculum by enrolling in and taking courses in the curriculum that are designed and taught by faculty. However, students engage with curriculum and faculty outside of formal courses as well; a student participating in an extracurricular club mentored by a faculty member is still engaging in a non-course-related curricular experience where the faculty mentor has a responsibility towards fostering the student's growth.

4.1.2 Allegorical introduction - Chefs wearing glasses in a kitchen

One way of playing with the ontology and making it more concrete is to cast it into an allegory and see what connections this generates. In the image below, and in the remainder of the chapter that follows, I use a kitchen allegory: faculty are portrayed as chefs preparing food for hungry restaurant patrons. The food represents the curriculum, and the patrons represent students. The ontology itself is portrayed by a set of ordinary wireframe glasses worn by the chef. This signifies its usage as a commonplace ontology in higher education, an unremarkable and unmarked choice.

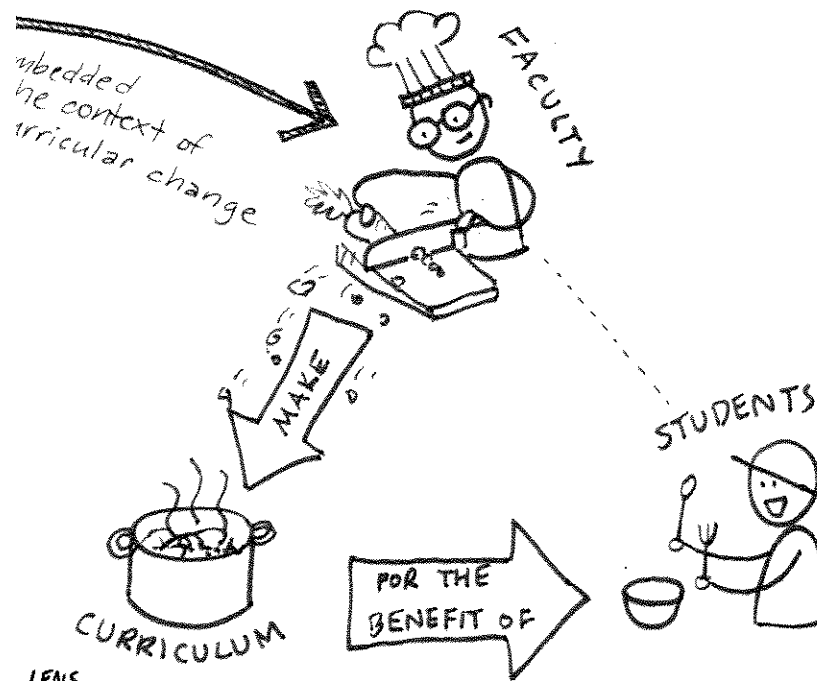


Figure 4.2. Allegory of the restaurant (close-up from Intertext 3)

As shown in the drawing above, all three components in the ontological analogy are separate from each other: the faculty-chefs chop vegetables that fall into the curriculum-saucepot, and the resulting soup is served to the student-patrons. Chefs are not the food they serve, nor are they the people they serve food to, and the food is distinct from the person eating it. Similarly, in this ontology, faculty are not the curriculum they prepare, nor are they the students they instruct, and the students are separate from the curriculum they are given.

I chose a food and cooking image to represent this ontology for its connections to caretaking and nourishment. Cooking is often an act of service. Just as parents cook for their children in order to nourish their physical growth, faculty instruct their students in order to nourish their intellectual growth. The separation of restaurant patrons from the cooking process also echoes the separation of students from the curricular development process. Students receive and consume the curriculum, just as a restaurant patron eats the food given to them as opposed to helping to prepare it in the kitchen. Finally, the restaurant-style setting and positioning of students as patrons also evokes current discussions of higher education as an increasingly consumerist market, with students acting as paying "customers" entitled to good "service" by the faculty.

4.2 Looking through the “Makers” ontology: Stories

This section presents several stories from within the “Makers” ontology. In other words, if one assumes the “Makers” ontology is in fact the underlying reality of curricular change, and decides to “look through” that perspective at the narrative dataset, what do the narratives look like? I begin with a brief presentation of all five main projects from within the “Makers” ontology. Following this, I dive deeper into two examples: faculty as makers of a unified vocabulary for the D&D class, and faculty as makers of a curricular placeholder in the early Olin curriculum.

4.2.1 Project narratives framed via the “Makers” ontology

Each of the projects mentioned in Chapter 3A can be narrated utilizing the "Makers" ontology. In other words, entries from the table below can be used to fill in the following sentence: The story of (Project) portrays (Faculty) as makers of (Curriculum) for the benefit of (Students). For instance, using the first row of the table yields: "The story of (the TAD self-study) portrays (members of the TAD Division at Berea College in the years immediately prior to 2013) as makers of (the self-study that revised and renamed the 4-year TAD curriculum from its prior name of Industrial Arts to reflect an explicit focus on design) for the benefit of (present and future students in the TAD major, including the professionals the TAD faculty hope they will become)."

The table entries are brief, and serve only as brief examples and introductions to potential story framings that make sense within the “Makers” ontology. Some of the projects outlined in the table will be expanded upon as examples in the remainder of this chapter. The final row of the

table has been left blank as an exercise for the reader (that's you) to fill in an example from your own experiences with curricular change.

Table 4.1. Makers ontology view of projects in the data

The story of (Project)	Portrays (Faculty)	As makers of (Curriculum)	For the benefit of (Students)
(the) TAD self-study	Members of the TAD Division at Berea College in the years immediately prior to 2013	The self-study that revised and renamed the 4-year TAD curriculum from its prior name of Industrial Arts to reflect an explicit focus on design	Present and future students in the TAD major, including the professionals the TAD faculty hope they will become
D&D	The four TAD faculty who agreed to co-teach the course after the abrupt departure of the colleague originally assigned to teach it	An update to a foundational TAD course intended to teach the design process, including a midway standardization of design-related vocabulary	Students, largely early-stage TAD majors, enrolled in the course that semester
Olin's early days	The "founding faculty" at Olin who were hired before the arrival of the first class of first-year students	An "innovative" undergraduate engineering curriculum whose initial design included a design course placeholder in the sophomore year	Olin's first class of incoming students, who were still being admitted and had not yet arrived on campus to start courses
UOCD	The first cohort of UOCD studio instructors, most of whom had no prior design studio teaching experience	The first run of a required sophomore-level engineering design course focused on user-centered design	The Olin sophomore class, who were all enrolled in the course that spring
SoH (not expanded in this chapter)	Rob, a history professor, and Jon, a materials science professor	An integrated history and materials science course	Students who fulfilled both humanities and science requirements by enrolling in the course
Reader project			

4.2.2 Example from D&D: making a unified vocabulary

D&D: (Four co-teaching faculty) were makers of (a standardized vocabulary of design terminology) for the benefit of (students confused by language inconsistency).

The story of vocabulary unification within TAD's D&D course is one that can be told within the "Makers" ontology. In this story, the four faculty co-teaching D&D revised the language they used in the classroom to describe design practice. They created a standardized set of design vocabulary for within-division usage in order to clear up student confusion around inconsistent terminology. In this case, the curriculum created or revised was the shared language itself, as a crucial aspect of the learning environment. The intended benefit for student learning was to reduce communicative confusion. Framed through the "Makers" ontology, this is a story of how D&D faculty made a standardized design vocabulary for the benefit of students who were confused by inconsistent terminology.

D&D is a required introductory course for all TAD majors. It introduces students to habits of mind and elements of design practice that will appear in multiple subsequent courses. As such, students enrolled in TAD are constantly encountering a large amount of unfamiliar material – new disciplinary and department cultures, new technological tools and fabrication skills, new levels of responsibility as college students, and new vocabulary. One semester, the four faculty members co-teaching D&D noticed that students were confused by the unfamiliar vocabulary because some key words were being used inconsistently during class.

There were four terms that we were talking about, all design related... design criteria... design constraints... design cycle... design intent. It's confusing to students who are just learning about design... to use both terms interchangeably...

There's some overlap between some of those terms that I just mentioned, but they are different... we were using them sometimes interchangeably, like 'design criteria' and 'design constraints.' Sometimes one of us would call what we were doing constraint... and the other person might call it a criteria. (Alan 3, 104-105, 108)

These slight inconsistencies of vocabulary had not previously been an issue for the course faculty. All four of them were mature design practitioners who stemmed from different sorts of design backgrounds: graduate school at different universities, specialties working in different media, and so forth. Each faculty had brought in vocabulary habits from their own experience, leading to a diversity of language among the faculty. Gary explained it as being a situation where "you're all saying the same thing... It's just the verbiage you're using means different things to different people" (Gary 2, 116). However, the differences in terminology were subtle enough – and their fluency of shared practice great enough – that the faculty were still able to understand each other.

I think all of us knew, like if Mark said design criteria or design constraint, I knew what he was talking about... We understood why we were using terms interchangeably... there is overlap between design criteria and design constraints. Because the criteria, like we can say okay, this object that we're designing has to be made out of wood. Okay? That's a criteria. But it's also... a constraint. You cannot use metal. You cannot use plastic. You have to use wood. There's some overlap there. (Alan 3, 108, 112)

Even if the four faculty could make sense of each other's' vocabulary, they realized, several weeks into the semester, that their students were confused. According to the faculty role defined in the “Makers” ontology, the faculty would therefore have a responsibility to change something about the curriculum in order to alleviate that student confusion. This is exactly what happened; the faculty decided they needed to “be[come] more precise with our terminology and language in class” (Alan 3, 112), so they took one of their teaching team meetings to explicitly address the problem.

We had a conversation last Friday in our planning meeting for that [D&D] class. And the conversation was that for some of these design terms, we're using them in different ways... for the benefit of the students... we need to get on board to make sure that we're talking about the same thing.

And we just kind of sat there and talked. And we, just amongst faculty, we clarified what, when should we use 'criteria, when should we use 'constraints,' when should we use 'intent,' and when should we use 'cycle.' And said we'll start using design criteria when we're talking about this. And we'll talk about a design constraint when we're talking about these elements.

So we decided to clarify a little bit and to be consistent with our use of the term. [Now] all four of us will hopefully be using the same terms when we're talking about the same thing. So we do have a common language and the students are using that common language. (Alan 3, 103-105, 108, 110)

Note several things about this story, largely told from the perspective of Alan. First of all, the faculty were the ones responsible for the vocabulary development. The conversation took place at a teaching team meeting where only the faculty were present, rather than with students in the classroom. To use this chapter's kitchen allegory, all the cooking took place in the kitchen among cooks; the clarification occurred “just amongst faculty.” There was no “tableside preparation,” so to speak.

Secondly, the resultant “common language” is described as if it were something separate from both the faculty who made it and the students who use it. Faculty created and now “have a

common language,” and the “students are using that common language.” To use this chapter’s kitchen allegory, the language was prepared in the kitchen, then brought out into the dining room to be served to the students.

Finally, the motivating factor behind this curricular change was student learning and student benefit. The previous, more interchangeable usage of vocabulary was usable by faculty and actually served a purpose – to express overlaps between concepts and the terms they described. However, a language practice that worked for faculty with design experience was “confusing to students who are just learning about design,” and it was the student experience that was prioritized and centered in the curricular (vocabulary) redesign. This curricular (re)making was informed by student reactions.

4.2.3 Example from Olin’s early days: making a sophomore year design placeholder

Olin’s early days: (The founding faculty) were makers of (a placeholder for a fourth-semester design course) for the benefit of (sophomore-year students who needed some kind of culminating mid-way design experience after their shared introductory foundation).

The creation of space for a “Sophomore Design Project” in the four-year Olin curriculum is a narrative from Olin’s early days that makes sense within the “Makers” ontology. In this narrative, the founding faculty in the early days of Olin created a placeholder in the fourth semester for a sophomore design course, which later turned out to be a pivotal course for students in the four-year sequence. In this case, the curricular object being made was a course slot – not yet a course – within the larger sequence, and the intended benefit for student learning was to help them synthesize the foundational courses they had just completed. Framed through the “Makers” ontology, this is a story of how Olin faculty made a space for sophomore-year students to have a culminating design experience after their first three semesters.

Founding faculty in the early days of Olin were given a curricular blank slate and told to fill it. They knew they were supposed to do something new and different in undergraduate engineering education. They knew they wanted a student experience that wasn’t like the lecture-heavy courses that the current calls for change in engineering education were critiquing. It was an exciting time, full of both possibility and responsibility.

We were doing something exciting and dynamic to roll out the curriculum and break the mold while doing a good job for our students, helping them get a good education and not be hurt because they were guinea pigs. (Rob 1, 122)

One of the elements the faculty envisioned in the curriculum was a focus on hands-on design projects. This was an early decision made by the faculty, and became an agreed-upon part of the overarching picture. Authentic design projects would thread through the entirety of the four-year program.

I would say the conversation in the early days was more along the lines of “let’s give students real hands-on experience that are connected to real problems that people care about”. And try to build that into the curriculum throughout all four years. (Jon 1, 51)

We had a picture for the curriculum overall... There was an idea there would be hands-on design projects in every year. That came from a meeting in the first year [of teaching]... and we were all committed to that. (Lynn 1, 89, 296)

With the overarching picture of a four-year focus on design in place, the faculty then needed to create a course progression that would fit within that. They had ideas for what the start and end of the four-year student experience might look like. The first year would include simple design projects from the beginning. The fourth year would culminate in larger-scale design capstones in both technical and non-technical disciplines.

The first-year [student curriculum] was probably [building] bottle rockets or something like that. It was much [more] about... helping people to actualize technical knowledge than it was about design for end users... we knew that we’d have integrated experiences in the first two semesters...

We always knew we’d have senior design... culminating experiences: a year-long industry-sponsored engineering design experience, plus an individual ‘actualization’ performance-before-experts mini-capstone in AHS or E! [arts, humanities, social sciences, or entrepreneurship]. (Lynn 1, 90, 235, 304-308)

Between the first and fourth years, faculty “knew we needed a midway design bit, which was going to be SDP [Sophomore Design Project]” (Lynn 1, 236). The Sophomore Design Project was not so much a course as it was a placeholder for a course: “we need a design experience in the fourth semester, [here are] several ideas of what this could be” (Lynn 1, 310). Whatever the Sophomore Design Project course was, it would come after a common core of “integrated experiences” from the first year, tie them together, and serve as a mini-capstone that was a half-length preview version of the senior capstone project.

If you look at the engineering curriculum, the earliest version, you will see things like the Sophomore Design Project in year 2. (Jon 1, 52)

[A sophomore design course] was always intended to be a part of everyone's curriculum... by the end of the fourth semester the shared foundation would be largely complete. Clearly this culminated with some sort of tie-it-together design experience... [so] in the second year of the curriculum, there was a space carved out in the fourth semester for the Sophomore Design Project. The idea was, over the course of the first three semesters, these integrated [courses]... would lead to this intensive design experience in the fourth semester. (Lynn 1, 86-89, 296-309)

In year two we wanted– the language that I remember from the early days was we wanted something like a mini capstone experience. We thought that would happen in the 4th semester. So instead of a year long it would be a semester long and a smaller scale project... (Jon 3, 56-57)

The founding faculty had some thoughts on how they might use that fourth-semester design slot. The word ‘design’ can mean many different things: artistic, fabrication-based, optimization-focused, and so forth. Jon and Lynn described several kinds of design the early faculty wanted students to engage with in the Sophomore Design Project.

[The Sophomore Design Project was supposed to be a place] where students were designing, fabricating, testing something... we want them to design, fabricate and test some system. (Jon 3, 57)

Design as solving an ill-specified problem first by problem setting... that was going to happen in SDP [Sophomore Design Project]... We definitely knew we wanted the students-make-choices and it's-ok-to-be-artsy kinds of design. We had to have the parameter tweaking kind [of design]; we are engineers, after all. And we had a clue that eventually we'd want the problem setting kind. (Lynn 3, 31-34)

Of course, the Sophomore Design Project could only stay a placeholder for so long before students arrived and faculty would have to create and teach a concrete class. Lynn and Jon were among the “six faculty members who taught the first incarnation of the Sophomore Design Project... which was UOCD” (Lynn 1, 103-105). UOCD, or User-Oriented Collaborative Design, ended up becoming a crucial part of the Olin curriculum and a story in its own right, and is in fact one of the other main curricular change projects narrated by Olin faculty in this document. UOCD has also subsequently been adapted to other undergraduate engineering programs (Goldberg & Somerville, 2014), and is promoted as one of Olin’s most significant contributions to engineering education curricular change outside its campus to date (Olin Collaboratory, 2016). Without the

decision of the early Olin faculty to create a space for a design course in the sophomore year, UOCD may never have come to pass.

This story was largely told from the perspectives of Lynn and Jon, and matches the “Makers” ontology in several ways. First, the faculty are the only ones involved in the decision to create a design slot in the sophomore year. Student voices are absent from the narrative; every time the faculty narrators in this story speak of belonging to a collective “we” that “had a picture for the curriculum overall” or “always knew we’d have senior design,” they are referring to the founding faculty, not students – students had not even arrived on campus yet. The overarching focus on design across the four-year curriculum, and the decision to hold a sophomore-year course slot for design, are told as if they were decisions authored solely by faculty in advance of any student contributions. To use this chapter’s kitchen allegory, the cooks arrived, did their *mise-en-place* preparation, and planned the overall restaurant menu theme long before the restaurant opened to customers.

Secondly, the curricular object created – a “space carved out” for a Sophomore Design Experience – is distinct from both the faculty making it and the students they are making it for. Phrases like “let’s give students real hands-on experience” position the faculty as the givers, the hands-on experience as a thing given, and the students as recipients. This “space carved out” was a course placeholder rather than a course. In the kitchen allegory, this is akin to chefs deciding there will be a soup course, and perhaps that the soup will be vegetarian, without deciding exactly what the soup will be and which recipe will be used.

Finally, the students are positioned as consumers of not just the course, but of the whole four-year curriculum. Rob even portrays the students as “guinea pigs” that faculty were looking out for, “helping them get a good education and not be hurt” by their experimental participation. There’s a sense of caretaking towards students, which fits nicely with the kitchen allegory’s connotations of nourishment and service. Faculty were responsible for making sure their four-year curricular design would progress students through a beneficial sequence that would turn them into engineers.

4.3 Looking at the “Makers” ontology: Affordances

Like any tool, using the “Makers” ontology provides certain affordances. Some of these affordances can benefit certain people in certain ways. In this section, I will describe several affordances of the ontology and the kinds of benefits these affordances might provide when

making sense of faculty roles within curricular change settings. Specifically, the “Makers” ontology affords a clear focus on student learning, faculty commonality, prioritization and gauging of progress, and a broad notion of what “curriculum” might be.

4.3.1 Affords a clarity on roles and prioritization of student learning

The first feature of the "Makers" ontology is that it affords clarity on faculty roles: faculty are to prioritize that which benefits student learning. Clearer priorities assist in clearer decision-making by contributing stability. By setting up "benefit to students" as a fixed goal, faculty can gauge their choices about time and energy against that goal instead of spending energy and time further negotiating what that goal might be.

As one example, take the complex scenario of allocating limited resources for classroom space and renovation, which one faculty narrators was in the midst of managing during our interviews. Mark described the conflicting opinions, voices, and considerations he had to weigh during space allocation discussions. Then he gave an example of how he responds to requests for resources he cannot grant by using student benefit as a clarifying gauge:

I'm like, "Well, sorry, but we have a budget limit, and we need to do stuff that's for the students, not because you need it." (Mark 3, 66)

Mark's response indicates a prioritization of "stuff that's for the students." This fits within the "Makers" ontology framing: in this case, Mark and his TAD colleagues are the faculty makers, and the curriculum they make includes their choices about space usage. After all, things like equipment availability, project storage space, and class size influence student learning. When there are finite resources such as a budget limit, resources are to be directed towards students, as opposed to other things faculty might request, such as larger offices or private lab space or equipment for their individual research projects. Within the "Makers" ontology, Mark's decision to prioritize student experiences is interpreted as a valid choice in the context of his faculty role.

Gary provided another example of a complex scenario that becomes clear in the context of the "Makers" ontology. He described the problem of how to decide whether a curricular change idea was valid or not, and critiqued the notion of change for the sake of change. Again, when faculty are making decisions about how to allocate their time and energy, what criterion determine the potential value of a curricular change project? Gary's answer, like Mark's, invokes the clarity and prioritization afforded by the "Makers" ontology.

"I'm going to oversimplify... sometimes people... they think they have all the answers. So they're always wanting to change [curriculum] just for change's sake. My experience is then when you question why are you doing this, sometimes you find out there's nothing behind it other than just the fact that they wanted to change. So the students, the college, the profession, none of those things were even thought about or considered. It's just this could be cool. Let's try this. Everything, I don't know, from my point of view then should be focused on getting the students to where a good place would be..." (Gary 1, 81, 85)

In this case, Gary and his colleagues are the faculty making decisions about what curricular changes to pursue – what curricula they will make or re-make. Framed through the "Makers" ontology, Gary's statement can be interpreted as requiring curricular change ideas to be filtered through the ontology itself for approval. Is a proposed curricular change "focused on getting the students to where a good place would be"? If so, it is a valid thing for those in a faculty role to spend time on. If not, its validity is called into question. Although Gary lists other factors for consideration, such as "the college" (Berea College) and "the profession" (Technology / Industrial Arts education) they work within, students are his priority consideration. Seen in the context of the "Makers" ontology, Gary's filtering criteria is legible and validated.

The ontological affordance of role clarity via a stable prioritization of student experiences matches Barr and Tagg's description of a paradigm shift in curricular change "from teaching to learning," after their paper by the same title (1995). Instead of thinking about education by looking at what and how faculty are teaching, Barr and Tagg promote a view of education focused on what and how students are learning. After all, they argued, it doesn't matter what faculty are doing if students are not learning from it. This argument only makes sense if one assumes, as the "Makers" ontology does, that student benefit is the determining factor for what matters in curricular design.

Similarly, this ontological affordance aligns with curriculum design workshops and literature that take a student-centered approach. For instance, Olin College's week-long faculty workshop on Designing Student-Centered Learning Experiences (Olin College, 2016) serves as a studio space where faculty teams from different institutions can work through curricular change projects already underway on their campus. As the workshop title suggests, activities are geared towards designing student-centered curricula. For instance, early in the workshop, faculty teams are required to construct fictional student personas inspired by their campus demographics – the anxious overachiever, the first-generation student with significant off-campus work commitments, the evening course part-timer who is also a working parent – and then roleplay through how each

of these personas might experience their current curricular designs over the course of a semester. Workshop participants take on the role of makers of curriculum via a focus on how students experience and benefit from their curricular designs.

As another set of examples, Wiggins & McTighe walk readers through the process of checking how students might receive particular curricular activities as part of their 2005 book, "Understanding by Design." Their book is used by the "Content, Assessment, and Pedagogy" (CAP) course developed by Ruth Streveler and Karl Smith as a requirement for Engineering Education PhD students at Purdue (Streveler, Smith, & Pilotte, 2012). In the Spring 2012 version of the course I was enrolled in, our final project was to design a curriculum. As part of the project, we had to justify our design decisions in light of what our hypothetical students had experienced in the past (prerequisite assumptions) and what we wanted them to leave with in the future (enduring understandings). For instance, I chose to make a workshop series on academic blogging (the curriculum) for the benefit of non-blogging scholars (the students) by introducing them to tools and practices like Wordpress and open licensing. I was initially stymied by the near-infinite variety of resources and activities I could draw from in this domain, and directions to filter these by potential student benefit were helpful in whittling the corpus down to a manageable size. Anything that worked towards that benefit for that audience was kept; anything that did not was discarded. This sort of framing and clarity is part of the sensemaking afforded by the "Makers" ontology.

4.3.2 Affords unification of faculty and their goals

Another feature of the "Makers" ontology is that it affords faculty unification. Regardless of their other differences, faculty can use their shared relationship to curriculum and students as a space of commonality. As fellow inhabitants of the faculty role within the "Makers" ontology, they share a responsibility towards student learning. This starting point provides a way for faculty to get on the same page and direct their efforts towards a common goal, even when they may otherwise be in conflict.

As one example, all three TAD narrators talked about how the past few years of division instability had influenced their curricular work on D&D. Mark set the scene for his description of D&D by describing the influx of faculty hires, retirements, and departures as a "revolving door" (Mark 1, 27) that had only recently settled.

This is the first time since I have been here that I feel we have a core group of faculty. There is 5 of us all kind of sitting down together and having real discussions about the curriculum... From a program standpoint, we are still in the process of coming together. One of the things we talk about [is that] we don't even have necessarily a modern, updated, agreed-upon mission. There is 5 individuals, if you include [our admin] Sandy that's 6, working together to provide an education for students to go out in a broad field, yet the 6 of us have yet to sit down and come down to an idea. (Mark 1, 21, 94-96)

The teaching team for the D&D course redesign consisted of 4 of the 5 faculty "individuals" that Mark mentioned. The team had a wide variety of backgrounds, perspectives, and time spent teaching within TAD, ranging from over a decade to less than a year of experience. With the teaching team "still in the process of coming together," conflicts arose. There were "a lot of tense moments early on" (Mark 2, 84) due to philosophical disagreements on how to address certain aspects of the course. However, when students appeared at the start of the semester, the faculty began to come together.

And then when we actually finally had to get to the point where we were doing things with the students, I think that maybe helped [a disagreeing] person understand a little more about it... And that would be the 'rubber meets the road' piece. (Gary 3, 60)

[The] rubber met the road, we were no longer arguing over theoretical stuff. Now we're in the practical stage and everyone kind of aligned." (Mark 2, 84)

Framed through the "Makers" ontology, this story can be read as the D&D teaching team banding together to collectively fulfill their faculty role as curriculum makers. "Doing things with the students" right in front of them served as a concrete point of unification. In the context of this ontology, it makes sense that the appearance of students would trigger faculty unification; serving those students is an already-shared priority by virtue of how the "Makers" ontology defines the faculty role. As Mark explained it, "it's one of those things that I think everyone... if you say we're working on this for the sake of our students, boom. You have the attention of the room. You know, in one way, shape, or form" (Mark 2, 133).

Curricular change projects can be complex and chaotic. In a constantly changing situation, interacting with a group of colleagues who are themselves constantly growing and changing, it can be difficult to "come down to an idea." In the "Makers" ontology, the curriculum is an artifact that is separate from both faculty and students. Framing curriculum as an externalized object allows it to serve as a boundary artifact and point of discussion among faculty. Similarly, framing students

as an externalized group allows faculty to see themselves as alike in their relationships to that group. When the "Makers" ontology is a shared underlying assumption amongst a faculty team, it can provide a common baseline from which faculty can discuss their conflicts and come to consensus; regardless of what they may disagree on, they are all there to make curriculum for the benefit of the students.

4.3.3 Affords faculty motivation through difficult tasks

Another feature of the "Makers" ontology is that it affords motivation. Being a faculty member in the midst of curricular change and experimentation is a difficult job. However, the desire to fulfill one's role as a maker of curriculum for the benefit of students can serve as a motivator for faculty members to do difficult things.

For example, Jon described a critical incident from his own early involvement in the UOCD project. UOCD was a sophomore-level course focused on user-centered design and taught in a studio format. Jon was a new faculty member at Olin who had been recruited as a studio instructor. Jon had never encountered user-centered design before, nor had he taught in a studio environment; the whole curricular setup was foreign to him. The studio co-instructor Jon had been paired with was in a similar situation – in fact, most of the studio instructors were in a state of uncertainty and bewilderment. As Lynn, another early UOCD studio instructor, explained it, "we had students doing deep dives into the lives of various user groups, and that meant that a lot of us were coaching them on things we'd not done before" (Lynn 1, 245).

Faced with a classroom full of student teams working independently on projects that they had little to no experience with, Jon and his co-instructor retreated. As Jon summarized it, "this [story] is the one of [my co-instructor] and myself sitting in UOCD and basically [being] paralyzed, not knowing what to do or how we should engage" (Jon 6, 164). Instead of diving into the projects of their students, they sat in the studio classroom doing their own work, physically present but otherwise relatively disengaged. It took several weeks for Jon and his co-instructor to realize what was going on, but that moment of insight catalyzed a change in their curricular engagement.

A few weeks into the semester, [my co-instructor] and I kind of recognized around the same time we weren't doing much of anything in the class... I will never forget one day in the studio, all the students were working... [My co-instructor] and I are sitting on our laptops doing some other work, next to each other, hanging out and having a conversation and getting a little work done while students are on their own.

And we looked at each other and had this moment, "Oh shit, we are not doing anything useful and certainly not helping our students in any way." We were there, present, chatting with students on occasion, but in terms of facilitating student learning and development and supporting it, I think we were doing a horrible job.

I think we both realized, we didn't know what to do, we hadn't internalized this new way of thinking design and so we didn't really get it. We couldn't do anything to help students get it and base their behaviors or activities or some kind of new understanding of what they were doing. It was a transformative moment for me.

[I turned to my co-instructor and said,] "Hey, we can help each other through this. Let's figure out what is going on, what we need to learn and actually change our behavior." (Jon 1, 120-128)

Jon and his co-instructor were successful at turning their behavior around after that critical incident. As Jon tells it, "from that moment on, we became much more active and engaged members of the UOCD teaching team" (Jon 6, 166). However, it was a difficult journey into unfamiliar material, and Jon had to endure confusion and discomfort as part of his learning process.

My experience was... especially in the first couple of UOCD sessions in the auditorium where [the lead instructors] would do a lecture on design thinking... I would just be sitting there kind of in awe with my mouth hanging open... I recognized it was really hard and it was language I wasn't used to using. It was a stretch. It was really stretching me in ways that were at times kind of uncomfortable. (Jon 3, 87)

This UOCD studio moment was a critical incident for Jon; he describes it as a "transformative moment" and discussed it again in his 2nd, 3rd, and 6th interviews. Read in the context of the "Makers" ontology, Jon's critical incident can be interpreted as a realization that he and his co-instructor were violating their faculty roles by "not helping [their] students in any way," since student benefit is the *raison d'etre* of the "Makers" faculty role. Again, this is one possible interpretation of Jon's UOCD story that utilizes the "Makers" ontology. Whether this is the interpretation that Jon "really meant" is beside the point; the UOCD story can and will be told in the context of other ontologies in later chapters. However, the "Makers" ontology can be used to make sense of Jon's critical incident as an attempt to fix an ontological violation.

The "Makers" ontology provides guidance on what sorts of things Jon and his co-instructor *should* have been doing in their UOCD studio. If Jon and his co-instructor were inhabiting the faculty role, they were supposed to be making curriculum for the benefit of the students. In this case, the curriculum included their actions in the design studio, which shaped the course

environment students were learning from. To borrow Jon's words, a curricular contribution might have involved actively "facilitating student learning and development and supporting it." For instance, they could have proactively checked in with student teams about how they were progressing towards deadlines. They could have gone around looking at in-progress prototypes and giving feedback. Instead, they were "sitting on our laptops doing some other work," which meant, according to the role definitions of the "Makers" ontology, that they were "doing a horrible job" of fulfilling that faculty role.

When Jon and his co-instructor recognized the disconnect between their faculty roles as envisioned and performed, they were motivated to resolve that gap. Jon's suggestion to his co-instructor proposed "figur[ing] out... what we need to learn" in order to "actually change our behavior" so they could fulfill their role as faculty. They were successful in doing so, "bec[oming] much more active and engaged members of the UOCD teaching team," even if that involved being stretched "in ways that were at times kind of uncomfortable." The desire to fulfill their role as faculty required them to improve their skills for supporting students and motivated them to learn design concepts and studio teaching practice.

The motivational affordance of the "Makers" ontology means that it can make sense of why faculty learn and grow in terms of their identities and worldviews. Personal transformation can be difficult, but the desire to perform the faculty role well can act as a motivator to persevere through whatever one needs to go through in order to better serve students. As Mark phrased it elsewhere, "it is not about you, it is not about me, it is for the students. If you are doing something wrong or maybe something could help them better, why wouldn't you." (Mark 1, 210) In the context of the "Makers" ontology, faculty actions are validated if they increase faculty abilities to make curriculum for the benefit of the students.

4.3.4 Affords a broad view of the forms curriculum might take

The fourth and final feature I will discuss for the "Makers" ontology is the way it affords broad interpretations, and even radical reconceptualizations, of what "curriculum" is allowed to be. In actuality, it affords a broad interpretation to all three roles: faculty, curriculum and students. However, I will focus on the curricular component here, with a note that the same techniques can be used to extend the role boundaries for both faculty and students.

By holding the relations and separations of faculty, curriculum, and student roles constant, the items included within the boundaries of each role can be shifted and enlarged. The only requirement is that the role boundaries themselves stay solid and distinct relative to each other, and that things considered part of the “curriculum” be made by “faculty” for the benefit of “students.” In other words, any curriculum-making that benefits students can be considered a valid part of a faculty role. Any engagement with faculty-created learning experiences, regardless of formal course or credit status, can be considered a valid part of a student role. Any scope, scale, or format of curriculum is valid, so long as it is made by faculty for the benefit of students.

If "curriculum" is defined as something made by the faculty for the benefit of the students, it can take any form that fits that criteria. So long as they prioritize student benefit in their decision-making, faculty are free to pursue making whatever curricular designs they want (subject to other constraints such as time, resources, and faculty skillsets, of course). Curriculum need not take a specific format; whether a class is large, small, lecture-based, project-based, introductory, upper-level, or any other criteria does not affect its ability to be a "valid" part of the curriculum. In fact, within the "Makers" ontology, curriculum can include things that are not formal, for-credit coursework at all.

For example, Mark discusses his undergraduate advising meetings as experiences he creates for students in order to foster their growth. Framed by the "Makers" ontology, Mark is a faculty member making a curriculum – a series of informal, spontaneous lessons with students who come to his office – in order to benefit his students by teaching them professional behavior. The first excerpt below portrays a curriculum for "how to enter someone's office politely," and the second portrays a curriculum for "how to engage your project team."

I even think sometimes it comes down to basic manners, sometimes. Students come walking in my office, I'm like, "Did I invite you in?" They're like, "No." I'm like, and I have 'em go out, stand by the door, knock on the door and say, "Excuse me, Doctor Mahoney." "Alright," and stuff like that. (Mark 3, 110)

In an advising meeting [I had with a student about his project team]... we talked very critically about the fact that he was relying on other people to do something, but he himself was not engaging with any of this until they did something. Having that heart to heart in that real life [context]... And he seemed like he had the "aha moment," but time will tell, obviously. (Mark 3, 106-107)

The "Makers" ontology affords a reading of these brief, informal interactions as "curriculum." Elsewhere, Mark spoke of wanting to teach his students not only content, but things

"that will affect [them] as a parent, as a person, as an employee," (Mark 3, 92). Some of this teaching occurs outside the context of formal coursework. The interpretation afforded by the "Makers" ontology allows that teaching to be legitimized as "curriculum" nevertheless. Framed by the "Makers" ontology, Mark's informal interactions are no less "curricular" than D&D and the other formal courses he instructs. After all, these spontaneous lessons are made by a faculty member (Mark) and are oriented towards benefitting students (teaching them basic professional manners and teamwork skills). According to the role definitions set forth in the "Makers" ontology, they fulfill the requirements to be considered "curriculum" even if they fall outside of formal course boundaries.

The "Makers" ontology can also make sense of curricular elements that stretch across formal course boundaries. For instance, Gary and Alan talked about skills that are or should be present in multiple places across the TAD major. Gary describes the skill of design critique; Alan describes the design process, the skill of approaching a sophisticated technology with non-intimidation, and the practice of iteration.

The way I view our major, that should be habit of mind sorts of things... when I walk into a room like this, I notice what the walls are made of, and the ceiling is made of, and [what the] furniture is made of, and if it's a good design, it probably has a reason... If it's a good design, everything is there for a reason, and you immediately look through that and you think, "I could improve this by doing that, or improve this, or change this around." I think there's a habit of mind you would like to move toward. (Gary 1, 118)

Yes. The design process we want to be habit of mind. [Regarding] our high tech tools, [my colleague] said students that come through our program... they should think of a 3D printer as... no more sophisticated than a pencil and paper, or as easy to use as pencil and paper. (Alan 1, 169)

We're really pushing design iterations, making changes, keep improving... Now I am seeing, "Oh, yeah, they're doing the same thing in the Design and Documentation (D&D) class." "Oh yeah, they're doing the same thing in the Woods class." So yeah, it's becoming more visible now that it's being reinforced in every class that we teach. (Alan 2, 69-71)

Gary and Alan describe these aspects as "habits of mind" that can be taken across course boundaries and "reinforced in every class we teach," as well as outside of classes, as when Gary "walk[s] into a room" and automatically notices the design of the built environment around him. The conceptualization of "curriculum" within the "Makers" ontology is not limited to isolated course objectives, but speaks to a broader sense of how to encounter things in the world.

The broadness associated with this conception of “curriculum” is echoed in initiatives to teach various topics across it, as in projects to teach writing, critical thinking, mathematics, and so forth “across the curriculum.” Some examples within engineering education literature include Cruz & Frey’s paper about “integrating ethics across the curriculum in engineering” (2003) and Manuel-Dupont’s JEE article on “writing across the curriculum in an engineering program” (1996). Such efforts make perfect sense within the “Makers” ontology, which does not restrict “curriculum” to any specific scope, scale, or format.

The “Makers” ontology affords a broad view of what curriculum and curricular actions can be considered legitimate, including curricular fluidity. Within this ontology, mid-course curricular changes such as the D&D vocabulary consolidation are not “wrong,” they are simply illustrations of how faculty make curriculum responsively for the benefit of students. Framing curricular change through the “Makers” ontology opens a space where ongoing curricular innovation is not just permissible, but actively desired inasmuch as it can improve the student experience. If the notion that “faculty make curriculum for the benefit of students” is construed as a fundamental truth, then faculty will naturally try different things, even difficult things, if it will help their students learn.

5. ONTOLOGY: FACULTY ARE INHERITORS OF CURRICULUM AND STUDENTS

I saw my role as having the next leg of the baton race. (Rob 2, 46)

We have not inherited this earth from our parents to do with it what we will. We have borrowed it from our children and we must be careful to use it in their interests as well as our own.

– Moss Cass

The “Inheritors” ontology portrays faculty as people who inherit an intertwined assemblage of curriculum-inhabited-by-students. As with the “Makers” ontology in Chapter 4, the “Inheritors” ontology can be used to interpret many everyday faculty comments. In other words, many faculty comments make sense if the reader presupposes that the role of faculty is inheriting – and responding to – an intertwined assemblage of curriculum and students. For example, within the narrative dataset:

1. Lynn described how “[One professor]... was the lead for the sophomore design project. He left and went back to [his old institution] before the sophomore design project was ever taught. And we hired Ben Linder [and told him,] Ben, please save the day” (Lynn 1, 93-96, 314). This can be interpreted within the “Inheritors” ontology as a description of Ben’s role as a faculty member who inherited a course, complete with enrolled students, and needed to figure out some way to handle it.
2. Gary described how “we’re gonna hire a new person to teach [the D&D course]... And then we’re gonna have to do something, whether we team teach with this person or whatever, to try to get them to what we think is important, plus be open to whatever they think is important, that we can then put through our program to improve the program” (Gary 3, 122, 124). Read through the “Inheritors” ontology, Gary is setting expectations that the new hire will inherit the work done by previous instructors of the course, and go through a process of negotiating how to take on that work themselves.
3. Mark explained how he “did this [D&D] course this way to better prepare them for the senior seminar course... trying to interweave those underlying concepts, foundational elements, into this early course... But we expect to see a difference, especially in the senior course, as more students get exposed to it” (Mark 2, 148-153). Within the “Inheritors”

analogy, this can be read as Mark's description of students as a curricular object handed from one faculty to the next; as in Rob's "baton race" quote above, curricular change choices affect the next person in line.

The three examples above make sense within the faculty (and curriculum and student) roles prescribed by the "Inheritors" ontology. Again, this is not the only way these narrator comments can be read; other interpretations and underlying ontologies are also possible. However, the above statements, along with the more extended examples given in the remainder of this chapter, are rendered legible via the role assumptions that faculty are inheritors of curriculum and students, and that these role assumptions are a fundamental part of the reality of curricular change.

This chapter is divided into the same three sections as the preceding one. The first section introduces the ontology, the second section looks through it at the faculty narratives told for this project, and the third section looks at the ontology and discusses its features and affordances. Together, the three sections provide multiple angles on how the "Inheritors" ontology of curricular change makes sense of faculty roles.

5.1 Introducing the "Inheritors" ontology

In this section, I introduce the ontology in two different ways. First comes a theoretical discussion of the ontology, which consists of three roles that stand as separate philosophical components. Second, I provide a playful allegory of faculty "inheritors" as new homeowners and landlords surveying a house inhabited by tenants and under constant renovation.

5.1.1 Theoretical introduction – intertwined curriculum and students

As in all four ontologies, the "Makers" ontology correlates the faculty role with the philosophical concept of the Self, the curricular role with the World, and the student role with the Other. In this ontology, the faculty role is distinct from the curricular and student roles. The curricular and student roles are intertwined. The image below shows the relationship between all three ontological components, and the paragraphs that follow address their corresponding roles in turn.

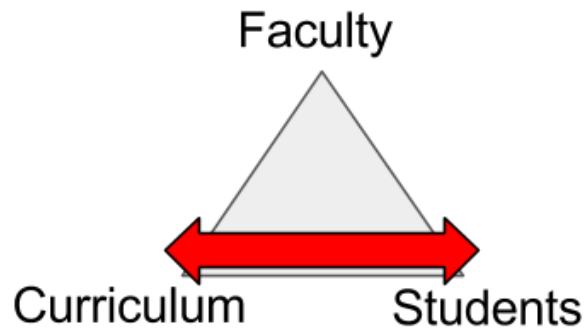


Figure 5.1. Component relations: Curriculum and students joined

In the “Inheritors” ontology, faculty are portrayed as inheritors of curricula, newcomers stepping into a world created by others before them. Faculty are shown as separate from the curriculum-student assemblage and are portrayed as entering it “from the outside.” They have agency to change the curriculum and influence the students within it, but must first learn the nature and history of the curricular culture they are changing.

Within the same ontology, the curriculum “inherited” by faculty is inhabited by students who continue to live within and influence that curriculum. The boundary between the curriculum and the students as others who influence it is blurred; in a sense, faculty encounter their inherited curricula partially in the form of students, as students embody curriculum by being part of the world these faculty must come to know. Although students may be unfamiliar with certain aspects of curricular content, they already “know” aspects of the curriculum because they are parts of that curriculum – carriers of the learning cultures faculty are encountering. Anything that is inherited must have existed before the inheriting party took ownership of it, and the backstory of how things have come to be the way they are is crucial to understanding what it currently is and how it might be influenced in the future. The curricular and student cultures that faculty inherit have a rich past, and the “Inheritors” assemblage highlights the existence of that past.

5.1.2 Allegorical introduction – Homeowners wearing safety goggles in a renovation

One way of playing with the ontology and making it more concrete is to cast it into an allegory and see what connections this generates. In the image below, and in the remainder of the chapter that follows, I use a renovation allegory: faculty are portrayed as new homeowners

strapping on their toolbelts and stepping into the ongoing renovation of a huge house that is also swarming with occupants. The house represents the curriculum; the occupants represent the students. The ontology itself is portrayed by a set of safety goggles worn by construction workers or machinists. This signifies the potential for unexpected surprises that an "inheritor" role implies; it is exciting and full of possibility, but also contains elements of possible danger.

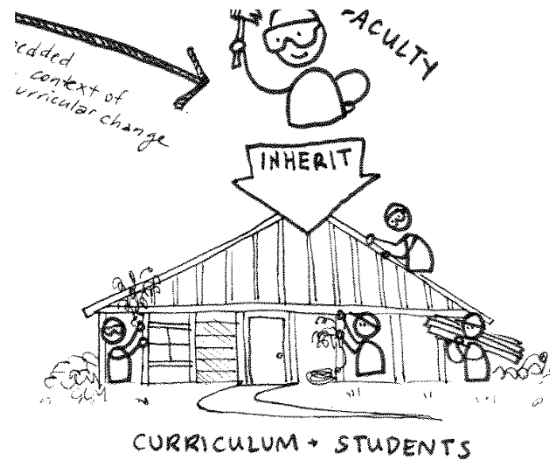


Figure 5.2. Allegory of the landlord (close-up from Intertext 3)

The house and occupants are tightly bound together; they come as a package. One cannot renovate the house without affecting the current occupants, and the occupants are constantly modifying the house as well – wearing out the carpet, unclogging the sink, stacking bookshelves to make temporary walls. Anyone inheriting an inhabited house needs to make sense of its dynamics and its history as part of navigating what sorts of changes they will make to it. Similarly, in this ontology, faculty need to make sense of the interacting assemblage of curriculum and students and how that curricular-student culture has come to be.

I chose a home renovation image to represent this ontology for its connections to shelter and constant adaptation. Just as renovating a house affects the lives of the people who live in it, engaging in curricular change affects the lives of the students already present. Home renovation is a responsive act; it is done to fill the needs of specific people that have, are, or will inhabit the house. Similarly, this ontology portrays curricular change and navigation as needing to learn and respond to the history and culture already underway. Finally, the act of inheriting a house or a curriculum places faculty in the position of a new sojourner into that existing culture; they need to

first understand the situation they are encountering before they are able to make any changes to its structure.

5.2 Looking through the “Inheritors” ontology: Stories

This section presents several stories from within the “Inheritors” ontology. In other words, if one assumes the “Inheritors” ontology is in fact the underlying reality of curricular change, and decides to “look through” that perspective at the narrative dataset, what do the narratives look like? I begin with a brief presentation of all five main projects from within the “Inheritors” ontology. Following this, I dive deeper into two examples: the TAD faculty covering the course of a colleague who left, and the TAD faculty responding to changes in the field of Industrial Arts.

5.2.1 Project narratives framed via the “Inheritors” ontology

Each of the projects mentioned in Chapter 3A can be narrated utilizing the "Inheritors" ontology. In other words, entries from the table below can be used to fill in the following sentence: The story of (Project) portrays (Faculty) as inheritors of (Curriculum) and (Students). For instance, using the second row of the table yields: "The story of (D&D) portrays (the four TAD faculty who agreed to co-teach the course at the last moment) as inheritors of (a foundational TAD course that introduced the design process and had been taught by the same faculty member since its last revision until his sudden departure) and (the students who were already enrolled in that course for the upcoming fall)."

The table entries are brief, and serve only as brief examples and introductions to potential story framings that make sense within the “Inheritors” ontology. Some of the projects outlined in the table will be expanded upon as examples in the remainder of this chapter. The final row of the table has been left blank as an exercise for the reader (that's you) to fill in an example from your own experiences with curricular change.

Table 5.1 Inheritors ontology view of projects in the data

The story of (Project)	Portrays (Faculty)	As inheritors of (Curriculum)	And (Students)
(the) TAD self-study	Members of the TAD Division at Berea College involved in the division renaming debate	A changing field in which other Industrial Arts programs were renaming themselves en masse	Incoming TAD students who had fewer opportunities for Industrial Arts exposure compared to prior generations
D&D (Documentation & Design)	The four TAD faculty who agreed to co-teach the course at the last moment	A foundational TAD course that introduced the design process and had been taught by the same faculty member since its last revision until his sudden departure	The students who were already enrolled in that course for the upcoming fall
Olin's early days	The "founding faculty" at Olin who arrived before students and were tasked with co-designing the first courses	A multitude of ideas and prospective requirements for an "innovative" undergraduate engineering curriculum that had not yet been implemented	Olin's first class of incoming students, who were in the process of being admitted and/or participating in early-stage curricular design
UOCD	The first cohort of UOCD instructors, most of whom had no prior design studio teaching experience	The first run of a course on user-centered design, created by two faculty members with a background in the field	The first batch of sophomores, who had all enrolled in the course as a graduation requirement
SoH	Rob, a history professor, and Jon, a materials science professor	A course taught in parallel with UOCD, an adjacent curriculum that ended up heavily influencing SoH	Students who were simultaneously in UOCD and SoH
Reader project:			

5.2.2 Example from D&D: covering the course of a faculty member who left

D&D: (The four TAD faculty who agreed to co-teach the course at the last moment) were inheritors of (a foundational TAD course that introduced the design process and had been taught by the same faculty member since its last revision until his sudden departure) and (the students who were already enrolled in that course for the upcoming fall)

The story of the four-person D&D co-teaching reboot is one that can be told within the "Inheritors" ontology. In this story, the faculty originally assigned to teach the course abruptly departed over the summer, and the remaining four faculty decided they would fill the gap together.

In this case, the faculty inheritors were the four co-instructors, and the curricular-student assemblage inherited was the D&D course teaching assignment and the students already registered for its two sections. Framed through the “Inheritors” ontology, this is a story of how D&D faculty responded to their inheritance of unexpected responsibilities.

D&D is a foundational course for the TAD major. It is a required course not only for graduation, but as a prerequisite to taking any other core course within the major. As a curricular gateway, its shutdown would be catastrophic; without the ability to take D&D, students are effectively blocked from starting the major at all. This meant that when the faculty member assigned to teach D&D departed at the start of the summer, the TAD division was left with a critical gap to fill.

We've had a lot of changes that have occurred... both in the direction of the program and a certain change in staff. During the summer, we lost a faculty member. We had one that left. So there was a course that was available, that had to be covered. (Mark 2, 18-20, 252)

It was, basically, "Okay, how do we cover this course?" (Alan 2, 44)

So I guess the first chapter [if this story were a book] would be, "Oh shit." We knew what was gonna happen, [but] we didn't know when it was gonna happen. Then it happened... [on] July 11th... so we had to do stuff. (Mark 3, 175-178, 187)

The thing the TAD division knew "was gonna happen" was the creation of a faculty-shaped gap – the need for a course to "be covered." They had expected their colleague to depart at some point, but not in mid-July, with the semester starting in late August. As Mark's sentiment of "oh shit" points out, this is a stressful situation; there wasn't a lot of time to plan, and there weren't a lot of options available. Berea is in rural Kentucky, and searching for adjuncts to cover a unique, cross-disciplinary course that wasn't offered at any other colleges was not likely to be a fruitful course of action.

This meant that the remaining faculty were suddenly responsible for deciding who among them would be covering the course. All of them were already carrying a full teaching load for the semester; anyone taking on D&D would be accepting a teaching overload. Additionally, the four faculty members had varying levels of experience with the course material. Some had taught it before, but not recently; others were new and had never taught it at all.

Well, some of us have never taught this course, or taught it 10 years ago. (Alan 2, 44)

I don't think it would be a good assumption that all four [of us] were capable of teaching the class. I don't think it's a true statement. One person hasn't had all the coursework in one area. And one hasn't had it in a long time. And another person could possibly update their skills. (Gary 2, 16-18)

The TAD division looked at the abilities of each of their faculty teammates to cover the course and realized that not everyone was fully prepared to teach D&D. They decided on a goal: all faculty in the division should be able to teach the course. In order to achieve that goal, all faculty in the division would teach that course... at the same time. The inheritance of responsibility they received was involuntary, but their response of how to share it, and who would be sharing it, was deliberate.

And so we said, Well, everybody should know how to do this. And so we decided... We had two people that knew what they were doing... So, let's just team teach it. We just saw this as an opportunity. (Alan 2, 44, 59)

We looked at our schedules, and... we all had free times. Here's an opportunity that we can really work together. And there's no point leaving anyone out of it. This is something that we've said is foundational. We should all be involved in it. (Mark 2, 17, 27-29)

And I think it was sort of looked at as an opportunity to where maybe the person that's from outside the area could maybe get an idea of where the area looked like. (Gary 2, 17)

All three TAD narrators describe the D&D situation as an "opportunity" the division decided to take in order to develop their collective ability to teach the course. In other words, the TAD faculty deliberately framed the course as a faculty development situation. The cost was nontrivial; agreeing to the team teaching arrangement meant that everyone was also accepting a teaching overload. I include this part of the story in order to emphasize how high a value the teaching team placed on this development opportunity.

I know for me, it was a complete overload, and I think some of the other people had to overload their schedules a little bit in order to be able to do that. (Gary 3, 97)

So on paper it doesn't sound like a smart move... we got four people teaching two classes... So yeah, people are overloaded by doing this. (Alan 2, 53, 59)

[We're teaching week-to-week] because we're all teaching overloads. We don't have the time, really, to dedicate any other time to it. (195)

Part of developing their shared ability to teach D&D was a desire to "get on the same page" about what the foundations taught in D&D were. If faculty were supposed to use their advanced

courses to build on design topics introduced in D&D, they first needed to understand what those topics were. By having all four TAD faculty co-teach D&D during the same semester, they could situate themselves within a common space and build an understanding within that shared experience.

There is a lack of consistency, a lack of understanding. We are trying to get people be on the same page, have a community understanding of what it is we are doing. (Mark 1, 260)

I think when we're done teaching this course, the four of us, I think we'll be on the same page as far as design and what it means and what it means for our students. (Alan 3, 94)

After a semester of teaching week-to-week on overloads, the teaching team stepped back to reflect on how they had done. They had progressed towards their original goal of developing their collective capacity to all teach D&D as a foundational course. Furthermore, they had a better idea of where they were as a department: what the class was, how students experienced it, how to collaborate with one another. All these aspects of development are ongoing, and reaching perfection is impossible; however, learning can and did occur.

I can't answer where everybody came out on that, but at least we've had that common experience. I think where they're at now versus where they started, is a positive direction. (Gary 3, 126-129)

So, now there's a lot more sharing, people know what's going on with each other and we'll have a better idea of what students, if they've taken this course, what they should be able to do in the follow-up courses. (Alan 2, 23)

Note two things about this story, told from the perspective of all three TAD narrators. First of all, the "Inheritors" ontology frames the TAD faculty as people who went through a clear state transition: they were not teaching D&D, and then they were. Some of them had taught D&D before and others had not, but none of them started the story already in that position. Someone else had been teaching it immediately previous, and now it had been handed down to them. To use this chapter's renovation allegory, the house ownership transferred – or perhaps they crossed the threshold of the door.

Secondly, the inherited assemblage is neither curriculum alone nor students alone, but the two together in a specific situated context. It is not an abstract notion of a course, but rather two specific sections during a specific semester, in which specific students were enrolled. The gap

inherited contains the responsibility of developing specific students in the specific context given (time, place, learning objectives, and so on).

5.2.3 Example from the TAD self-study: navigating changes in Industrial Arts

TAD self-study: (Members of the TAD Division at Berea College involved in the division renaming debate) were inheritors of (a changing field in which other Industrial Arts programs were renaming themselves en masse) and (incoming TAD students who had fewer opportunities for Industrial Arts exposure compared to prior generations)

The story of how TAD faculty explored their division's relationship with the changing field of Industrial Arts is one that can be told within the “Inheritors” ontology. In this story, the TAD division drew on the reflections that led to a major decision in their self-study process: changing their division name. Previously, the program had been called Industrial Arts. After the change, the program was known by its current name of TAD (Technology and Applied Design). Here, the TAD division faculty serve as the faculty inheritors, and the curricular/student assemblage involves Industrial Arts and high school students who may or may not have encountered it before. Framed through the “Inheritors” ontology, this is a story of how TAD faculty inherited the changing history of a discipline and its subsequent effects on incoming students.

As in most colleges, incoming TAD majors are heavily influenced by the K-12 system that formed them. Specifically, their background exposure, or lack thereof, to TAD's field of study influences how they are able to engage with TAD courses and concepts. Gary and Alan both mention the current student generation as different from prior years, when the prevalence of pre-college exposure to hands-on activities and Industrial Arts was greater.

When I first came here at Berea in 1989, there were still some very active Industrial Arts programs in the public schools. And that faded away and our students were coming with absolutely no knowledge of anything that we do here... very, very few if any are coming with any kind of machine work. Whether it be CNC machine or regular, manual machines. Very few students have any experience coming out of high school any more. (Alan 3, 39, 44)

Having taught at a time when there were lots of students that came from agricultural backgrounds, they had to get results and if something broke they had to fix it. That kind of thing, you had a population coming in that was at a much different level than say the video game culture... (Gary 1, 62)

20 years ago you would have students... most of them were males. They would come to college already knowing how to use a lot of the equipment and do things, but... that's changing. (Alan 1, 57)

Gary and Alan are both experienced faculty who have been teaching in their field for many years. Both grew up and were schooled as Industrial Arts practitioners in a different era. They remember the field's history as something they have lived through.

Entering the ongoing discussion of what their field was called, TAD faculty learned that there was a national trend away from using the name "Industrial Arts." Not only was their field becoming less prevalent in high schools, it was starting to change its own name, often including the word "Technology" in the new moniker regardless of whether the name change reflected an actual or idealized shift in implementation (Foster, 1994). The name change from "Industrials Arts" to "Technology" was not happening in a unified or centralized manner, but here and there as individual college programs renamed themselves over time. As part of the self-study, TAD decided to rename itself to use the word "Technology" as well, but also wanted to highlight its emphasis on design.

[I was] attending conferences... attending multiple professional organizations to understand the direction that the field was going in... if you look at the history of Industrial Arts, it has sort of a long transitional history. When you deal with things in technology, they're always in flux and always chang[ing]. We surveyed all the constitutions and there were two left with Industrial Arts in the title in the whole country. So it was quite obvious that was an outdated term at that point and that we needed to move it. So we needed to change it. (Gary 1, 34, 77, 99)

That is when the name change [at TAD] started. Industrial Arts is an old name. Not that it is a bad name but it is associated not necessarily with the highest line of our field. So let's change the name, get something that reflects what we do better. (Mark 1, 113)

[Before,] the Industrial Arts was... more craft oriented... With the adoption of computers becoming a lot more prevalent, again, they started calling it "Industrial Arts and Technology." Over time, "Industrial Arts" became a term that was no longer appropriate. So it was dropped pretty much across the board throughout the United States...

You won't find Industrial Arts as a term in any program [name] today... it's going to be some form of [the word] 'technology.' Could just be [called a] 'Technology' program, [or] 'Industrial Technology.' Some programs use [the word] 'design' in there like we do. That was a very intentional choice for us to add 'design' into the title of our program instead of just technology where you might learn how to use

machines and learn how to make things. We really want to emphasize how important it is to design things. (Alan 1, 26-30)

The name choice of "Technology and Applied Design" was an intentional choice that fit what TAD faculty perceived as their division's existing identity. As Gary put it, "Our program has always been applied... [and] I think design has always been a part of TAD" (Gary 1, 95, 143). The field of Industrial Arts was changing, their students' exposure to Industrial Arts was changing, and so the division's relationship to the thing called "Industrial Arts" changed as well.

Note several things about this story, told from the perspective of Alan and Gary, the two more experienced TAD narrators. First, the "Inheritors" ontology frames the TAD faculty as participants in a larger system subject to historical trends and forces they did not control. The field of Industrial Arts – or what we might call technology education – was changing on other campuses across the country. The K-12 system that educated their incoming students had cut Industrial Arts experiences, so their incoming student body had less hands-on fabrication experience. Many decisions, made by many other people, rippled out to shape the complex systems the TAD division had to work with and within for any curricular change project they wanted to undertake.

Secondly, the students and curriculum are intertwined. The students entering the TAD major are shaped by the Industrial Arts trends as played out through their high schools. Since Industrial Arts as a field was becoming less and less commonly offered in K-12 education, students came into college with less and less experience machining. This applies to informal curriculum as well; in the absence of a formal Industrial Arts course, incoming students could have learned to fix mechanical devices by growing up on farms. However, they did not acquire those learning experiences either.

Seen through the "Inheritors" ontology, curricular change is a complex inheritance. The inheritance of a course responsibility intersects with the state of existing lab equipment, course schedules, campus culture, college policies, and more. To use the renovation allegory, the inheritance is not "just" the building and the land it stands on, but everything and everyone touching that land: tenants and their rent agreements, the furniture, the water and electric hookups, the leak in the basement, town ordinances, and so forth.

5.3 Looking at the “Inheritors” ontology: Affordances

Like any tool, using the "Inheritors" ontology provides certain affordances. Some of these affordances can benefit certain people in certain ways. In this section, I will describe several affordances of the ontology and the kinds of benefits these affordances might provide when making sense of faculty roles within curricular change settings. Specifically, the “Inheritors” ontology affords an explicit acknowledgement of history, a framing of curricular change as a site for faculty development, visibility around the complex and interacting nature of that development, and an active student role in embodying aspects of the curriculum that faculty inherit.

5.3.1 Affords an acknowledgement of known and unknown curricular change history

The first feature of the "Inheritors" ontology is that it affords explicit acknowledgement of curricular change history. In other words, this ontology is explicitly not ahistorical. The curricular-student assemblages that faculty inherit have been shaped by many forces, many stories, many people, and many power dynamics. Faculty are not only initiators of curricular change; as inheritors, they also respond to what is already there when they arrive.

For example, Jon's story of the worst headache of his life can be framed with the "Inheritors" ontology as a new faculty member's first encounter with a chaotic curricular history. It occurred within the context of Olin's early days, when the students had not yet arrived and the curriculum was still in formation. Jon was an early Olin faculty member, but not part of the very first round of hiring. Upon arriving, he tried to find out what was already happening in terms of curricular design.

So my first day here, I made a point of going around and talking to as many people as I could, that included the 8 faculty here before me, administrators and staff people, and I basically wanted to get people's take on what Olin was, kind of their vision for the place. At the end of the day... [a colleague asked,] "What are you hearing from people?" I said, "That is the interesting thing, I am hearing all sorts of different things, lots of different ideas."

His next question, I thought was pretty insightful. He said, "Are they compatible, these different ideas? It was a long, long pause before I responded, and I think I said... "I am not sure if they are compatible." After that I went on to the back porch... by myself at the picnic table, trying to process everything including what he said, and I developed the worse headache I think to this day I ever had in my life... as much as I could tell, it was very much due to like overworking my cognitive processes, trying to make sense of all these different inputs, and I couldn't do it, and it was quite a struggle. (Jon 1, 158-164)

Framed via the "Inheritors" ontology, I can portray Jon as inheriting joint title to an ongoing, chaotic, mishmash of curricular ideas. The discussion had already started, and he was now entering into it, trying to make sense of it, and struggling. The important thing to note here is that the curriculum did not begin with Jon – in a sense, even the classes Jon designed did not begin with Jon. Jon's curricular change work at Olin occurred in the context of a culture that preceded his arrival. He needed to learn how to navigate its complexity in order to gain fluency in modifying it (Dreyfus & Dreyfus, 1980).

One way to encounter something is to not-encounter it – and this affordance also includes a making-visible of the partialities of the histories that individuals know. What are we ignorant of? What have we forgotten? What details has a culture lost or chosen to ignore, or chosen or forgotten to pass down as members of an institution come and go?

The UOCD story itself illustrates this fluid, contingent, plural nature of curricular memory as Olin narrators begin to question and trouble Lynn's initial telling of the story of how the course was founded. In the "Inheritors" ontology, not only does the curricular-student assemblage carry history within it, that history is multifaceted and pluralistic and sometimes inconsistent in its telling.

During her first interview, Lynn narrated an extensive version of the story of how the UOCD course was established. She initially attributes the course to Ben Linder, but then quickly points out that Ben was not the only faculty member involved in its design. Ben had enlisted his friend Chris as a visiting professor, and the two together had developed the course. In a later interview, Lynn also points out that she and Jill Crisman, another faculty colleague, had owned responsibility for the course design prior to Ben's arrival.

[Then] Ben figures out he should bring in Chris or something. Chris Heape, who was from the, some design school in Copenhagen... He was Danish and visiting us for the spring. I don't recall how that magic happened. (Lynn 1, 102, 315)

I wonder whether Rob and Jon remember that [the class] needed to be designed before Ben was hired, and that Jill and I had been handed the task. (Lynn 3, 102)

Lynn disclaims how she doesn't "recall how that magic happened," a hint at the inevitably partial nature of memory. Read through the "Inheritors" ontology, Lynn acknowledges there is a history here, even if she does not personally know it. She also wonders about institutional memory in the form of what her colleagues remember about the course, and whether her own contributions (and Jill's) had been rendered invisible.

As it turns out, Rob did remember – or was able to be reminded. In several of his interviews, Rob read this part of Lynn's UOCD story. In one instance, Rob pointed out that Chris's participation was not widely known in the current Olin community. Chris had gone back to Denmark the following year, so later generations of UOCD students and instructors would have no occasion to encounter him. In another instance, Lynn's historical storytelling was enough to prompt Rob to self-correct and re-write Jill into his narrative.

Nowadays, Ben Linder is often the face of design at Olin, and everyone says "Ben brought all of this design stuff to Olin." That is not to minimize that Ben has, in fact done a lot of stuff. He has. But I wonder if people now at Olin may have forgotten Chris Heape... because we focus on the person who is still here and who is still making contributions. (Rob 6, 16)

Lynn mentioned Jill, I actually had forgotten Jill's role in this. I might have put other people in that discussion who didn't belong [in] this. (Rob 3, 58)

The "Inheritors" ontology presupposes that the inherited object has a history, even if that history is unknown. In doing so, it turns the unknown from an "unknown unknown" into a "known unknown" – an acknowledged gap instead of an invisible one. As Rob and Lynn's interacting statements point out, UOCD's history itself is troubled. As it is told over time, aspects are shifted, lost, and reframed.

Which version is "true"? From a postmodern perspective, the answer is that many versions can be true. Instead of being concerned with "forensic truth," or the post-positivist notion of tracking precise and externally observable events that occurred in a particular place and time, we look for something closer to "narrative truth" or "dialogic" truth. Here, "factual accuracy" is not the consideration; rather, it is the ability to make sense of something as part of the story's telling, and to do so in dialogue with others in the community (South Africa, 1998).

As Rob puts it during his 3rd interview, "the stories people tell about this course are somehow important." (Rob 3, 119) They are important because they are portrayals and performances that the community deems it important to convey. A narrative accrual may not be "forensically" true, but there is a sense in which it points to the truths held by a community, the same way family legends and cultural fables represent part of that group's reality. This is the nature of the history that faculty inherit when they step into curricular change situations: histories that are pluralistic, with each history story told in a situated, partial, and perspectival way.

When curricular history is made visible, curricular change can no longer be seen as a platonic ideal or divorced from context. The rationale behind past decisions, responses to situational occurrences, and effects of personality quirks can also be used to remind present participants that the assemblage is not an absolute, unchangeable artifact. Just as others have made decisions in the past that shape the assemblage today, people in the present can make decisions to shape it for the present and future. In other words, the historicity of the assemblage can remind readers that it they can also take a writerly stance towards it.

5.3.2 Affords framing curricular change as a site for faculty development

The second feature I will discuss for the "Inheritors" ontology is how it affords seeing curricular change as a faculty development opportunity. When faculty inherit curriculum and students, they meet and get to know that culture and those people. They need to learn what the situation is, and then they may need to learn additional skills to address it. To use the renovation allegory from this chapter, a new home owner needs to learn their way around their home and what sorts of repairs need to be done – and then they need to learn the skills to do or hire someone for those repairs.

The D&D course story provides an example of this framing of curricular change as a site for faculty development. As mentioned earlier in this chapter, the D&D faculty decided to co-teach the course after a colleague's abrupt departure. Their stated intent in doing so was to improve their collective ability to teach the course; specifically, they wanted all TAD faculty to be able to cover the course, not only one or two of them. In this example, the TAD faculty are the ones who inherited responsibility for teaching the course to the students enrolled in it; they responded to this inheritance by framing it as a responsibility to learn to handle what had just been given to them.

I re-present the excerpts below to point out how the TAD faculty set up D&D as a team faculty development experience. They could have declared the expectation of D&D instructional capacity as a universal but individual goal, where individuals who already had that skill were excused from further participation and individuals who did not have that skill were expected to catch up by themselves. Instead, they declared that "everybody should know how to do this."

And so we said, Well, everybody should know how to do this. And so we decided...
We had two people that knew what they were doing... So, let's just team teach it.
We just saw this as an opportunity. (Alan 2, 44, 59)

We looked at our schedules, and... we all had free times. Here's an opportunity that we can really work together. And there's no point leaving anyone out of it. This is something that we've said is foundational. We should all be involved in it. (Mark 2, 17, 27-29)

And I think it was sort of looked at as an opportunity to where maybe the person that's from outside the area could maybe get an idea of where the area looked like. (Gary 2, 17)

The D&D teaching team set up their learning as communal, where they could "really work together," because there was "no point leaving anyone out of it." Co-teaching D&D was not only seen as a learning experience for students to develop design skills, but as a learning experience for faculty to develop design teaching skills. It was perhaps not the most time or resource efficient solution by some metrics – as Alan noted, "on paper it doesn't sound like a smart move" to have "four people teaching two classes" (Alan 2, 53, 59) – but the "tuition" of opportunity cost was something the TAD faculty deemed worthwhile.

Another example of how the "Inheritors" ontology frames curricular change as a site for faculty development comes from the UOCD story. Whereas the D&D story frames faculty as intentionally engaging in curricular change as a developmental process, the UOCD story shows what faculty can look like in the midst of that process. The first time UOCD was taught, most of the instructional team – including Jon and Lynn – had no prior experience teaching either the content or the course format. They were co-teaching the course while learning it themselves from the two more experienced course designers and head instructors, Ben and Chris. In this story, Jon and Lynn serve as inheritors to the UOCD course and the students enrolled in its first iteration, and they did not entirely know how to make sense of the thing they had inherited.

We had students doing deep dives into the lives of various user groups, and that meant that a lot of us were coaching them on things we'd not done before. There was a lot of learning from one another and a lot of learning from the students. And there was a certain amount of asking questions in the hopes that students would figure out whatever they needed to figure out, because we weren't going to be able to provide the answers (Lynn 1, 245, 251-252)

The first few weeks I was confused, looking at everything, and my mouth would hang open as I tried to take everything in, trying to make sense of all of these different inputs, and put that in my existing definition of the world and engineering design. I remember feeling more and more comfortable as the semester went on. (Jon 1, 103, 105)

Curricular change is not (typically) a formal faculty development environment with thought-out scaffolding, especially in contrast to something like a faculty workshop on a clear topic where a progression through material is provided to participants. It can be complex and chaotic, and faculty in this situation can look rather confused and overwhelmed – learning by being thrown into the deep end of the ocean. And there was "a lot of learning" and "mak[ing] sense of all these different inputs" – Jon and Lynn were actively being challenged to stretch and grow.

This affordance of the "Inheritors" ontology is echoed in conversations about course assignments for faculty, especially new faculty and graduate teaching assistants. What sort of teaching placement would be good to acculturate a novice instructor into the world of teaching, while still giving them time enough to do their research? Which faculty will soon retire or go on sabbatical, who might take over their courses, and what preparation do those people need? How does a graduate student go about selecting which courses to TA for, with an eye towards presenting themselves as being able to teach similar courses when they go on the job market? Although curricular assignments are not primarily designed as faculty development events, they can be used towards that purpose and framed as an assignment that will help the developmental growth of particular faculty members.

In turn, this framing is beneficial to interrogating faculty roles in ways that go beyond their usual framing of being instructors. When curricular change is framed as a site for faculty development, faculty growth becomes meaningful "signal" in the data instead of simply incidental "noise." It can be held up, examined, valued, resourced, and questioned. In other words, this ontology opens the possibility of considering faculty development outcomes as a criteria of curricular change "success." Seeing faculty growth as a valid outcome makes it easier to resource and assess it as such.

5.3.3 Affords visibility of multiple areas of complex and interacting faculty development

A third feature of the "Inheritors" ontology is how it affords not only making-visible curricular change as a faculty development opportunity, but making-visible the variety of aspects developed. One of the arguments for learning from participation in authentic practice is that such practices develop complex skills in context (Brown, Collins, & Duguid, 1989). For instance, instead of learning Ohm's law as an isolated and abstracted skill, using it in the context of home wiring repair can illuminate why it is useful, how it connects to bulb wattage, fastener design,

metallurgical choices for wires, and so forth. Similarly, curricular change affords simultaneous opportunities for development along a wide range of complex, interacting axes. I will give examples of three types in the paragraphs that follow: technological tools, course content, and co-teaching.

As one example, faculty engaged in new curricular experiences might learn how to use technological tools. These tools might be tools for teaching, as well as tools for the practice being taught. In Alan's case, he learned both kinds while team-teaching D&D. Alan had to learn his co-instructor's software systems for submitting and grading work, as shown in his first quote below. He also needed to learn how to work around a CAD program with files he was less familiar with, as shown in his second quote below.

[My co-instructor] has also all these different high-tech grading pieces of software and how you evaluate student work, and everything is submitted digitally and you never see a hard copy of anything... to me, they're out in virtual space somewhere, but I've never seen any of them and I don't know how to get to them. I have never had students submit work through all the different methods, Dropboxes and e-mails and Moodle and all those things, and I'm just... My head's spinning... Because, see, I'm used to "Okay, turn your graphic designs in. Print them out and turn them in to me and drop them in this folder." And when I say folder I'm talking about a paper folder. And then I sit down and I'll grade those. So that's been a huge change for me... (Alan 2, 240-245)

Again, another example is I had a drawing on my computer all ready to show the students, demonstrate where to put dimensions... I had already practiced it. I knew everything about it, but then the class happens and I go to use somebody else's drawing. [Because my drawing] was on my personal [computer] and we were using the one that was in the classroom and it had another drawing on it... and it wasn't my drawing. I hadn't practiced with it... It's just a little bit different and I thought I could handle it [but] it had something on there that when I tried to dimension I could not get it to work right... So yeah, it's an experience. (Alan 2, 264-266)

Just as coursework will often put students in unexpected and uncomfortable situations in order to promote growth, teaching will often put faculty in unexpected and uncomfortable situations in order to promote growth. Framed by the "Inheritors" ontology, Alan inherited grading and submission software from his co-instructor, and also inadvertently inherited a CAD file he had not practiced manipulating. Left to his own devices, Alan may have made technological choices he was already comfortable with. "If I was teaching all by myself," he admitted, "...I had my own drawing. I had already practiced it. I knew everything about it..." (Alan 2, 266) However, this experience compelled him to struggle with new technical skills instead.

Faculty engaged in curricular change might also learn the content and techniques they teach students within that course. For instance, Jon and Lynn co-taught the first iteration of Olin's UOCD course, focused on user-centered design. They had no prior experience with the topic, learned it by teaching it, and then began to disseminate those concepts to other courses in the Olin curriculum and beyond.

[After the first time teaching UOCD,] we start using post-its in our [faculty] meeting. We start talking about things like "generative thinking". We start figuring out what we did... It turns out that UOCD was useful after all. We start to incorporate what we learned into how we think. (Lynn 1, 324)

Yeah, that's sort of the diffusion or permeation of all the other stuff at Olin with the ideas and ways and processes of UOCD. Certainly that happened. (Jon 3, 105)

After the iteration of UOCD, people are running techniques [from that course] in our own curriculum activities and committee work and going into other courses. (Rob 3, 112)

Seen through this lens, a set of unfamiliar ideas from the UOCD curricular-student assemblage has come to embed itself into the practice of the faculty "selves" who have encountered it. Techniques used in the UOCD class are being used in other courses and in committee work. Eventually, UOCD course content became a common framework for discussing curricular design within the school. For instance, faculty talk about understanding students as users of their courses. However, Jon and Lynn first needed to acquire that course content, which they did via apprenticing as co-instructors of the course.

Another thing faculty learn by engaging in the curricular change is how to co-teach. In the example below, Rob describes his co-teaching development after a long partnership with Jon. He contrasts the smoothness of those well-practiced interactions with the experience of teaching with another faculty member who he has never co-taught with before.

[After co-teaching with Jon] for many years... we've sort of become really familiar and comfortable with each other, almost like an old married couple where this is extremely smooth and a mutually rewarding partnership. And I'm now co-teaching with [another colleague], the very first time we've ever done this together and it's showing me how much I forgot about the early co-teaching process, about that part where you're still learning each other's abilities and preferences, and those kinds of things, so I'm going through that right now. (Rob 4, 62-63)

The co-teaching skill development described by Rob is different from a generalized knowledge of how to co-teach; this learning is specifically about how he, Rob, works as a co-

instructor with Jon as opposed to another instructor. It is a situated and perspectival knowledge that needs to shift when he switches co-instructors; when Rob later teaches with a different colleague, the question becomes how he, Rob, co-teaches with that faculty member as a unique individual he needs to re-adapt to.

These three different types of things that faculty develop – technological tools, course content, and co-teaching – are not an exhaustive list. Faculty develop pedagogical skills, cultural capital, geographic knowledge, rapport with individual students, presentation skills... the list is endless. The three examples presented are meant to be a starting point to show some of the wide variety of complex skills that faculty can develop by authentic participation in a complex context like curricular change. Undergraduate programs such as co-ops and internships, study away, and undergraduate research are lauded for their ability to rapidly immerse students in the sort of complexity that helps them grow in complex and difficult-to-measure ways. The "Inheritors" ontology can frame faculty participation in curricular change projects in a similar manner. The world they learn from, with, and within is large and complex and has been influenced by many things and people that ripple out in time and space. The curricular assemblage they are encountering is interwoven with not only history, but the wider world in a way that does not give it distinct, clear boundaries in neither time nor space.

5.3.4 Affords visibility into student influences on the faculty experience

The final feature I will discuss for the "Inheritors" ontology is how it affords visibility into student influences on the faculty experience of curricular change. In this ontology, students are framed as influential on and inseparably part of the learning experience assemblage inherited and experienced by faculty. They are not passive recipients of learning; they are also active in shaping an environment that influences faculty growth.

This affordance can be seen operating at multiple levels of student involvement. At a very simple level, students create a rationale and motivation for faculty to design and teach courses. Student enrollment, or desire for student enrollment, can drive faculty to enter a curricular space that they subsequently grow within.

For example, when the TAD division had a faculty member abruptly leave, there were still students who needed to take the D&D course they had taught. Similarly, at Olin, the first batch of students was about to reach their sophomore year, and the faculty had decided there needed to be

a "sophomore design experience" at that point. These "student needs" became the situation that the teaching teams inherited; part of the inheritance was the urgency of specific students depending on the faculty to teach the course so they could graduate.

However, students can also be much more active and agential contributors to faculty learning. Sometimes, students themselves are the source of new ideas and skills faculty pick up. For example, students can help carry ideas and vocabulary across courses that might otherwise be separated. Since students constitute part of the inheritance that faculty receive, they become not only people to teach, but curricular tools to use. Student knowledge, possibly acquired from courses earlier in the curriculum, can now become a part of the current course's curriculum. As Rob put it, "Given our students now have this experience in their tool kit, what can I do in my courses that draws upon it? Not necessarily to support the design course, but more to let the design course support me..." (Rob 2, 39)

This happened to both Rob and Jon at Olin, with the inherited course being UOCD via the students taking it. Rob was not teaching the UOCD course, but found it affecting his courses anyway; students served the mechanism by which the UOCD assemblage reached him. Similarly, Jon was co-teaching UOCD, but he was also teaching materials (polymers) courses separate from UOCD; students began carrying ideas into his polymers course as well. Read through the "Inheritors" ontology, Rob and Jon can be framed as inheritors of UOCD vocabulary and concepts that were transmitted to their courses by their students.

Students were a great transmitter of that information. Students were coming in... before class [and] were making comments, I would be so fascinated, "What are you talking about? ...it is for a course." (Rob 3, 73-76)

Design thinking crept into most aspects of the course. The students were often the ones who brought them in. "We did a persona activity in UOCD, maybe we could do it here." That is where I started experiencing this vocabulary. (Rob 2, 167-168)

Having seen all of what students see in UOCD, it was very apparent to me as soon as it started happening in my other classes... oh, you're drawing on UOCD thinking or UOCD tools or processes... sometimes [it] surprised me... I did an engineering polymers class... and asked my students to design and manufacture... some product that's made from a polymer. The first things that students wanted to do was to go out and... talk to other students about what might be a cool thing to make, how would it be used... They basically wanted to do the user study at the start of my course that was titled engineering polymers. I was thrilled. (Jon 3, 107-108, 115)

In a sense, Rob and Jon's students were like birds scattering seeds from one island to another. The students encountered a different cross-section of curriculum than their faculty did. Olin students take an average of 4 courses each semester, and generally touch each course only

once before moving on, unless they fail and repeat a course, or elect to TA it. In contrast, an Olin faculty might teach two courses per term, and is likely to teach the same class for years instead of constantly moving on to new material.

Students provide a mechanism for exposing faculty to other curricula, serving as a sort of transport vehicle for some aspects of curricular change. Students' presence, nature, personalities, experiences, and actions contribute to the curricular assemblage as they both carry and modify the curricular culture they live within. This affordance is beneficial to an understanding of faculty roles in curricular change because it frames students as people they can learn from and in response to. In some ways, students can occasionally be framed as taking a "teaching" role in this ontology, as when Rob's students were the one to introduce him to design vocabulary from another class. Student actions are interesting, complex, and relevant to the development of faculty, and as part of the environment they learn with and within.

6. ONTOLOGY: FACULTY ARE EMBODIMENTS OF CURRICULUM ENCOUNTERED BY STUDENTS

*Each mortal thing does one thing and the same:
Deals out that being indoors each one dwells;
Selves — goes itself; myself it speaks and spells,
Crying What I dó is me: for that I came.*
—from “As Kingfishers Catch Fire” by Gerald Manley Hopkins

[Students] don't remember what you try to teach them. They remember what you are.
— Jim Henson

The “Embodiments” ontology portrays faculty as makers of curriculum for the benefit of the students. Many everyday faculty comments can be interpreted within the context of the “Embodiments” ontology. In other words, many faculty comments make sense if the reader presupposes that the role of faculty is to embody curriculum encountered by students. For example, within the narrative dataset:

1. Lynn explained how her “undergrad is[from] Harvard. Formative, y'know. The cognitive science bits, and the interdisciplinary bits, and the not-being-an-engineer bits, are all Harvard.” (Lynn 3, 210, 218) This can be interpreted within the “Embodiments” ontology as depicting how Lynn’s undergraduate experience at Harvard shaped aspects of her faculty self that persist today: cognitive science, interdisciplinary, and non-engineering identities.
2. Alan described how “appreciating the design of a certain piece of furniture was always very important to me, or... actually designing, composing a photograph has always been very important.” (Alan 3, 199) This can be interpreted within the “Embodiments” ontology as describing Alan’s design sense as a key part of his faculty identity that likely influences his curricular approach.
3. Jon thought back to the start of his faculty career, noting that “I thought I was designing courses. I didn't realize that I was designing relationships with other people, faculty and students, and I didn't realize that I was developing myself, my identity, my skills, my mental models.” (Jon 6, 204) This can be interpreted within the “Embodiments” ontology

as the co-development of courses (curriculum) and faculty; as Jon designs courses, in a sense, the courses design him.

All the above examples make sense within the faculty (and curriculum and student) roles prescribed by the "Embodiments" ontology. Now, this is not the only way these narrator comments can be read; other interpretations and underlying ontologies are also possible. However, the above statements, along with the more extended examples given in the remainder of this chapter, are rendered legible via the role assumptions that faculty are embodiments of curriculum encountered by students, and that these role assumptions are a fundamental part of the reality of curricular change.

This chapter is divided into three sections, as described in the intertext outlining the format for all four analysis chapters. The first section introduces the ontology, the second section looks through it at the faculty narratives told for this project, and the third section looks at the ontology and discusses its features and affordances. Together, the three sections provide multiple angles on how the “Embodiments” ontology of curricular change makes sense of faculty roles.

6.1 Introducing the Embodiments ontology

In this section, I introduce the ontology in two different ways. First comes a theoretical discussion of the ontology, which consists of three roles that stand as separate philosophical components. Second, I provide an allegory of faculty “embodiments” as young divers who grow up to introduce future young divers to their passion for the ocean, which provides a playful and concrete way to approach the ontology.

6.1.1 Theoretical introduction – intertwined faculty and curriculum

As in all four ontologies, the “Embodiments” ontology correlates the faculty role with the philosophical concept of the Self, the curricular role with the World, and the student role with the Other. In this ontology, the faculty and curriculum roles are intertwined; the student role is separate. The image below shows the relationship between all three ontological components, and the paragraphs that follow address their corresponding roles in turn.

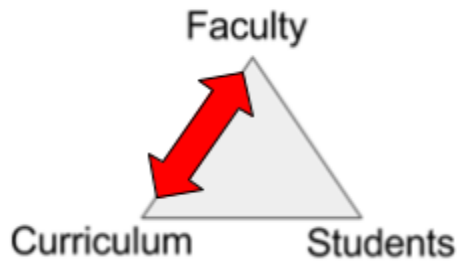


Figure 6.1. Component relations: Faculty and curriculum joined

In the “Embodiments” ontology, the intertwined assemblage of faculty and curriculum consists of many blended selves, most notably a self that moves and grows in time. A faculty self does not only exist in the present day; a person in the role of faculty today is not separate from their past self as a student or their future self as a more senior faculty member. Those selves are furthermore not separate from the curricular contexts they are situated in; faculty respond to and influence the worlds they are within. The past and future selves and curricular worlds influence the way the current faculty role is inhabited, and thereby how the current curricular world is shaped. A faculty self in this ontology can also cross domains other than time. For instance, one might be a faculty member who is a daughter and a professional, a faculty member who is an engineer and a dancer, and/or a faculty member who is an Olin and Purdue alumna. These selves are embedded in their corresponding formal and informal curricular worlds: the family and workplace as learning environments, the engineering lab and the dance studio, and various campuses and courses and late-night adventures with fellow student friends across the local town.

The student role in this ontology is, in one sense, less prominent than in other ontologies. Much of this chapter focuses on the relationship between faculty and curricular roles and the way in which they inseparably co-construct each other. However, the student role here can also be seen as an alternate framing for the past faculty self; once upon a time, those who embody faculty roles today have embodied student roles in the past. Sometime in the future, those who inhabit student roles today may become the faculty teaching the next generation of students.

6.1.2 Allegorical introduction - Divers wearing masks in the pool (or ocean)

One way of playing with the ontology and making it more concrete is to cast it into an allegory and see what connections this generates. In the image below, and in the remainder of the

chapter that follows, I use a diving allegory: faculty are portrayed as divers beckoning students into the pool they swim in. The faculty swimming in the pool represents the intertwined assemblage of faculty and curriculum: the diver is literally soaking, immersed in the pool. The novice divers on the pool's edge represent students. The ontology itself is portrayed by a dive mask worn by the diver.

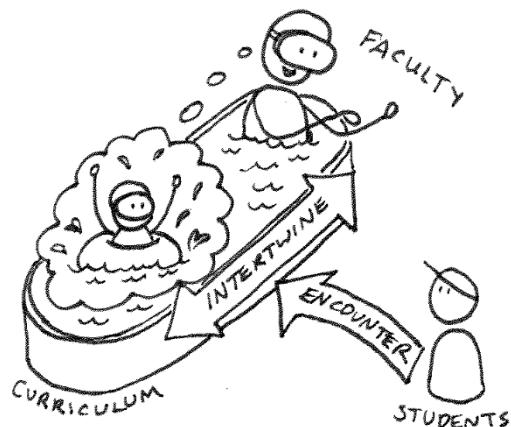


Figure 6.2. Allegory of the diver (close-up from Intertext 3)

I chose a diving image to represent this ontology for its connections to personalization and passion. Divers are generally introduced to the sport not as an obligation, but as a thing they are interested in. Divers sometimes pursue dives to add to their store of happy memories of seeing beauty in the oceans, and tell stories about dives they have gone on in the past. No two divers have the same collection of dives; one may have done the Great Barrier Reef in Australia, and another may have hopped around small islands across Southeast Asia. Similarly, faculty are often passionate about the field they have devoted their life's study to, and/or about some aspect of their work in the academy – they might be keen on teaching, dedicated to increasing inclusion, appreciative of the constant intellectual stimulation, or some other aspect. Their paths to and through the academy are also diverse; the mentors who supported them, the research interests they mature into a lab, the work experiences they do or don't have prior to entering graduate school, and so forth.

6.2 Looking through the “Embodiments” ontology: Stories

This section presents several stories from within the “Embodiments” ontology. In other words, if one assumes the “Embodiments” ontology is in fact the underlying reality of curricular change, and decides to “look through” that perspective at the narrative dataset, what do the narratives look like? I begin with a brief presentation of all five main projects from within the “Embodiments” ontology. Following this, I dive deeper into two examples centered on individual faculty: Jon’s frustration at the undergraduate design courses he had to take as a student, and Rob’s late exposure to history pedagogy.

6.2.1 Project narratives framed via the “Embodiments” ontology

Each of the projects mentioned in Chapter 3A can be narrated utilizing the “Embodiments” ontology. In other words, entries from the table below can be used to fill in the following sentence: The story of (Project) portrays (Faculty) as embodiments of (Curriculum) encountered by (Students). For instance, using the fifth row of the table yields: “The story of (SoH) portrays (co-founding faculty members Jon and Rob) as embodiments of (the pedagogies of their respective disciplines of history and materials science) encountered by (students enrolled in their cross-disciplinary course).”

The table entries are brief, and serve only as brief examples and introductions to potential story framings that make sense within the “Embodiments” ontology. Some of the projects outlined in the table will be expanded upon as examples in the remainder of this chapter. The final row of the table has been left blank as an exercise for the reader (that’s you) to fill in an example from your own experiences with curricular change.

Table 6.1. Embodiments ontology view of projects in the data

The story of (Project)	portrays (Faculty)	as embodiments of (Curriculum)	encountered by (Students)
(the) TAD self-study	Individual faculty members in the TAD division	A diverse set of technology-related experiences, values, and teaching practices	Students taking their classes as part of the TAD major
D&D	The four-person teaching team, split across two sections so each section had a range of experiences	A variety of teaching styles, vocabulary usage, and tool preferences	Students enrolled in each of the two sections of the course
Olin's early days	The faculty who created the curriculum before the arrival of students	A conflicting panoply of disciplines and preferences that could never fit into a 4-year degree	The inaugural class of students, who had not yet arrived on campus
UOCD	The faculty thrust into teaching the first round of the studio-based design course	A wide range of experience and comfort levels in studio-style instruction	The first batch of engineering sophomores required to take the course
SoH	Co-founding faculty members Jon and Rob	The pedagogies of their respective disciplines of history and materials science	Students enrolled in their cross-disciplinary course
Reader project			

6.2.2 Example from Jon: hands-on undergraduate design from a former frustrated undergraduate

Jon: (Jon's teaching approach) is an embodiment of (his past frustrations with his undergraduate design curriculum) encountered by (his current students).

One example of a story that can be read through the "Embodiments" ontology is the story of Jon's undergraduate experience and how it subsequently shaped his teaching. Past encounters with explicit or implicit curriculum can teach faculty about who they are, as well as who they are not. The formation of one's sense of faculty self can be influenced both in identification with or rejection of curricular experiences. Jon's stories of his undergraduate experiences with design can be read, via the "Embodiments" ontology, as the intertwining of experience with identity. In this case, Jon's past undergraduate student self is incorporated into his current role as faculty. The curriculum is both his past self's contrasting and simultaneous encounters with formal and informal engineering design experiences, and the curriculum he designs as a faculty in the present day. Jon's

present-day students encounter a faculty member whose design teaching is shaped by prior curricular experiences.

As a young man, Jon pursued a bachelor's degree in mechanical engineering and was disappointed by what he found there. Although he did well academically, he wasn't thrilled by the analytical work he was assigned. He expected to be given design problems eventually, but the "design" courses he took did not give him the experiences he associated with "design" and had hoped to encounter.

I guess I can talk from my own experience. I went to school for a mechanical engineering degree... What I really did was analysis. I was really good at working through problem sets... I was good at doing analysis, at least in the academic domain... (Jon 1, 42, 45)

These were classes in the curriculum. Late junior or senior year I had a stream of courses labeled mechanical engineering design maybe 1 and 2, something like that. So I looked forward to these courses. I went through all these other analysis courses, kept looking at these things thinking it is going to be awesome when I get to mechanical engineering design, I will be creating, designing new things. [And] I had just enormous frustration on what was going on in classes [that were called] design. (Jon 2, 42)

I got to these courses, it wasn't about design at all, it was... one analytical problem after another. I never did any design. What I really did was analysis. I crunched a bunch of numbers and did math and I never felt like I designed anything. (Jon 1, 43)

Jon still remembers these incidents years later as a faculty member, and used them in the context of his interview to explain to me what he meant by the word "design." As a faculty member who now teaches design courses, Jon's conception of what "design" means influences how and what he teaches under that word. Since words like "design" do not have standardized meanings on their own, Jon compares it with other activities that are "not design" as a way to distinguish his particular conceptualizations of the world. For Jon, "design" seems to be related to "real hands-on experience" and "creating... new things," as opposed to "analysis." In his story, he expressed his "enormous frustration" in encountering classes that claimed to be design, but did not fit his internal model.

The word "design" is not simply an abstract, externalized concept for Jon. He has a strong identity as a designer, as someone who does design. Therefore, the meaning of the word "design"

– the thing he does – is key to understanding who he is. Jon expresses a desire for others to see this part of his identity, and excitement at being able to bring that part of himself to his work.

For whatever reason, that is really important to me... I want people to know that I was here for the design efforts at Olin, actually putting stuff on paper that did not previously exist, that I was one of the creators... I want creator and designer to be part of my identity. I think that is part of it...

I view myself as a person who makes stuff, creates stuff... Olin is the first place where I really felt that I could be very creative and actually design work as part of my job. Before, it was kind of a hobby. Bring design and creativity to the job, that was a big deal to me. (Jon 1, 143-153)

Jon's formation of his concept of "design," and of himself as a designer, was also influenced by contrasting and simultaneous experiences at his father's company. Before and during his college years, Jon worked at his father's failure analysis firm. Here, he encountered a different practice that was also called "design." This practice also shaped his expectations of what engineering "design" was, and more closely fit his concept of what it should be.

I had a parallel experience working for a failure analysis firm, run by my father, run by two of my brothers. I grew up in a lab space... And that's what I associated with real engineering and science. (Jon 1, 46-49)

At the same time [as I was in college,] I was working at my father's failure analysis consulting and testing company in Dallas. I would work there some weekends and evenings there. I was doing real analytical work which was much more complex, but also designing fixtures, testing rigs, doing pretty simple mechanical design. I kind of knew what was going on in the real world. Also, I was interacting with real mechanical engineers, they were designing, building, and fabricating and testing things all the time and bringing them to the lab for us to test. (Jon 2, 44)

Jon's two experiences of design came into sharp contrast in a particular undergraduate lab course in materials science. Jon describes the contrast he experienced between the two worlds; "real" work at his father's company, compared to being told to not touch anything during his lab course. Having a comparison point allowed Jon to recognize that his undergraduate lab experience was not the only possible kind of experience, and that he did not like this option.

The thing that I always remember is my intro material science course, in the lab components... this was the thing that caused me to recognize as an undergrad how awful it was. I was working through junior high and high school and college at this failure analysis lab doing real world work, real equipment, machines, electrical microscopes, writing reports...

...and I get to this one lab in undergrad, and it was a lab we were supposed to a test on a piece of steel, and we were told we are not allowed to touch any of the equipment, our job was to stand around as a group of students, 10 or 15 of us, and watch as a teaching assistant ran a test on a machine and then that person handed each of us a floppy disk with the output and our job was to go analyze the output. That was our lab. For me, to have had the experience in the real world, knowing that I am paying for this experience, that was a very much a "wow, this really sucks" kind of moment. (Jon 1, 259-263)

I kind of knew what I was getting in school wasn't design, and it was really frustrating. (Jon 2, 45)

Jon looks at two versions of what he is being told about "engineering" and "design," and decides he identifies with the one from his father's shop, not the one his professors in college are telling him. When describing his father's shop, Jon uses the word "real" repeatedly. His college curriculum did not have "real" problems; his father's shop did. He associated the shop with "real engineering and science," and describes it as where he hangs out with "real mechanical engineers." These experiences influence what current-day Jon means when he uses the words "design" and "engineering," two major concepts in his current-day curricular design. This is not to say that current-day Jon has a clear or static concept of "design" or "engineering," since people constantly shift their meaning-making. However, there is an influential connection; in telling this story, Jon is implying that when he uses the word "design," there is an aspect of the definition that points to what he did in his father's shop, in contrast to what he did in college.

Both Jon's undergraduate classes and his work experience were learning environments that explicitly or implicitly taught him possibilities for what his role as a designer and a student could be. These possibilities are echoed in the way Jon describes how he creates learning experiences for his own design students. He explicitly contrasts his approach with the traditional approach that he experienced, saying that "those... elements that are very much part of what we do [with design] at Olin, I don't think they are commonly found in a lot of engineering programs" (Jon 1, 76-82).

When current-day Jon describes his thought process in working on Olin's curriculum, he uses language that echo the positive aspects of his undergraduate work experience. For instance, he expresses a conviction that students need hands-on experience making and testing working systems. Including these aspects in the curriculum, said Jon, would benefit the students.

Yeah, I gotta say, for me, it was still a really strong sense that students needed... or could benefit from, I should say, a hands-on, in the machine shop, you know, doing

engineering drawings, making some working system and testing it. There was still that, a strong sense within me that that would be a valuable experience. (Jon 3, 81)

The "valuable experience" that Jon described seems to match the description of the "real" work he did as an undergrad with his father's company. The younger Jon engaged in "real" engineering design work by "designing fixtures, testing rigs, doing pretty simple mechanical design... interacting with real mechanical engineers [who] were designing, building, and fabricating and testing things all the time and bringing them to the lab for us to test." Now, as a faculty member, Jon strives to bring these same sorts of experiences to his students.

Faculty learn their faculty roles within a curricular change context by engaging in those contexts. Sometimes they engage with them from the perspective of the student role, in the past. Sometimes they engage from the perspective as a faculty role in the present and future (and less-recent past). Read through the "Embodiments" ontology, Jon's story shows how a faculty member's curricular experiences and faculty identities are intertwined. Jon self-identifies as a designer who makes real things, and both his past and present experiences as consumer and creator of curriculum are shaped by this identity.

6.2.3 Example from Rob: Graduate history pedagogy from a former history graduate student

Rob: (Rob's teaching approach) is an embodiment of (his graduate-level exposure to history pedagogy) encountered by (his current students).

Another example read through the "Embodiments" ontology is Rob's acquisition of the disciplinary pedagogy of history. Since Rob did his undergraduate degree in engineering, he first encountered history pedagogy at the graduate level. Consequently, when Rob started teaching undergraduate history courses, he simply taught them like the graduate courses he was used to, not realizing that graduate and undergraduate history courses were taught differently until a classroom visitor told him that was unusual. In this story, Rob's faculty role is intertwined with a curriculum of teaching, namely the pedagogies he assumes history faculty use with their students. Rob's undergraduate students encountered a curriculum accented by Rob's "non-native historian" teaching style.

As an undergraduate at MIT, Rob majored in science in engineering. He later decided to blend his technical and humanities interests by pursuing a PhD in history and focusing on the

history of technology. This meant he was first exposed to history pedagogy at the graduate level, which is heavily discussion-based and engages students as active participants in meaning-making. Rob enjoyed this sort of pedagogy, and saw it as applicable to the culture of the institution he was starting in as a new history faculty member.

I was brought into the history field as a grad student. I was a student of science and then engineering. I got to history relatively late. I loved the graduate student model of inquiry, sitting around discussing a reading, everyone contributing to a discussion. I wanted to do this, and this kind of open-ended use of classroom time factors into the projects we were saying were so important at Olin. (Rob 2, 96, 134)

I always taught this way. I teach the way I would like to be taught... When I think history, I think of these wonderful graduate experiences I had, and how open-ended our discussions were. A bunch of people in the room working together to a... bigger common understanding. (Rob 2, 96, 102)

Rob positions his teaching style as a part of his faculty identity: "I always taught this way." The graduate model of inquiry and "open-ended discussions" where faculty and students are "working together" to build a "common understanding" is something he brought to his own classrooms. Rob took the elements he had enjoyed and applied them to the way he taught his own students, who were all undergraduates.

One way to prepare [students for projects] is to model classroom time in the way the students are taking a big role in running the classroom. It will not be a structured classroom where I have all the authority and then throw them in a project; that is not really fair. Instead, let's start at the beginning, let's go with an instructor-guided discussion rather than instructor-controlled discussion. Let me sit with them at the at the table as one of the participants. (Rob 2, 134-135)

Rob's setup of an "instructor-guided discussion" where he "[sat] with [students] at the at the table as one of the participants" echoed the graduate history courses that he had experienced. However, undergraduate history courses are more frequently "a structured classroom where [faculty] have all the authority." Rob did not realize the strangeness of his teaching style until a visiting professor pointed out that he was teaching undergraduates as if they were graduate students.

One time I had a visitor, he was an anthropology professor. At the end, he came up to me and said, "Rob that was a great class. Let me ask you a question; were you an undergrad in history or something different?"

Right away, I thought it was fascinating. "Actually, I was undergrad in science and masters in engineering and only in my PhD studies was I in history. I have got to ask you, why did you ask me that?"

[The visitor replied,] "You teach this course like a graduate course. A lot of historians and anthropology students went through their whole educational experience in one discipline. In the back of your mind you have this background in mind, how undergrad teaching should be. A lot of that is rote teaching and content based learning and so on. Rob, you don't do that."

The guy was wondering if I was lacking this kind of sense of tradition, because I sort of skipped that in my own [studies] and jumped right into the grad school model and therefore applied that when I was teaching undergrad. To him I said something like, "first of all, you got me, I was only a PhD in history. Not many, not a big formative part of my education. So, yes that's true, I never had that model."

To him, that was the answer, he was praising me, he thought it was a good model to be teaching undergraduates. I was thinking, "I don't want that to be the whole reason." Looking back, that is a part of it. (Rob 2, 97-101)

An older and more experienced Rob now describes his pedagogical style as "the graduate student model," but that wasn't how he necessarily conceptualized it as a new faculty member. Instead, it was possible for a younger Rob to frame these curricular experiences as belonging to a disciplinary pedagogy – the pedagogy of history. Having only experienced history pedagogy at the graduate level, it may not have been clear to Rob whether the curricular style he experienced was unique to his graduate program, characteristic of graduate-level programs across disciplines, characteristic of history pedagogy at both graduate or undergraduate levels, characteristic of history graduate-level programs, or some other combination.

The anthropology professor's comment is a reading of Rob's teaching style from within the "Embodiments" ontology. Rob was a faculty member who taught undergraduates like graduate students. Rob was a faculty member who entered his field as a graduate student. The way Rob knew how to embody his role as a history faculty member was as a faculty member teaching graduate students, since that was what he had been exposed to. As Rob points out, that isn't necessarily "the whole reason," but it is "part of it," or at least one possible way to make sense of Rob's story.

6.3 Looking at the “Embodiments” ontology: Affordances

Like any tool, using the "Embodiments" ontology provides certain affordances. Some of these affordances can benefit certain people in certain ways. In this section, I will describe several affordances of the ontology and the kinds of benefits these affordances might provide when

making sense of faculty roles within curricular change settings. Specifically, the “Embodiments” ontology affords a historical glimpse into curricular identities and present practices, viewing faculty as distinct individuals, unpacks the benefits of faculty collaborations such as co-teaching, and legitimizes faculty needs and interests as success criteria for curricular change.

6.3.1 Affords a historical explanation for curricular identities

The first feature of the "Embodiments" ontology is how it affords a historical explanation for curricular identities. The ontology makes-visible that curricular histories are inextricable from faculty selves. In other words, curriculum shapes faculty. Past learning experiences, both formal and informal, impact how faculty understand and shape learning experiences in the present and future. It affects how they view teaching, learning, and their academic discipline, as well as their values and beliefs about how the world works.

For example, Alan introduced himself as both an Industrial Arts practitioner and a photographer. Interpreted within the "Embodiments" ontology, Alan's faculty identity influences the curricular changes he makes and thus the learning experiences his students encounter in his graphic design and photography courses within the TAD major. Alan's identity, in turn, is influenced by his experiences with Industrial Arts and photography curricula as a student. During his third interview, Alan described the two photography programs he had encountered at his previous university: one in the art program, the other in the technology program.

When I was at Miami University, photography was part of the Industrial Arts programs, and it was also part of the Arts program. They had photography classes, and we would have our photography classes. They were totally different... In Art classes, it was pretty much "here's the camera, and now be creative with it." In the other, it would be, "here's the camera, here's the aperture, the shutter, and here's what that does. And now when you learned how to control the camera, now go out and take pictures..." (Alan 3, 197)

In this telling, Alan sets up two curricular environments from his past: photography within the Art program, and photography within the Industrial Arts program. His description sets up the two curricular environments as being "totally different," in contrast with one another. This is similar to how Jon's narrative earlier in this chapter set up his formal undergraduate engineering courses and his job at his father's shop as two distinct curricular cultures and environments.

Formally, younger-Alan was enrolled as a student within Industrial Arts and exposed to the pedagogy of "learn[ing] how to control the camera" before being sent out to take photographs. As his story continues, he used the two curriculums he has already set up from the story of his past (photography in Art vs photography in Industrial Arts) in order to position the photography curriculum he currently designs and teaches within TAD.

But the photography program at Berea, a lot of people would say why is it not in the arts program? But photography has always been part of graphics communication. And since we continue to require graphic communications as one of our core courses and students were exposed to photography and so forth, it's just remained a part of our curriculum. (Alan 3, 198)

Alan pre-emptively counteracts arguments for positioning Berea's photography courses only within the Arts division by describing "curricular reality" as follows: TAD teaches Technology and Applied Design, and graphics communications is a core part of Technology and Applied Design, and photography is a part of graphics communication, therefore photography is part of TAD. Here, Alan's story of the photography curriculum at Miami University serves as a way for him to argue for photography being admitted within the boundaries of "technology curriculum."

Alan depicted part of his identity and sense of self as being concerned with aesthetics. He used his background in photography, as a practice straddling the domains of both Art and Industrial Arts, to explain his own commitment to aesthetics as someone in the Industrial Arts domain. Note how Alan ascribes his affinity towards art as an ahistorical part of his identity, something he has "always been very interested in." Not only is this part of Alan's identity now, it always has been.

I think industrial arts, art was there for a reason. It was to emphasize the aesthetics and the craftsmanship of whatever you were making. So appreciating the design of a certain piece of furniture was always very important to me... I've always been very interested in the art part of industrial arts. The aesthetic side of industrial arts. That's usually if I'm making something or building something, the aesthetics is usually at the top of my list. (Alan 3, 198-199, 203)

However, Alan also acknowledges that his field is Technology / Industrial Arts, which highly values functionality. In describing himself as highly attuned to the aesthetic dimension, he also notes that others within his field may have different perspectives from his own, and that this is also valid. Some people in his field value function more highly than others, others value aesthetics more highly than others, and Alan values both.

You know, everybody is different. And you know to some people the function might be everything. Some people the function is so important that what it looks like may always be at the bottom of the list... I think it might vary from faculty member to faculty member how much they place on aesthetics.

I'm just saying from my perspective I put a lot of value on something on how it looks. I think it's a blending of the two. The function and the aesthetics. I have a strong emphasis on the aesthetics, how things look, without ignoring how they function.... I don't separate the two. They're both very important. But if I have a functional chair, that doesn't mean a whole lot to me. I want a functional chair that looks really good, or else I'm not going to build it. But if it doesn't function, it's a big failure... your design did not work out. (Alan 3, 208, 213)

As Alan says, "everybody is different," and his particular kind of difference includes a focus on the aesthetics as part of his self-identity as a Technology professor. He refuses to treat functionality and aesthetics as a binary; he "do[es]n't separate the two," requiring both to be present in a project before he deems it a success. Alan consciously thinks of balancing function and aesthetics in his own work, and how to push work to high levels in both areas simultaneously.

Consciousness of both functionality and design is something Alan passes on to his students within his curriculum. While Alan does not force his students to adopt aesthetics as their top criteria for a successful design, he does compel them to reflect on what it is that they value. The classroom activity he described as "one of the best things we did" was an ordering of design criteria: students were given 5 values (aesthetics among them) and asked to order and discuss them.

In our design, in our classroom where students have design, I think one of the best things we did was to give them five criteria one day in class and then start juggling that around. And eventually aesthetics did make it to the top of the list. So, yeah. You know, everybody is different. And you know to some people the function might be everything. Some people, the function is so important that what it looks like may always be at the bottom of the list. (Alan 3, 213)

Continuing to read this from within the "Embodiments" ontology, Alan's exercise is oriented towards giving students a sense of how they – the students – embody their own version of the values of their field. In balancing his aesthetic sense with the functionality-driven focus of his field, Alan became aware of a range of perspectives in this domain. In designing his curriculum for students, Alan includes activities to foster their awareness both of their own perspective and the range of perspectives of others, which may or may not match Alan's own.

Alan also uses his art background to explain why he was able to adopt new ways of design thinking and teaching as his field changed. He begins by setting up one side of the contrast: he was

reared in the "real strong industrial arts period of time" and is "heavily entrenched." In that time, Alan explains, design was not a key part of the curriculum; students largely focused on making things based on designs from other people. Design concepts and modern tools were not part of his education, and picking them up later in life is a "big adjustment" for him. He also describes other faculty from his age and era as having difficulty changing their curriculum.

When industrial arts was strong and thriving, it was heavily focused on being able to make things. Not necessarily design things. If you were in a woods class, you would normally build a piece of furniture... you located a design you like, and then you got the drawings to go with that. And yes, we made changes on [the drawings]. I can remember building a bookcase and we found a great drawing in a book that I liked a lot, but it was a little oversized for me. So I shrank all the measurements down and did some tweaking of it. In some sense, that's designing.

But that would usually be the extent of it. We pretty much got our designs from somebody who had already designed something that we're trying to build. And then the big thing then was to take that drawing and go into the woods lab and make that piece of furniture. That's how we did things. That's the background that I came from.

It's been a big adjustment to pick up on the new technology and design concepts that we didn't have when I was in, you know, in college... if you have some people that came out of that real strong industrial arts period of time, you know, it's a little more difficult to change your curriculum. (Alan 3, 174-180)

Alan's past curricular experiences as a student prepared him for a different curricular world than the one he is creating for his own students today. However, Alan describes himself as being able to "see the value of being able to design things and how important that is going to be in the future" (Alan 3, 176). After describing his own student experiences and the lack of design in them, and his subsequent challenges in adopting new and unfamiliar ideas in design curricula for technology student, Alan takes some time to outline his own unique aesthetics-centered approach shaped by his art training, and does so by using his identity as an artist to explain his ability to do so.

So appreciating the design of a certain piece of furniture was always very important to me... actually designing, composing a photograph has always been very important. So I guess having that kind of background [in art] has probably helped me a little bit with being open to designing, being a big part of a curriculum. (Alan 3, 200)

Alan attributes his background in photography as helpful to his current curricular openness. Read through the "Embodiments" ontology, Alan's faculty self was formed by art curricula in such

a way that the inclusion of design later on did not violate that identity. In doing so, Alan is able to challenge a false binary: one does not need to either be an artist focused on aesthetics or a technologist focused on functionality. As an embodiment of this duality, Alan is both at the same time. It is also not a matter of "entrenched in the old paradigm of Industrial Arts" vs "unable to adopt new design curricula ideas" – in fact, Alan's blurring of the binary of aesthetics and functionality is (according to him) one of the things that enables him to blur this other binary and be someone who comes from the old paradigm of Industrial Arts, yet adopting new design curricula designs for his own classrooms.

In contrast, consider a faculty member who considers themselves to be "technical" and views design as "nontechnical." Such a faculty member might struggle with the idea of teaching design, because there is no entry point into their identity such that the action of teaching a "nontechnical" topic would make sense for who they are. Jon and Alan's examples illustrate how the faculty self is inextricable from the curriculum being created, and how, an expression of self, the curriculum reflects the experiences and preferences of the faculty who create it.

6.3.2 Affords faculty individuality and non-interchangeability

The second feature of the "Embodiments" ontology I will explore is the way in which it affords valuing the individuality of faculty and makes-visible ways of reading that individual identity. If the curriculum is embodied by faculty, then the diversity and richness of the faculty body and their experiences directly ties into the diversity and richness of the curriculum encountered by students. Far from being interchangeable cogs in a machine, faculty are made-visible as distinct individuals.

This affordance of the "Embodiments" ontology can be used to make sense of courses in a particular way; courses are framed as being "of" the faculty who create them, so faculty variance is seen as a benefit that leads to a diversity of course offerings, rather than simply a liability that makes it more difficult to fulfill standard course offerings. As any former student knows, the "same" course with multiple sections taught by different faculty is hardly the same course, and faculty rating websites overflow with comments about whose section is "hardest" or "best" or "most theoretical."

Not only are these things interlinked, they are interlinked in a non-static manner; curriculum and faculty selves continue to evolve and influence each other in their uniqueness. Jon

commented on the intertwined development of courses and faculty selves and relationships. He talked about the realization that course development also developed relationships, identities, and skills, among other things. Jon also pointed out that the other developmental aspects are typically rendered invisible by the way faculty talk about this intertwined development. The narrative tendency is to mention only one part – the curricular development – and not the other aspects of relationship and personal growth.

[Early on,] I thought I was designing courses. I didn't realize that I was designing relationships with other people, faculty and students, and I didn't realize that I was developing myself, my identity, my skills, my mental models. I certainly realize it now and I go into every new effort with all this stuff on my radar, but it's not framed that way still...

[This activity] is always called 'curriculum reform' or 'curriculum redesign' or 'program design' or 'course design'... [what if we were] not calling it that but calling it... This will be hilarious. "What are you doing?" "Oh we're... doing personal design, interpersonal design and curriculum design as part of our effort right now." Like, that would totally freak most people out... (Jon 6, 205-210)

Jon's comments point to the faculty benefit that can be made invisible when curricular change activities are framed purely in terms of curricular design, and not in terms of the sorts of learning and growth that are happening for faculty. In working on his courses, Jon is indeed developing curriculum, but he is also "developing [him]self, [his] identity, [his] skills, [and his] mental models" as well as his relationships with colleagues. The "Embodiments" ontology explicitly makes this interaction visible by defining the faculty self as intertwined, by nature, with the curriculum.

Although Jon describes this making-visible of faculty/curricular development intertwining as something that "would totally freak most people out," it is also a commonplace practice in academia. This ontological affordance of seeing and valuing faculty individuality for curricular change can be seen during faculty interviews, when prospective candidates are asked what courses they would design and teach. A faculty member's individual research interests and specialties are seen as unique opportunities for students, who will be able to study cutting-edge topics with the people creating them, as well as opportunities for faculty colleagues who might want to collaborate on new courses (and research projects). Hiring committees evaluate what a prospective hire might bring to the department or college, which acknowledges the value of diversity and distinct interests, attitudes, and skills so long as they can still fit and work within the community. Along these veins,

Mark and Alan describe a new TAD hire who fit both of those criteria, bringing a unique perspective to a division that he also fit into.

But [the new faculty member]'s main position, since coming to our program, has been in graphics, which is graphic communication design... I think that [he] is very willing; I think he has a strong interest in it... And he's used some of the equipment, especially for his art, because his art is basically sculptures. So, he used a lot of that kind of equipment, which is good, especially for us. So, there's a lot of familiarity. (Mark 3, 25-26)

The person I'm team teaching with is a joint hire between Art and Technology. He actually has... His degree is a MFA in Art. With an emphasis in sculpture. So, all this... Yeah. This makes sense to him, so this is nothing new so it's working fine... in building sculptures he's come in contact with tools, machines, and things that we use. He was familiar with AutoCAD software and that type of thing. And plus he brings a strong design background too. (Alan 2, 83-89)

Framed within the “Embodiments” ontology, the new hire was both unique enough and not too unique – an art background that used the same sort of tools and design thinking the TAD division identified with. One possible way of making sense of this is that the new hire would bring something new to the division, and that new material would still be legible – coherent, understandable, and integrated with – the division. They had the capability to understand his contributions as signal rather than noise.

Another example of this affordance in faculty hiring comes from Jon, who described how he thought his characteristics and past experiences made him an appealing faculty candidate at Olin. His background in materials science and mechanical engineering were disciplinary spaces that fit into the school's plans to offer courses in both, and his past portfolio of teaching hands-on projects at a small college fit the culture that early Olin faculty hoped to build.

I guess we can get into why I think I was hired at Olin... I think I was originally kind of pinned as material science slash mechanical engineering who knew something about hands on projects and who could design learning spaces that looked a little different than the typical classroom space. I think people saw that in me when I first arrived. I think the other thing for whatever reason is that I had some experience teaching at a small liberal arts school... I think that resonated with the people at Olin, here is a guy with hands on experience in the lab, designs learning spaces and works with undergrads on technical research. (Jon 1, 25-30)

Framed the "Embodiments" ontology, the early faculty "read" Jon during his interview as having not only useful skills, but useful experiences and viewpoints. Past experiences are sometimes associated with current skills and viewpoints; someone who got a PhD in engineering

is assumed to be technically skilled, and someone with small liberal arts college experiences is assumed to have encountered intimate, student-centered teaching. These assumptions are not universally true – there is a sense in which they are stereotypes – but they are points that can be used to narrate faculty identity by both revealing and hiding aspects of self. Consider the woman who deliberately does not disclose her marital and motherhood status during an interview, or the faculty of color who introduces themselves as “Dr.” and works their prestigious alma mater into the conversation early on in order to assert the intelligence these experiences are often linked to.

As the above examples illustrate, the historical nature of the faculty self in the "Embodiments" ontology leads to its affordance of seeing faculty as unique individuals. Different journeys through life and exposures to different curricula, formal and informal, explicit and implicit, mean that each faculty self has been shaped in a unique way. If curriculum is framed as an expression of the faculty self (or selves) creating it, the curriculum for the "same" class will be created differently by two different individuals. This affordance discourages seeing and treating faculty as interchangeable parts; it does matter who designs the first-year courses, and it does matter who students encounter in their classrooms.

6.3.3 Affords visibility of faculty collaborations, including co-teaching

The third feature of the "Embodiments" ontology I will discuss is how it affords visibility and valuation of co-teaching and other forms of faculty collaboration on curricular change. Read within the "Embodiments" ontology, faculty collaborations are engagements of mutual learning and growth that shape the faculty involved. Instead of being read as "lower-efficiency" approaches, each curricular change partnership leads to a unique curriculum that only that particular combination of faculty members could have created at that time. It is as if the curriculum were a child, born of the "scholarly DNA" of all the faculty collaborators involved – their interests and skills not separated into different modules or categories, but intertwined in new and exciting ways.

One example of this affordance occurs in Rob's depiction of his guest lecture at a technical class, where he was invited to represent his discipline of history. The course included math, engineering, and physics, but not yet history or any other humanities perspective. As a visiting lecturer, Rob guided the students through discussing the historical contexts of the technical projects they were working on.

"In the first year of Olin.... Sarah... Jon, and Mark [were] teaching an integrated math, engineering and physics activity. They wanted to bring in a history of technology perspective. [I came as a guest lecturer and said to the students,] "Let's pick up and talk about Isaac Newton. How do you think this invention you're creating would have looked differently in the 19th century? At the end of Edison, which constraints would be different?" Coming into their classroom was one of the biggest thrills I had in the first year..." (Rob 1, 210-223)

Rob's role as a guest lecturer was to embody his discipline of history and "bring in a history of technology perspective." Framed with the "Embodiments" ontology, each faculty member brought in a different disciplinary angle: Sarah was a mathematician, Jon was an engineer, and Mark (not the TAD faculty narrator Mark) was a physicist/engineer. Their course was "integrated math, engineering, and physics," and the temporary addition of Rob added history to the mix and broadened the range of the curricula students encountered.

Faculty collaborations such as team teaching are not only about broadening the curricula students are exposed to and creating unique curricula. They also transform the faculty members involved. In another narrative, Rob talked about how co-designing and co-teaching SoH (Stuff of History) with Jon transformed his relationship with design. Before co-designing SoH, Rob identified as a history/humanities faculty and saw his discipline as separate from design. By co-teaching a class that included elements of design, Rob began to incorporate design into his faculty identity as something that a historian could also do.

[Previously, I said,] "Hey, I am the humanities guy, don't bother me with that stuff." On the one hand, I am going to do things with you in the humanities space that are exciting and fun. We are learning about how to make your communication more effective, context. On the other hand, hey, I am the humanities guy, I wouldn't do as good a job [at teaching design], it wouldn't be efficient, it would take me away from other stuff."

Being in the Stuff of History [course], we both stopped saying that. Yes, I am the humanities guy, [but] that is not relevant now, we are working, being in interdisciplinary space. We are asking you as students to stretch yourself in the space. I am no longer "humanities guy," I am a member of a big team trying to deal with really exciting interdisciplinary problems... you are designing your projects in Stuff of History. (Rob 2, 146-149)

Rob's engagement with an interdisciplinary colleague influenced the way he embodied his faculty and curricular self. One reading via the "Embodiments" ontology would be to say that Rob's previous conception of his faculty/curricular role was that of a history faculty, as opposed to a design faculty; his curricular responsibilities had to do with history, not design. History and

design were placed in binary opposition in this schema. Following SoH, the binary was disrupted; Rob began to embody an interdisciplinary faculty role in which he worked in a curriculum where history and design were intertwined – with responsibility for both disciplines rather than only one of them. His embodiment shifted to a both/and rather than an either/or.

These kinds of curricular collaborations can be transformative to faculty identities, and by extension, to the curricula that they produce. Rob's later reflection on team-teaching illuminates this when read through the "Embodiments" ontology. He talked about how team-teaching helped him get to know his colleagues, and how that in turn helped him to get to know himself.

Working with others in team-taught courses... was where I learned the most about my colleagues and myself... Sitting down afterwards and having those conversations of, "I thought I knew you, but now I really know you." That's how you really get to know your colleagues.

And then maybe this is a smaller discussion that happens off to the side, but there's also "I thought I knew me, but now I really know me." It isn't until you have to articulate to an outsider what you do that you solidify your own identity and go, "Oh, wait. I actually believe that." Having to explain things to other people helps me to say "Oh! Look, this is me." (Rob 6, 191-192)

By interacting with and contrasting his own actions with others, collaborations with fellow faculty become a place where Rob learns how to characterize and narrate himself. Collaborating with different faculty members on different curricula means that Rob's sense of curricular/faculty self recurs against different contexts. In comparing himself as a stable point against these different contexts, he can make sense of what his identity as a faculty member means, and what his unique contributions to curricular change might be.

6.3.4 Affords legitimization of faculty needs, interests, and values in curricular change designs

The final feature I will explore with the "Embodiments" ontology is how it affords valuing faculty needs, wants, preferences, styles, and desires – in other words, making-visible and validating the ways in which curricula accommodate the faculty who (re)design and teach them. For a diver to fit into a scuba wetsuit, the wetsuit needs to fit their body; it cannot be too small or large, since they need to be physically capable of wearing it. Similarly, if faculty are embodying curriculum, the curriculum must be something they are able and willing to embody.

For instance, Rob discusses the range of teaching styles within Olin in a way that makes sense within the "Embodiments" ontology. Rob describes how some faculty members give students autonomous projects and allow them to fail. However, not all Olin faculty take that approach; some do take a content-focused route. In the context of Olin, this means that there are some lecture-style classes and some classes that have more restricted project autonomy. The different teaching styles of various Olin faculty are not penalized; instead, they are accepted as valid ways to teach, because there are "a lot of answers to that question" of how an Olin course can be taught.

We have done exactly that. "Here is an autonomous project; go fail..." It is good to fail, and you should know what you are doing, and understand what it means to fail and succeed, and then be allowed to fail....

Not every faculty member bought into [giving students project autonomy]. The faculty member who says "I need to give you these crafted high-content experiences..." Olin did not take the decision to say "good luck finding a new job, that's not what we do here." Instead they said "okay we can make that work, too. We can plug it maybe in the curriculum, paired with the project, some way we can squeeze value out of that..." There is a lot of answers to that question; we have always taken the approach "let's make use of these tools." (Rob 2, 112-114)

If faculty embody the curriculum, accepting a range of faculty means accepting a wide range of curricular embodiments. Sometimes this means creative problem-solving: how might a stay-at-home parent arrange their teaching to all take place in the evenings when their spouse is home? How might a chronically ill faculty make provisions for teaching remotely on the days they cannot leave home? How might a physically disabled faculty adapt their lab equipment to be accessible? How might a feminist faculty member adapt old course materials that employ misogynist stereotypes? Rob describes an attitude of "we can make that work, too" – a generative framing full of possibilities to explore.

This ontological affordance also legitimizes another narrative of course formation that is driven by faculty interests and desires. For instance, the way Rob explains how he came to co-design and co-teach SoH with Jon centers his own sense of fun and interest. When he entered Jon's (and Mark's and Sarah's) classroom for a day as a history instructor, Rob had such a thrilling experience that he wanted to return, and did. Eventually, he and Jon agreed that they were having a lot of fun working together and wanted to pursue their collaboration further. Later, Rob justifies

some of their curricular experimentation decisions by saying that "we [Jon and Rob] think it is fun; we are going to give it a try."

Coming into their classroom was one of the biggest thrills I had in the first year... The students were eating it up in a way that beyond the enthusiasm they had showed in my history course... being the guest lecturer that was supposed to happen once and it was a series of 3 visits. So we ended up on the spot broadening my role a little bit... It was a very early thrill for me that in some ways led me deeper into the idea of interdisciplinary integration which culminated into... [an] integrated course with Jon, the Stuff of History [course,] which was basically saying if we could have that much fun in a few sessions what do we do with a whole course together. (Rob 1, 216, 219-225)

As we started teaching it, it was the project where we were starting to go give ourselves permission to use time inefficiently. "The discussion we are going to have addresses neither of the competencies on the syllabus, but we think it is fun; we are going to give it a try." (Rob 2, 143-144)

Again, this is not the only possible framing of the SoH story, or even the only possible framing of Rob's telling of it above. Every narrative told walks amidst the whispers of the narratives that could have been told and were not; every interpretation walks amidst ghosts of other interpretations that might-also-be. However, one way to read Rob's SoH origin story from within the "Embodiments" ontology is that of two faculty – Rob and Jon – embodying an interdisciplinary class together out their own shared interests.

From Rob and Jon's self-introductions and narrations towards the start of this chapter, one could argue that they place great value on the experiences of their students. Jon values giving his students a better experience than the one he was frustrated by as an undergraduate. Rob teaches his students using the pedagogies that thrilled him as a graduate student. Students certainly seem to have enjoyed and learned from the course; SoH became one of Olin's most popular classes, running for over a decade with overwhelmingly positive student feedback. However, Rob's telling of this version of the story does not reflect a stance that faculty interests were simply a side effect of optimizing for the student experience; Jon and Rob's desire to collaborate and explore themselves is portrayed as the driver for this shared curricular embodiment. In other words, Stuff of History was created at least in part for the benefit of the faculty.

This affordance highlights the benefits of valuing faculty needs and interests. If faculty embody the curriculum, it makes sense to have those faculty be as happy, fulfilled, and highly-developed as possible so that their curricular change projects will reflect the same qualities. If

curriculum is embodied by faculty – if it is "of" the faculty – then it should also be "for" the faculty. This is particularly pertinent when faculty have needs their students do not necessarily share. For instance, foreign instructors in American classrooms need a racism-free environment just as much as foreign students do; female instructors in predominantly-male engineering fields cannot be expected to tolerate sexism, and disabled instructors need access to their classrooms and course materials even if their student population is able-bodied.

Such conversations are already taking place in academia; phrases such as "we should do something together sometime" or "the best way to learn something is to teach it" reflect this sentiment. The "Embodiments" ontology is an acknowledgement that faculty also live in the curricular worlds they help to build. Since the world they are building is a space in which they will also reside, they must create the world and frame it in such a way that it will also work for them and be congruent with the ways they see their roles and interests as faculty.

7. ONTOLOGY: FACULTY ARE COLLABORATORS ON CURRICULUM WITH STUDENTS

無貴無賤
無長無少
道之所存
師之所存也

*There is no rank, higher or lower;
there is no age, older or younger.
Where truth is,
there the teacher is.*

弟子不必不如師
師不必賢於弟子
聞道有先後
術業有專攻
如是而已

*Student need not be below the level of teacher,
nor need teacher be wiser than student.
Learning the truth is a simple matter of who learns it when,
and technical fields have specialized knowledge.
That is all there is to it.*

– Hán Yù 韓愈 (768–824)《師說》 [On having a teacher], translated by David Prager Branner

The “Collaborators” ontology portrays faculty as collaborators on curriculum with students. Many everyday faculty comments can be interpreted within the context of the “Collaborators” ontology. In other words, many faculty comments make sense if the reader presupposes that the role of faculty is to collaborate on curriculum with the students. For example, within the narrative dataset:

Alan explained that he and his co-instructors “bring [our curricular experimentation] up because it's gonna be... obvious to the students, I'm sure, that yeah, we're trying to work this out, we have different ways of doing things, sometimes we step all over each other, sometimes we don't quite know exactly what we're doing.” (Alan 2, 251) This can be interpreted within the "Collaborators" ontology as portraying Alan and his colleagues as opening up their curricular change process to the students, who act as collaborators in the role of participant-witnesses to their experimentation.

Lynn described how “there are NINJAs [Olin's undergraduate TAs] who know much more than I do about some things, or have much more insight, and I definitely feel like I appreciate that. And at the same time if I disagree I will weigh it in the context of what I think I bring to the issue vs. what I think the NINJA does.” (Lynn 5, 51-52) This can be read within the “Collaborators” ontology as Lynn’s depiction of her collaboration with her undergraduate TAs – careful and sometimes in disagreement, but appreciating their curricular contributions nonetheless.

Rob clarified that he thinks “there is something to be done for creating a culture where this discussion happens, setting it up in the right way... we're not saying, ‘Let the students run the [curricular] show, and as an instructor, the best thing to do is shut your mouth.’ That's not true. There is a place for the instructor, and our perspective and experience is valuable.” (Rob 5, 174-176) Within the “Collaborators” ontology, this can be framed as positioning both faculty and students as valuable contributors to curriculum, with complementary perspectives and experiences.

All the above examples make sense within the faculty (and curriculum and student) roles prescribed by the "Collaborators" ontology. Now, this is not the only way these narrator comments can be read; other interpretations and underlying ontologies are also possible. However, the above statements, along with the more extended examples given in the remainder of this chapter, are rendered legible via the role assumptions that faculty are collaborators on curriculum with students, and that these role assumptions are a fundamental part of the reality of curricular change.

This chapter is divided into three sections, as described in the intertext outlining the format for all four analysis chapters. The first section introduces the ontology, the second section looks through it at the faculty narratives told for this project, and the third section looks at the ontology and discusses its features and affordances. Together, the three sections provide multiple angles on how the “Collaborators” ontology of curricular change makes sense of faculty roles.

7.1 Introducing the Collaborators ontology

This part of the chapter introduces the Collaborators ontology in two different ways. In the first section, I give a theoretical introduction to the final combination of the three ontological components. In this ontology, the faculty and student role components are intertwined. In the second section, I introduce an allegory of director-actors wearing contact lenses in a theatre, and use this imagery to play with different aspects of the ontology that will appear in later sections.

7.1.1 Theoretical introduction – intertwined faculty and students

As in all four ontologies, the “Collaborators” ontology correlates the faculty role with the philosophical concept of the Self, the curricular role with the World, and the student role with the Other. In this ontology, the faculty and student roles are intertwined; the curricular role is separate as the thing that faculty and students mutually work on. The image below shows the relationship between all three ontological components, and the paragraphs that follow address their corresponding roles in turn.

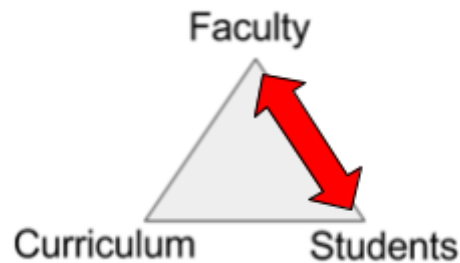


Figure 7.1. Component relations: Faculty and students joined

In the “Collaborators” ontology, the curricular component stands as a boundary object that both faculty and students work on. Within that role, its format is flexible; it can be short-term, long-term, large, small, within a discipline, across multiple ones. It can be composed of material objects such as prototypes and textbooks, as well as ethereal ones such as utterances and gestures. It serves as a shared space and a common project, product, and environment that the participants work with and within.

The intertwined assemblage of faculty and students works both within and against the categorical separation between their two roles. Faculty and students are simultaneously like and

unlike each other. They share a collaboration – specifically, a collaboration on the curriculum in whatever form it might take. They can be framed as having both similar and complementary roles. For instance, faculty might be similar to students in that they are doing the same kinds of things (a master building a bookshelf next to her apprentice). They might be doing a different role that complements the student role (a tango instructor dancing lead in order to teach a novice follower). Their roles might simultaneously be alike and not-alike. Either way, the defining assumptions of this ontology is that the faculty and students share the same positionality with respect to the curriculum; the relationship they hold within that collaboration can take a broad range of forms.

7.1.2 Allegorical introduction – Actor/directors wearing contacts in a theatre

One way of playing with the ontology and making it more concrete is to cast it into an allegory and see what connections this generates. In the image below, and in the remainder of the chapter that follows, I use a theatrical analogy; faculty are portrayed as actors working on and with a theatre of fellow actor, with shared responsibilities for direction. The theatre – both the stage as a performance platform and the backstage lighting, scenery, green room, rehearsals, etc. comprising the behind-the-scenes activities – represents the curriculum. The students in this allegory correspond with other actors on stage, but with some level of directing responsibility that varies based on the theatrical company setup. The ontology itself is portrayed by a set of contact lenses; it is difficult to tell who is wearing contact lens and who is not, which mirrors the ontology's role boundary blurring between which things correspond to the role of faculty and which to the role of student.

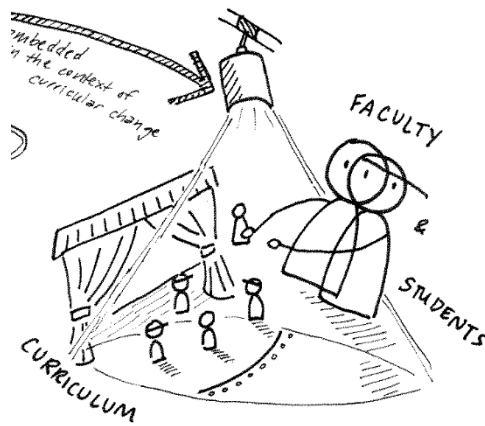


Figure 7.2. Allegory of the theatre (close-up from Intertext 3)

As shown in the drawing above, the faculty and student roles are intertwined; in the drawing, the heads of the faculty and student overlap such that they each have one eye that is distinctly their own, and share a central eye. This speaks to both the similarities and differences between faculty and student roles in this ontology.

Additionally, the curriculum is portrayed as an environment that faculty and student actors live within – they are on the stage, affected by the lighting and set. At the same time, the faculty and students have tremendous manipulative power over the stage; they can control the lighting, script, action, and so forth. It is a world they both change and are changed by, together.

I chose a theatrical image for its relationship to performativity and play, as well as for the way in which it orients towards diverse roles collaborating towards a common goal. Theatre is a place where temporary worlds are made and performed before an audience by a diverse team all oriented towards a show. To be part of a production is to be privy to the backstage dynamics that the audience may never see – even the smallest bit part actor or the newest backstage hand will see the bumps and glitches of rehearsal, will notice the lighting cue that didn't get called on time that night – they are part of the production rather than the audience. Additionally, theatre is live and flexible; there may be a script, but those in the show never put it on the same way twice; one show the lead actor is tired and delivers his lines with less vigor, another time the house is packed and the lighting director is hypervigilant because her old instructor is there – it's not a pre-set performance, but a living and responsive one, and that is where much of its energy and vividness come from.

7.2 Looking through the “Collaborators” ontology: Stories

This section presents several stories from within the “Collaborators” ontology. In other words, if one assumes the “Collaborators” ontology is in fact the underlying reality of curricular change, and decides to “look through” that perspective at the narrative dataset, what do the narratives look like? I begin with a brief presentation of all five main projects from within the “Collaborators” ontology. Following this, I dive deeper into two examples: Jon’s positionality of being “like a student” during his first time instructing UOCD, and Rob’s discussion-based feedback practice with his history class.

7.2.1 Project narratives framed via the “Collaborators” ontology

Each of the projects mentioned in Chapter 3A can be narrated utilizing the “Collaborators” ontology. In other words, entries from the table below can be used to fill in the following sentence: The story of (Project) portrays (Faculty) as collaborators on (Curriculum) with (Students). For instance, using the third row of the table yields: “The story of (Olin’s early days) portrays (faculty designing the inaugural curriculum) as collaborators on (the first iterations of both Olin’s curriculum and its curricular development and change culture) with (undergraduates who served as junior partners and opinionated co-designers of their learning experiences).”

The table entries are brief, and serve only as brief examples and introductions to potential story framings that make sense within the “Collaborators” ontology. Some of the projects outlined in the table will be expanded upon as examples in the remainder of this chapter. The final row of the table has been left blank as an exercise for the reader (that’s you) to fill in an example from your own experiences with curricular change.

Table 7.1. Collaborators ontology view of projects in the data

The story of (Project)	portrays (Faculty)	as collaborators on (Curriculum)	with (Students)
(the) TAD self-study	TAD faculty debating the division re-naming	The external representation of the division's teaching focus	Students with strong but under-informed opinions on the name of their degree
D&D	Faculty teaching an unexpected, last-minute redesign of the course	A just-in-time version of the D&D curriculum	Students enrolled in the course that semester who get to see the "mess"
Olin's early days	Faculty designing the inaugural curriculum	The first iterations of both Olin's curriculum and its curricular development and change culture	Undergraduates who served as junior partners and opinionated co-designers of their learning experiences
UOCD	Faculty teaching the UOCD course, some of whom were unfamiliar with the material	The experience of learning about user-centered design concepts and practices	Students enrolled in the course
SoH	Co-instructors Rob and Jon	History and materials science, including multiple reading assignments	Students in the course who gave vocal feedback about their opinions on the readings
Reader project			

7.2.2 Example from UOCD: sitting in the lecture hall

UOCD: (Faculty teaching the UOCD course, some of whom were unfamiliar with the material) were collaborators on (the experience of learning about user-centered design concepts and practices) with (students enrolled in the course).

One example of a story that can be read from within the "Collaborators" ontology comes from Jon's portrayals of himself as a first-time teacher of the UOCD course. Although Jon took a faculty role in the course as a studio instructor, he narrates himself as if he was a student. Using the role descriptions from the "Collaborators" ontology, his story can be framed as one of a faculty member collaborating on curriculum with students by engaging the material from a similar perspective.

In his interviews, Jon described literally sitting in the student seats of the auditorium as the head instructors of the course lectured. Although he "attended the lectures as an instructor," he was "really just another student" having an intense learning experience. Jon's account of that moment

identifies his experience with the experience of students, being "in exactly the same boat" both intellectually and affectively. Although it was frustrating and confusing, Jon "lov[ed] every minute of it" from "a learning perspective."

The thing that was so cool about that, when I was in UOCD, I attended the lectures as an instructor, right, but I was really just another student, because I would listen to [the head instructor] talk and I would be just as confused as most of the students in the class. I would listen to [the other head instructor] and it would take me forever to figure out what in the world is he saying, I don't understand his words, I don't know any of this jargon, I don't know what he's expressing. I was actually loving every minute of it. From a learning perspective, I thought it was fantastic. (Jon 2, 111)

[I'm] putting myself back in time when I was in the audience along with students watching Chris talk about design. I know the students were frustrated with the use of design jargon and words they had never seen before and words and concepts they had never considered before, and I was in exactly the same boat, I was feeling it as much as students were. (Jon 1, 270-271)

Jon's description of himself as "just another student" comes alongside descriptions of his having similar experiences. He was "just as confused" and "in exactly the same boat" regarding being "frustrated with... words and concepts they had never considered before" and "feeling it just as much as students were." Although his formal title was that of a faculty, he looked, walked (or sat), and talked like a student in this situation, in relation to the unfamiliar curricular material, and in relation to the head instructors teaching that material.

Stories like Jon's make-visible how the "Collaborators" ontology can position faculty roles as a model for the student role. One mode of collaboration comes when faculty place themselves in the same situations as students are in, giving students a model of behavior in their own context and role. In doing so, faculty role-model possible ways to be a student.

However, things aren't as simple as saying that Jon was a student in this situation; his perspective exhibited student-like qualities, but also differed in important ways. In both interviews, Jon acknowledged he had positionality differences compared to a student. For one, he was in the formal role of an instructor in the other portion of the class, with certain responsibilities towards the curriculum and students than the students themselves did not share. When Jon and the students left the auditorium to go to the related studio, he entered that studio as a faculty member with formal teaching responsibilities, and they entered them as students with formal learning responsibilities.

Jon also was not formally enrolled in the course and "wasn't even graded... I knew I wouldn't be assessed or evaluated, except I guess I kind of was by my peers.... in some ways, I was being evaluated by students" (Jon 1, 272; Jon 2, 111). In other words, Jon may have been going through the same situation as students, sitting (physically) side by side with them with a similar lack of background knowledge. However, the responsibilities he had towards the situation, and the way his performance towards those responsibilities would be evaluated and by whom, differed from students in ways that continued to distinguish his faculty status from theirs.

Jon was a UOCD "student" and a faculty member at the same time. This duality illustrates the sorts of tensions that can be made-visible by the "Collaborators" ontology. What does it mean for faculty and students to collaborate on curriculum – how does that similarity of role blur and challenge, but also clarify, the distinctions and boundaries between the two roles? How might we articulate the ways in which faculty and students can be similar-enough to collaborate, yet different-enough to bring different things to the table?

7.2.3 Example from Rob: discussion

Rob's feedback practice: (Rob) collaborated on (course feedback practice and reading selection) with (students in his course who gave vocal feedback about their opinions on the readings).

Another story that can be read through the "Collaborators" ontology comes from Rob's classroom, where he talked about the way he runs course feedback. Course feedback scenarios are highly legible within the "Collaborators" ontology, as the roles fit nicely into their definitions – faculty and students are collaborating in order to improve a course's curriculum. Within the ontology, there are not only many possible ways for faculty and students to collaborate on the curriculum, there are also many possible ways for them to relate, with each of those relations having a plethora of allowable ways to collaborate.

For instance, the collaboration could be one of high role separation, as when a faculty member administers a survey and students take it. Those two actions correspond tightly to two roles that have distinct and uneven power relationships; faculty control the questions being asked, and students answer them. Rob's example looks different; here, students engage in the same sorts of actions as faculty, blurring the role distinctions. Why should a faculty member be the only one

figuring out reading choices for a class? Why shouldn't a student also consider what makes a good homework assignment?

Rob narrates the way he runs "feedback as a dialog," and how he restrains himself from commenting when students make (what seems to him to be) narrow-minded comments about the readings. In the absence of Rob immediately taking the role of rebutter, his students sometimes do. When this goes well, they begin to correct each other, listen to each other, and eventually begin to talk about higher-level topics both within and about the course curriculum: "How do we get value out of a reading?"

I like to do feedback as a dialog, where I say, I'm gonna just put out a prompt or I'm just gonna say, "What's working, what's not working, everyone raise their hand and you're gonna talk and I'm gonna just listen. I'm gonna write things on the whiteboard."

And this is really hard. There's times when I feel like a punching bag, when there's a lot of people just criticizing. There's other times when I feel, where I'm biting my tongue because you're just hearing a lot of these limited viewpoints... where a student's just getting up, saying, "Yeah, obviously, this reading was terrible, you should never have assigned it, it's very weak." And I'm dying to stand there and say, "Why did you think it was terrible? Do you think it's just you or is it everybody? Could you articulate your metrics?"

But I bite my tongue. What's wonderful is that I am, more often than not, greatly rewarded for being silent because a student will get up and say something like... "Yeah, of the three readings you assigned, the third one was the best, you should just assign that in the future... Next class, let's do more readings exactly like these readings"... and then someone else will raise their hand and a fellow student will say, "Please don't speak for me, I don't agree with that whatsoever. I think your favorite reading was my least favorite reading..."

And then you have two people looking at each other, feeling a little bit shell-shocked... "Hold on, you mean, it's not just Rob, the old man, who likes that other reading? Because, of course, he's gonna like that 'cause he's anciently old and he's a historian, so he's kinda weird... someone my age sitting in this class thought it was valuable? The one that I think was not valuable? How could that be? ...How could they not see the gorgeous beauty in the reading that I loved?"

So it becomes less this idea of teaching Rob the 80 mistakes he made in picking the readings, and more a case of saying, "What makes a reading a good reading or what makes it a bad reading? And what do we get out of reading? How do we get value out of a reading?" (Rob 5, 75-80)

In this excerpt, a faculty member (Rob) and his students are collaborating on making sense of readings within the curriculum. Because of Rob's restraint in "biting his tongue," students have

room to step into a bigger role in that collaboration. The discussion becomes one of multiple student viewpoints interacting with each other, rather than all student viewpoints interacting with a single faculty viewpoint. When Rob withholds the words he would have voiced from his perspective, students can voice them – or other viewpoints – to one another instead.

Within the "Collaborators" ontology, both differences and similarities between faculty and student roles play a key part in the "paradigm shifting" Rob describes. Rob explicitly does not assert the authority of his role difference immediately; he quiets his own voice and listens alongside the rest of the student body. However, Rob's differential role and authority as a faculty member is exactly what makes the student dialogue so powerful. As a faculty member, his perspective is easily dismissible without much consideration because he is "anciently old and... a historian," and thus expected to have a different perspective than a student would.

There's a big danger of total eye-rolling; of the student hearing me say something and saying, "Well, of course, you would say that. Like I said, you're old and you're in this discipline already. I'm young and I'm not in that discipline. So why does your perspective matter to me?" So already, the student doesn't really see my perspective as being indicative of anything meaningful. (Rob 5, 161)

In Rob's portrayal, the moment of paradigm shift happens when a student's expectations of "someone my age," someone like them, is disrupted. A person within the group they identify with disagrees with them; that disagreement may be worthy of further consideration. This forces the student to search for other ways of making sense of the difference, rather than simply being able to say "it's because Rob is a different type of person than I am." Rob's role as faculty – in his restrained silence – and the roles that students take up in the absence of his enforced authority – are collaborative contributions towards curricular sensemaking. Rob's story portrays a kind of interplay that is possible within this kind of curricular collaboration. In this case, the collaboration centers around the questions of what readings are important, which ones should be chosen, and what sorts of qualities they should be chosen based on.

7.3 Looking at the “Collaborators” ontology: Affordances

Like any tool, using the "Collaborators" ontology provides certain affordances. Some of these affordances can benefit certain people in certain ways. In this section, I will describe several affordances of the ontology and the kinds of benefits these affordances might provide when making sense of faculty roles within curricular change settings. Specifically, the “Collaborators”

ontology affords visibility into the many ways faculty and students can interact, explicitly allows faculty and students to be viewed with the same theoretical frameworks, showcases metacognition, and displays the benefits of intersubjectivity.

7.3.1 Affords visibility into the multiplicity of faculty response choices

One feature of the "Collaborators" ontology is the way it affords examination of multiple possible choices about collaborative dynamics and responses between faculty and students. Framing faculty as collaborators makes-visible choices about the nature of that collaboration. For any given situation, there are often multiple acceptable choices, not necessarily a single "best" way to collaborate.

Mark and Jon provide a good example of this multiplicity of options. Mark described his response to a student who wanted to change the TAD curriculum. The student wanted to make welding a requirement for everyone in the major, and Mark's response was to say no; the curriculum needed to serve all students, but a welding requirement would only serve a few. While he would support the student's individual pursuit of welding, he refused to broaden that individual pursuit into a more general requirement.

I've heard students in the past tell us, "you should have a class in just welding." I'm like... "That would be great. I mean, yeah, that's fine. We can do that as an exploratory course." She's like... "No, [as] part of the requirements!" [I think,] That's a one-sided, biased consideration. Because you want to weld....

[My reply is,] Then you should go to a trade school. That's not part of our mission. Yeah, I'll teach you how to weld. That's not a problem. If you ask me, I'll teach you. But I'm not going to gut my curriculum so I can meet what one student or two students want. I'll help them, guide them, tell them where they can get it, even drive you to the test center. But you've got to understand – how much flexibility do we actually have when we're trying to serve this population? We have to be committed to that. (Mark 2, 302)

Later, Jon read that portion of Mark's transcript and came up with an alternative response. Instead of treating the student's question as a direct request for a specific curricular change that could be approved or denied, Jon described a way of engaging that question as an inquiry into the student's curricular values. He gives several questions as example probes for how to draw out the student's underlying assumptions and intents, leading to "abstraction from welding to something bigger."

My personal opinion is that, when students say things like these, it's not necessarily... about welding. [I would ask,] "Tell me about welding. What is it that you like? Why do you like it?" Kind of do the five whys questioning [a practice wherein one asks "why?" five times when pursuing a question instead of accepting the first answer]. Inquiry, right? Like, "Who are you? How did you get to this position where you think welding is one that could be interesting?" and kind of let that play out a little bit. And I think that to me – That kind of conversation could lead to abstraction from welding to something bigger..." (Jon 5, 56-57)

Jon's scaffolding is a refocusing technique. Instead of taking the student's statement at face value, he digs and unpacks what might be underneath it. Whereas Mark's approach is direct and concise, efficiently ending the conversation to move on to a different topic, Jon's approach unpacks and redirects it. Both are collaborative engagements with the student who has proposed a curricular change. Neither approach is inherently superior to the other; it depends on many factors, including the goals the faculty are trying to achieve – refocus on a different topic? Help students understand the feasibility of their proposals?

Another example of faculty choices around curricular collaboration comes from Rob, who describes the choice of letting students peek "behind the scenes" of a messy curricular change project. Rob describes it as a free choice that does not, initially seem that free. Sometimes, he said, the decision to expose students to the messy underbelly of curricular change projects is unavoidable. Based on the situation, faculty and students may be forced to negotiate their roles and interactions with the curriculum. But sometimes, it is a luxury that one can choose – and in those situations, the choice becomes an active decision to shape the collaborative relationship between students and faculty in that way.

You can imagine education as something where there's a stage of some sort, there's a curtain and there's an audience... In the early days of Olin, we just didn't have the luxury of having that curtain... 'cause someone might run into class and say, "Okay, I just figured out what we're doing today. Let's do it." So you often get these statements here, where you're saying, "Look, I'm lifting the curtain because I need to do that as a survival mechanism. We are just racing ahead." ...Part of it was intentional, but some of it wasn't and we just didn't have the luxury for that.

The second time, you have a little more luxury to build that curtain... So in other words, "I don't depend on their feedback anymore but I'm still going to ask for it." So it got into the culture where it wasn't a necessity anymore, it was a choice. And that became even more of a beautiful thing. Because now, it became more authentic... "I know where we're going to be later on this semester, but I would still like you to tell me what's working and what's not working, and I would still like to see if we can improve it together as a team." (Rob 5, 119-129)

To the early classes at Olin, pre-planning was not an option; faculty simply didn't have the time to prepare. Rob's statement hints towards the constraints and compulsions felt by faculty who might not sense an option other than to lift the curtain, "because I need to do that as a survival mechanism." Phrases like "didn't have the luxury" can be read within the "Collaborators" ontology to implicate a forced collaboration. The dynamic of showing students curricular "drafts" is a result of earlier decisions, such as the decisions to admit students and start the school year on a particular timeline. However, maintaining that dynamic can still be chosen later, when the option of asking students for feedback and input on rough curricula could more easily be avoided.

Rob's analogy of the "curtain," and the separation between faculty and students it describes, is not "merely" a neutral or descriptive linguistic construct. The concept of the curtain, made manifest by language, influences the world it purports to describe. Even the existence of two different words, "faculty" and "students," to distinguish people as belonging to each group, reifies that separation of groups and makes it more "real." As with the possible student interaction decisions made-visible by Mark and Jon, Rob's example exposes the places where faculty decisions shape which way, of multiple possible ways, their curricular change collaborations might go. Through struggling in this tension, faculty reveal themselves as incomplete and humble in their understanding of a difficult balance – there is no clear and stable answer to how to navigate the faculty/student role in a course, and they must constantly adapt to, learn about, and respond to their changing situated circumstances from whatever finite perspective they inevitably have.

7.3.2 Affords viewing faculty and students with the same frameworks

Another feature of the "Collaborators" ontology is how it affords using a common set of frameworks on both faculty and students. Both faculty and students are adult learners, and adult learners have different approaches and needs than children do. Although faculty and students still have different levels of expertise and experience, it is still appropriate to treat them both via an andragogical approach (educating adults, as opposed to pedagogy which technically refers to the instruction of children) and some of the generalities in adult education such as assuming a certain level of maturity, self-directedness, and prior experiences to draw from (Vella, 1997) work across both groups.

In this ontology, students are framed as junior partners – different from faculty, but partaking in some of the same role-related actions and on different places on the same continuum

of development. Instead of using separate frameworks to understand and articulate the work of faculty as opposed to students, the language can be consistent across groups. After all, if faculty members apply the same practices they're teaching to students, and place themselves in the same or similar situations as they place their students in, then some of the same sorts of theoretical tools should be able to make sense of the experiences of both groups. The sensemaking produced will not necessarily be identical, but it's reasonable to guess that sensemaking of some sort will be produced in each case.

Jon provides a great example of this in action. As a faculty member, some of his research includes a cross-institutional study on intrinsic motivation, a theory that posits that motivation is driven by three components: autonomy, relatedness, and competence (Ryan & Deci, 2000). As part of this work, Jon administers the Situational Motivational Scale (SiMS) instrument to students throughout a semester to track changes in these motivational components.

I knew Jon was well-versed in intrinsic motivation research, so when he described his experiences as an overwhelmed first-time teacher of design, "asked to facilitate student learning in this domain that was new to us, doing activities that were foreign to us... cognitive overload paralyzed us..." (Jon 6, 169) I asked if he was describing his own amotivation, or his lack of motivation to participate in the teaching activities he was responsible for. He immediately took that entry point and used the theory he uses in his own research on students to analyze himself.

If you gave me the Situational Motivation Scale at that moment and the questions related to intrinsic motivation, "Is it fun, enjoyable, interesting? Does it make me feel good?" No, absolutely not. If you asked me about value, is it valuable or useful? I might have said, "Yes, I think so"... The external [motivation scale], did I feel like I had to do it? That was probably pretty low, 'cause... I was asked and I voluntarily said, "Yeah, I'll be game"... So the autonomy was low, the competence was negative. And the relatedness, I wasn't building connections to students in the room. Probably building some connections to... others on the teaching team. (Jon 6, 178)

The particulars of Jon's self-assessment are not important here; the important part is that he's applying the same theories he uses to understand his students, except he's applying them to understand himself. It's as if Jon had the SiMS scale as a theoretical flashlight he was shining on the students in his studies, and he had just turned the flashlight around to point at himself. The act of turning the flashlight around is the relevant part, rather than what he sees when he does so. By doing so, Jon models the transfer of these theoretical concepts across domains (applying it to

students vs. applying it to himself, and by extension other non-student persons), a skill that could become part of the curriculum he models for his students.

In a separate interview, Jon described the parallels between the way he approached curricular design with students and the way he approached it with faculty. Recall that Jon's response to a student's proposal to include welding as a curricular requirement was not to reject the proposal as inappropriate, but to probe into the assumptions behind their suggestion: "Tell me about welding. What is it that you like... how did you get to this position where you think welding is one that could be interesting?" (Jon 5, 56) Similarly, he describes his response to faculty who come to him with rigid ideas about curricular needs; instead of outright disagreeing and rejecting the surface features of their proposal, he can "interrogate that" and "find out what's behind it."

And this is the same thing that I attempt to do with faculty. We say, "All my students need crystallography of ceramic materials," or something like that. Something super that sounds super specific to me. You could dismiss that and say, "Oh, well, obviously, that's not important. So, I'll ignore your biased opinion." Or you can interrogate that, or inquire into that statement and, kind of, find out what's behind it." (Jon 5, 52-73)

Jon's comment sets up a parallel interrogative process that can be used on both students and faculty. His questions are not about value statements that mark things as good or bad ("obviously, that's not important"). Rather, they are about articulation of one's own perspective ("Why is learning [this subject] important to you?").

The ability to apply the same frameworks to both faculty and students in analyses of curricular change has several effects. First, it means that some frameworks developed to study student learning can also be applied to faculty, especially if the frameworks are already developed for adult learners. For example, growth in self-authorship, whereby a learner moves from following external formulas towards self-aware maturity and the construction of knowledge, was originally developed on college students and recent grads (Baxter-Magolda, 2001; Baxter-Magolda & King, 2004). This time period in a young adult's life overlaps with the age where some faculty members were in graduate school, and thus can also be used to articulate aspects of young faculty formation. As another example, Belenky et al.'s (1997) research on "women's ways of knowing" can describe the growth of female faculty just as much as female students. Given the paucity of theoretical frameworks created specifically to study faculty learning, legitimizing the act of adapting frameworks from other areas allows more tools into the arsenal with which faculty can be studied.

Second, it means that students are framed as apprentices and junior practitioners in curricular change. Within the "Collaborators" ontology, it makes sense for faculty to expose and share their curricular change practice with students; after all, this practice is part of what student collaborators are apprenticing to learn. In the context of curricular change – including directly in the classroom and not only during teaching team meetings – faculty can model both cognitive and metacognitive behavior to their students, making their thinking visible not only in a within-disciplinary context, but a pedagogical design one (Schön, 2005; Collins, Brown, & Holum, 1991). Part of the faculty role, then, becomes modeling the frameworks of behavior and learning that they use to understand their students' learning. They become models of metacognitive praxis; rather than simply giving answers to the question of how one might perform a task, they become those answers themselves.

7.3.3 Affords the metacognitive role of the Wise Reader

The third feature I will discuss related to the "Collaborators" ontology is its affordances for metacognition, specifically what Donald Schön calls reflection-in-action (1983). This refers to thinking about practice while in the midst of practice, as when an actor deliberately pauses at a beat because they have an intended audience effect in mind. This is related to the previous affordance of using parallel frameworks for both faculty and student collaborators; if they are collaborators on curriculum, it makes sense to expose the decision-making behind collaboration choices.

Rob described a particular kind of metacognitive practice that fits into the "Collaborators" ontology. He calls it the role of the "Wise Reader," from a book by Orson Scott Card on how to write science fiction and fantasy (1990). Card uses the analogy of a playwright and their audience to explain how an author might set up their readers to give good feedback. The relationship between a playwright and their audience, and between an author and their readers, is mirrored in a potential relationship between a faculty member and their students.

[Orson Scott Card] talks about this idea of a wise reader... [if you are] the author [of a play], you're allowed to hide behind the curtain and look at the audience... and see their reaction and it is... 100% honest. There's times when people are on the edge of their seat, they're gasping, they're laughing or they're crying... then an actor will suddenly say the next line and 50 people... [will] look at their watches... [The analogue for writing is] "How did you react to that sentence when you read it?" So he talks about trying to educate people to be what he calls "wise readers," [which

means] can you be a reader who's not just in the moment, appreciating the story... can you [also] be up, aware of your own responses as you go through it? (Rob 5, 93-98)

The skill of being a Wise Reader can be undertaken by both faculty and students; it requires an awareness of oneself as a thinker, and of one's thought processes as things that can be analyzed and changed. To be a Wise Reader is to be aware of and able to articulate their experiences as they are experiencing them rather than in foresight or retrospect, which matches Schön's portrayal of reflection-in-action as happening during the action itself. Viewed from within the "Collaborators" ontology, faculty and students collaborate on the curriculum by mutually "reading" the curriculum as a shared text for discussion.

In the context of both student and faculty roles in curricular change, the Wise Reader is the person who can articulate their personal experience of the curriculum they are in the midst of taking or teaching. In Card's words, "a Wise Reader is not someone to tell you what to do next – it's someone to tell you what you have just done. In other words, you want your [reader] to report to you, in detail and accurately, on the experience of reading your story" (Card, 2001, p. 122). Adapted to the curricular change context, one might say that it is desirable for the student to report, in detail and accurately, on the experience of taking your class. This leads to a variety of reflective voices. Not only do faculty get to hear student viewpoints: students get to hear other student viewpoints, students get to hear faculty viewpoints, and (if multiple faculty are teaching the course) faculty get to hear other faculty viewpoints.

Being a Wise Reader can be both curse and blessing. Framed as a curse, the Wise Reader is using energy to prevent themselves from fully immersing into the experience as an audience member. Framed as a blessing, they make valuable and irreplaceable contributions to curricular change. Rob (and Card) describe the cost as "a terrible price to pay," but also a necessary price for a specific kind of learning to occur. Course feedback can only happen if people are willing to take the time and effort needed to learn how to give it, give it, and incorporate it; in other words, this sort of curricular collaboration can be powerful, but it also has an engagement cost.

You're taking yourself partly out of the experience of just immersively enjoying the [experience], because you're becoming aware of your own responses... [Orson Scott Card] calls it, "A terrible price to pay," because he said, when he trains some people really to be good at this, they never stop doing it... so he really talks about going meta here as a mixed bag, but he's saying, "Being selfish for a moment as the author, I need people to pay that price and to do that and to be a wise reader and to give me that feedback 'cause that's the only way I can learn..." (Rob 5, 99-100)

Rob goes on to describe becoming a Wise Reader as an irreversible process. People who experience it as a permanent change are "always kind of narrating their experiences and they might be watching a movie and they say, "Boy, I wasn't really into the movie 'cause I was aware of how I was responding to it" (Rob 5, 99). Read within the "Collaborators" ontology, Rob's description of the Wise Reader process can be interpreted as a transformative kind of collaboration. When faculty collaborate on curriculum with students in this manner, the collaboration can change them just as much as they change the curriculum.

7.3.4 Affords the benefits of intersubjectivity

The final feature I will discuss from the "Collaborators" ontology is the way in which it promotes and makes-visible the benefits of and opportunities for intersubjectivity. As the word itself implies, intersubjectivity is about putting multiple ("subjective") perspectives in conversation. Intersubjectivity is a natural consequence of this ontology's role setup; if faculty collaborate on the curriculum with students, multiple viewpoints (faculty viewpoints, student viewpoints, and a diverse collection of viewpoints within each of those categories) will be present. These multiple voices mutually inform each other as they interlace within a sort of complex curricular change chorus.

Rob provided a lovely portrayal of intersubjectivity by discussing the sorts of mutual learning that can occur when intersubjectivity is present. When different people bring their personal frameworks into the room and are open to engaging with those frameworks "on a common problem," they can experience the world as seen by others. The different perspectives of the other parties are not seen as deficits, but as positive contributions.

When you have five people in a room, in theory, you should have five sets of these frameworks. Five people are bringing their own perspectives... to bear on the same common problem... there's times when I'm bringing up paradigm theory, or tech systems, or one of many other things, and the person I'm teaching with is bringing in their structures and frameworks, and each of us are just thinking the other person is some sort of wizard, right? We're each saying, "How did you do that? That was like magic." (Rob 5, 44-45)

The premise of intersubjectivity is that each voice is situated, partial, and perspectival. Each voice comes embedded in its own context, and can see what that context provides, but not what other contexts provide. Every combination of situated, partial, and perspectival voices is itself

situated, partial, and perspectival. Bringing together multiple voices, no matter how many the voices or how skilled the synthesis, can never lead to complete knowledge; however, each voice contributes something new to our understanding of a complex phenomenon.

In the context of the complex phenomena of curricular change, the interactions assumed by the "Collaborators" ontology make-visible the benefits of intersubjective interactions that involve not only multiple faculty perspectives, but student perspectives as well. Since postmodernism places such a strong emphasis on plurality and positionality, it often seeks to bring this kind of plurality of positionalities together – not in argument with each other to see which is "right," but in dialogue to see what each can see that the other cannot. In the case of faculty/student collaborations within curricular change, there are some particular qualities that differentiate faculty and student perspectives, and make the valuable to each other.

It is important to note that both perspectives are limited; this is not an attempt to glorify the student perspective as "better" or "more important" than the faculty viewpoints that are more commonly heard in curricular change spaces. Certainly, faculty have more experience than students; as Lynn noted of students, "I have been where they are, or close, and they have not been some of the places I've been" (Lynn 5, 54). Similarly, Rob acknowledges that he's "been up there and I've been pummeled around... I have heard suggestions, that I know immediately are never going to happen because I understand political realities or accreditation issues, or whatever better than the students do" (Rob 5, 88). Clearly, student viewpoints have limitations, and faculty viewpoints have vantage points and considerations that student ones do not.

However, student viewpoints also have vantage points and considerations that faculty ones do not. Lynn describe students as being "in an excellent position to tell me what something looks like from a vantage point that I cannot obtain." (Lynn 5, 58) This dynamic of intersubjective perspectives will be familiar to anyone who has ever watched a spy movie such as James Bond; it is the scene where the person back at headquarters is communicating with the spy "on the ground" through a headset, annotating and guiding their observations. "I see three soldiers in black uniforms in front of a red car," says the spy. "If they have black uniforms, they must belong to the enemy troops," headquarters replies from a distance. "Their leader usually drives a red car; that might be him. Walk towards the car, but don't let them see you." Only the spy is on the ground; only the spy can see the soldiers and walk towards the car. For all the knowledge that headquarters can provide,

their boots are not on the ground to execute it – and in fact, they can provide that information precisely because their boots are not on the ground to execute it.

Additionally, having been somewhere is not the same as presently being there, as anyone who tries to share photographs with friends upon returning from a thrilling vacation can attest. Even if faculty have "been where they are," students are actually there right now, articulating their experiences in the moment. As Rob notes, the "stakes are high," in the sense that changes to the curriculum affect their immediate experience of the curriculum.

And I think that the more you have someone, in the moment, giving that feedback... I would argue, it's good to capture that. It's very valuable to do that when you've got your... Your passion is high, when the stakes are high, versus an alum who could look back in a more reflective detached manner. I wanna get some of that fire in the discussion. I think it's good. If someone's furious about an activity or just thrilled about it, they wanna take tons of it, I wanna capture that when I'm designing a curriculum. (Rob 5, 67-68, 85)

In addition to these considerations, students may represent different demographic groups and lived experiences that their faculty may not also represent. Consider the case of a white faculty member at a historically Black college or university (HBCU), or a female engineering student encountering primarily male faculty in her courses. The only way to get these voices into the conversation about curricular change is to include students who can articulate perspectives from their lived experiences that the faculty may not share.

Even student complaints about their courses can be framed by the "Collaborators" ontology as contributions to the collaboration. Rob interprets it as interest in curricular improvement, since complaints about curricular inadequacy presuppose a higher standard that the student wants to see. Rob pointed out that student motivation is a perpetual topic of discussion among faculty members, and that complaints are signs that a student is engaged (albeit in a frustrated manner) with the course.

The more passionate a student gets, often, the more vocal they get about this. And I actually, I honestly find some good in the fact that they see that. I think there's real motivation and there's real passion. This is different from the student who would say, "I don't care. You tell me what to learn. I'll do anything you say." This is a student who has a viewpoint, who has identified a preference, who really wants to do more of the things that interest her or him, right?

When I hear [students complain], I get excited. When I hear the student say, "I think everybody should do what I'm doing." To be honest, I'm hearing somebody who is crazy enough to think that they might be able to change the world, who really

believes in their viewpoint. I see real power here. So there's a goodness there. I don't wanna just stomp it out and say, "Your views mean nothing. You're only 18 years old. Stop thinking that you have the right answers." (Rob 5, 67-69)

Instead of framing student complaints as negative and short-sighted and looking for a way to "stomp it out" as something annoying, Rob look for how their actions point towards something powerful that he does want to facilitate. "There's a goodness here," he says. This is a student "who really believes in their viewpoint." The question is how to recognize that passion and to facilitate it towards the faculty member's end goals, whatever that may be and whoever they may be shared with. Within the context of the "Collaborators" ontology, that passion becomes signal and not noise; it can be interpreted as a unique contribution to the collaborative effort of curricular change, and then treated and fostered in that manner.

The passion itself may be an end goal, or related to one. The idea of having students take charge of their own education is not an unfamiliar one for educators. Helping students grow into being independent thinkers and doers, having them get involved in the workings of their school, and having them make the world a better place are sentiments often echoed in high-level program descriptions. The curriculum is part of the world, not only in the philosophical sense, but in the contextually embodied sense that classrooms are physical environments where human experiences occur. Therefore, tapping into student passions for improving that experience is, in a very real sense, having students change the world by contributing their intersubjective voices to curricular change projects, and collaborating faculty can foster that world-changing skill development.

8. DISCUSSION AND CONCLUSION

I started this entire project with questions about how we might understand the nature of faculty roles in engineering curriculum change. This chapter brings together the four ontologies presented as different “ways of understanding” in chapters 4-7. The faculty roles corresponding to the four ontologies (makers, inheritors, embodiments, and collaborators, respectively) serve as four possible responses to the research question: how might we make sense of faculty roles in their narrative ontologies of curricular change? Each ontology provides a different way of making sense of faculty roles. In previous chapters I explored how the ontologies could be used to make sense of the faculty roles within them; in this chapter, I extend this to show how the ontologies can be used to make sense of faculty roles from other ontologies.

This chapter consists of three parts. The first part integrates the four ontologies presented in this dissertation and summarizes their contributions, both individually and together, to curricular change work related to faculty roles and narratives. I then use the ontologies to demonstrate how the insights from this work could be used to facilitate and legitimize curricular change work being done by faculty. Finally, I reflect on the main choices made during this project, lessons learned, and possible future work focused on both curricular change narratives and postmodern methodologies within engineering education.

8.1 Integrating the ontologies

Faculty roles in curricular change can be portrayed in a wide variety of ways across different curricular change ontologies which coexist simultaneously, in all their contradictions, in the lives of actual faculty members. This first part of the chapter integrates the four curricular change ontologies and their corresponding faculty roles. In the first section, I frame the four ontologies as tools to choose between for discussing the kinds of situations and desired outcomes each ontology might be particularly useful or not-useful for. Following that, I show how this project’s narrators used (or more accurately, can be framed as using) various combinations of the four ontologies to portray the curricular change projects they narrated. Next, I show how working across multiple ontologies can uncover tensions in curricular change and provide opportunities to examine

assumptions about reality. Finally, I outline how this work contributes to the existing work on faculty roles and narratives of curricular change.

8.1.1 What each ontology might be useful for

The tools I developed for this project can be used as tools for engaging in engineering curricular change. This section frames ontologies in general, and the four ontologies I developed in this project more specifically, as tools that can be chosen between. Each ontology, named after its faculty role, affords/makes-possible different things. In other words, certain things are more visible, emphasized, and/or possible within some versions of reality than others. Here, I examine the affordances of all four ontologies (Makers, Inheritors, Embodiments, and Collaborators) together in order to discuss what each one might be useful for in comparison to the others. In each of the analytical/ontological chapters, I described four affordances of that chapter's ontology. In this section, I bring together all the affordances I described for all four ontologies.

By examining the affordances of all four ontologies side by side, I am taking a step back from viewing them as all-encompassing realities (“of course this is the way it is”) and treating them like tools in a toolbox to choose between (“which version of reality do you want to use?”). Each ontology's list of primary affordances is different, just as each tool in a toolbox has different primary affordances: hammers primarily afford hitting, screwdrivers primarily afford applying torque to things with small inset slits. Alongside each ontology and the four primary affordances explored in its corresponding chapter, I list potential situational goals that the given ontology might have advantages towards. The ideas below are not presented as an exhaustive list, but rather as a starting point for exploration.

The **Makers** ontology... (Chapter 4, “faculty make curriculum to benefit students”)

- Affords a clarity on roles and prioritization of student learning
- Affords unification of faculty and their goals
- Affords motivation through difficult tasks
- Affords a variety of curricular forms

When a curricular change effort needs to unify faculty and/or focus on the needs of a specific student population, this ontology can be a useful tool. If there is dissent or fractioning, being able

to present goals as being “for the benefit of the students” may help bring faculty on board for the work to be done. This ontology may be particularly useful towards the development of faculty *attitudes*. For instance, in this project’s narrative dataset, Mark responded to faculty debates about space usage by asking how proposals would benefit student learning.

The **Inheritors** ontology... (Chapter 5, “faculty inherit curriculum and students”)

- Affords known and unknown curricular change histories
- Affords framing curricular change as a site for faculty growth
- Affords multiple areas of complex and interacting faculty growth
- Affords student influences on the faculty experience

When curricular change is desired, or the continuation of a curricular change is desired, and the issue at hand is the readiness and development of faculty, this ontology can be a useful tool. This ontology frames curricular change work as an opportunity for faculty growth, and therefore may be particularly useful towards the development of faculty *skills*. For instance, in this project’s narrative dataset, Jon’s first time co-teaching the UOCD course became an opportunity for him to learn design from its more experienced instructors.

The **Embodiments** ontology... (Chapter 6, “faculty embody curriculum encountered by students”)

- Affords a historical explanation for curricular identities
- Affords faculty individuality and non-interchangeability
- Affords valuing faculty collaborations and co-teaching
- Affords legitimization of faculty needs, interests, and values in curricular change designs

When the curricular change story includes the interests and personalities of individual faculty, this ontology can be a useful tool. It may also be useful when part of the question is how to engage in curricular change in ways that will work for the faculty themselves, especially faculty who may identify as belonging to various marginalized groups in the field. This ontology may be particularly useful towards the recognition and incorporation of faculty *identities*. For instance, in this project’s

narrative dataset, Alan embodies both the artistic practice of a photographer and the procedural practice of an industrial arts major in the technology courses he teaches.

The **Collaborators** ontology... (Chapter 7, “faculty collaborate on curriculum with students”)

- Affords visibility into the multiplicity of faculty response choices
- Affords usage of the same frameworks on both faculty and students
- Affords the metacognitive view of the Wise Reader
- Affords intersubjectivity

When the curricular change seeks student investment and involvement and/or shifts in the attitudes of faculty towards students this ontology can be a useful tool. This ontology directly challenges and addresses the relationship between faculty and students. This ontology may be particularly useful towards fostering and engaging student and faculty *relationships*. For instance, in this project’s narrative dataset, Rob facilitates discussions amongst his students on how to choose readings for their course.

To summarize:

- The Makers ontology addresses faculty attitudes
- The Inheritors ontology addresses faculty skills
- The Embodiments ontology addresses faculty identities
- The Collaborators ontology addresses faculty relationships

Each ontology has more affordances than the four primary ones listed with it above. This is true of physical tools as well. Screwdrivers technically afford hitting, but are less effective than hammers at hitting things with enough accuracy and force to drive in a nail. Similarly, the Collaborators ontology affords intersubjectivity in an easy and obvious way; the other three ontologies do not exclude the possibility of intersubjectivity, but neither do they suggest it.

Viewing the ontologies as tools suggests that none of them are better *in an absolute sense* compared to the others; they are only better towards specific ends in specific contexts. Just like an engineer chooses their tools based on the affordance of the tool and the needs of the job at hand, a narrator can choose their ontologies based on the affordances of those ontologies and the needs

and goals of the communicative job at hand. Just like an engineer choosing a hammer for one job does not mean that she dislikes or is discarding her screwdriver, choosing one ontology does not mean the narrator does not have or will not use other ontologies when they serve them well in different situations.

8.1.2 Patterns of how this project’s narrators (can be seen as having) used the ontologies

Having discussed the sorts of factors that might influence an engineering faculty’s choices of which narrative(s and their affordances) to apply, I now turn to the choices that the faculty narrators in this study actually made – or more accurately, the ontological choices I interpreted them as making. I review the previous four chapters’ combinations of faculty narrators, ontological framings, and curricular change project stories in order to show that wide variety of combinations are possible. This re-emphasizes the idea of multiple ontologies as choices, rather than identifiable correlations (i.e. “this project is a Makers ontology sort of project” or “this narrator is a Collaborators ontology sort of narrator”) or progressions.

As the previous section demonstrated, different ontologies have different attributes and affordances that make them differently useful towards certain types of curricular change efforts. As this section shows, individual faculty narrators can slip between multiple ontologies in their narrations of curricular change stories, and curricular change stories can be read through multiple ontologies. The end effect is generativity – opening up options for telling and interpreting stories of curricular change, and thereby opening up options for envisioning the realities in which these curricular change projects might take place.

The tables below map the curricular change projects and narrators from chapters 4-7 to the four ontologies. The leftmost column lists subsections in each chapter, namely the two introductory examples and the four primary affordances discussed. The remaining columns denote which curricular change projects were used as examples (1 = TSS/TAD self-study, 2 = D&D/Documentation & Design, 3 = OED/Olin’s early days, 4 = UOCD/User-oriented Collaborative Design, 5 = SoH/Stuff of History) and which narrators excerpts were taken from (TAD narrators are A = Alan, G = Gary, and M = Mark; Olin narrators are J = Jon, L = Lynn, and R = Rob). An X in the column denotes that I used material from the corresponding project or narrator in my explanation of the example or affordance.

Table 8.1. Makers ontology coverage

Makers ontology (chapter 4)	1	2	3	4	5	A	G	M	J	L	R
Example: Making a unified vocabulary for D&D		x				x	x				
Example: Making a sophomore year design course placeholder in OED			x						x	x	x
Affords a clarity on roles and prioritization of student learning	x						x	x			
Affords unification of faculty and their goals		x					x	x			
Affords motivation through difficult tasks				x				x	x		
Affords a view of the forms curriculum might take	x					x	x	x			

Table 8.2. Inheritors ontology coverage

Inheritors ontology (chapter 5)	1	2	3	4	5	A	G	M	J	L	R
Example: Inheriting D&D, a course of a faculty member who left		x				x	x	x			
Example: Inheriting changes in the field of Industrial Arts	x					x	x	x			
Affords an acknowledgement of known and unknown curricular change histories				x					x	x	x
Affords framing curricular change as a site for faculty growth		x				x	x	x			
Affords visibility of multiple areas of complex and interacting faculty growth		x		x		x			x	x	x
Affords visibility into student influences on the faculty experience				x	x				x		x

Table 8.3. Embodiments ontology coverage

Embodiments ontology (chapter 6)	1	2	3	4	5	A	G	M	J	L	R
Example: Embodying hands-on undergraduate design as a former frustrated undergraduate			x	x					x		
Example: Embodying graduate-style history pedagogy as a former engineering undergraduate				x	x						x
Affords a historical explanation for curricular identities	x	x				x					
Affords faculty individuality and non-interchangeability	x		x			x		x	x		
Affords valuing faculty collaborations and co-teaching					x				x		x
Affords legitimization of faculty needs, interests, and values in curricular change designs					x						x

Table 8.4. Collaborators ontology coverage

Collaborators ontology (chapter 7)	1	2	3	4	5	A	G	M	J	L	R
Example: Collaborating on the learner role with students in the lecture hall				x					x		
Example: Collaborating on course designs with students during reading feedback discussions			x								x
Affords visibility into the multiplicity of faculty response choices	x		x					x	x		x
Affords viewing faculty and students through the same frameworks				x					x		
Affords the metacognitive view of the Wise Reader			x								x
Affords the benefits of intersubjectivity			x								x

As can be seen in the tables above, I was able to combine a wide variety of curricular change project stories, narrators, and ontologies in the preceding four chapters. This means that it is possible to make sense of curricular change using many combinations of project stories, narrators, and ontologies. Since the above tables only count the combinations I used in my particular (re)tellings and sensemakings, the absence of a mark does not mean that combination is

impossible, only that I did not use it in the chapter. In fact, the tables at the start of each chapter (sections 4.2.1, 5.2.1, 6.2.1, and 7.2.1) show all five projects can be told as stories within each of the four ontologies. Alternate versions of each chapter, either by myself and/or another author, could have utilized or expanded on different combinations; the goal here is to illustrate not exhaustive combination coverage, but that a wide range of combinations is possible. The tables are meant to be generative rather than exhaustive, serving as an invitation: “I used these combinations – which ones might others use?”

The marks in the tables above are not applied as prescriptive labels indicating that a certain ontology is the “true” nature of the project being narrated. Indeed, they would be contradictory if they attempted to. For instance, the UOCD story shows up in the tables for all four ontologies. This means I cannot say that the UOCD project’s reality is inherently configured to one specific ontology, because I demonstrate how it can be seen through all four of them. Instead, what I can say is that a particular ontology, when applied to a particular narrator’s telling of a particular story, makes-visible things that can be interpreted as meaningful in the context of curricular change. In other words, this table demonstrates that a single project and its stories can be legible – can be read – in the light of multiple realities, including versions of reality that may conflict with one another. Knowing this can happen is important because it is the first step towards allowing multiple conflicting realities to become a possibility.

Similarly, I cannot say that narrators are of a certain “ontological type” – that a specific narrator lives and thinks within a specific ontology. Every single narrator shows up in more than one of the four tables above, meaning that all of them can be interpreted as speaking from within multiple ontologies. This demonstrates within-subject intersubjectivity on the part of this project’s narrators. In other words, each narrator’s stories (sometimes even the same story by the same narrator) can be read in the light of multiple realities, including versions of reality that may conflict with one another. As Walt Whitman’s poem “Song of Myself” (1856) says: “Do I contradict myself? / Very well then I contradict myself / I am large, I contain multitudes.” Reality is complex, and people do (or at least appear to) contradict themselves; to deny this possibility in research is to erase the times this sort of complexity occurs.

Furthermore, these ontologies are not a progression; it is not that faculty start with the first ontology, and then progress through the next, then the next, then the next, as they gain more experience or insight. Rather, these are different perspectives faculty (and others) can have, and

combine in different ways. This fluidity of perspective is not an error; rather, it is a feature of the complexity of humans and their viewpoints and the worlds and stories they narrate. Humans switch between different types of language usage in their everyday utterances without noticing it (Joos, 1967); for instance, note what happens to the linguistic registers of a parental discussion of Santa Claus when their toddler suddenly walks into the room. Similarly, narrators adapt their storytelling to fit their relationship to their audience, as Annie Oakley found when she began telling interviewees in her project about new motherhood that she had also borne a child, and the women began to relate as fellow mothers (1981).

The variety of combinations of narrators, project stories, and ontologies remove the possibility of using the ontologies as a sort of “personality test” of narrators or curricular designs. As the table above shows, it is not the case that some faculty narrators were "Makers" types, whereas others were "Collaborators" types. Nor is it the case that a particular curricular setup or story precludes certain narrators from telling it, or precludes a specific ontology in its telling. The implication is that any of these combinations may be possible.

8.1.3 Introducing the diffraction grid, a tool for investigating ontological multiplicity

In the preceding two sections, I discussed the affordances of each of this project’s four ontologies, then demonstrated how ontological multiplicity appears in this project in multiple ways. In this section, I demonstrate and discuss the affordances of ontological multiplicity itself. In order to demonstrate the affordances of ontological multiplicity, I employ a tool I created called the diffraction grid, which uses the ontologies as both things to look *at* and things to look *through*. In the subsequent discussion, I use this diffraction grid as an example to explain how working across multiple ontologies can uncover opportunities for examining assumptions and making visible tensions within the phenomena being ontologized.

The diffraction grid is a tool for demonstrating theoretical reflexivity – that is, it operationalizes the notion that multiple ontologies allow for each ontology to shed light on each other one. Effectively, a diffraction table runs a framework through itself. Each element of the framework is listed as both a row and column in the grid; one axis (here, the vertical) treats it as a theoretical lens to look through, and the other axis (here, the horizontal) treats it as a piece of data to look at. The diffraction table’s structure points out that everything is subject to interrogation, and everything can be used to interrogate everything else. It does not say that roles do not exist,

but rather that role assumptions are fluid and changing, and that elements may have multiple simultaneous and seemingly contradictory roles. Ontologies can be simultaneously used as lens and data. Each intersection of the diffraction grid intersection make-visible what the “lens” ontology, when focused on the “data” ontology, makes-visible.

When an ontology is used as a lens, its assumptions are assumed to be “true.” This means that one diagonal of the diffraction grid corresponds to each ontology's view from within itself – an examination of that ontology that does not question its assumptions, but rather assumes they are all correct. These four diagonals (greyed in the grid below) correspond to the individual analytical/ontological chapters 4-7, which each dealt with a single ontology.

The cells outside the diagonal represent facets of curricular change faculty roles that are only made-visible via the interaction of multiple ontologies – things that are not apparent by simply visiting individual ontologies in turn. Without ontological multiplicity – specifically, interacting ontological multiplicity – these facets and the richness they point towards would remain invisible. When one ontology is used as a lens through which to examine a different ontology as data, the “lens” ontology is assumed to be “true,” so the “data” ontology may sometimes seem to be “wrong.” Another way of phrasing this is that working across multiple ontologies allows the examination of assumptions being made within each ontology.

For example, the Makers ontology assumes as a fundamental axiom that faculty make curriculum for the benefit of their students, whereas the Collaborators ontology assumes that faculty collaborate on curriculum with students. Assuming the axioms of the Makers ontology to be true, and looking at the Collaborators ontology through it, a tension appears: how can the Collaborators ontology possibly portray students of fellow makers of the curriculum? According to the Makers ontology, curricular creation is the faculty member’s job; the student role is not to co-create, but to consume. Looking at the Makers ontology through the Collaborators ontology, we see the opposite; if students are fundamentally supposed to be collaborating on curriculum with faculty, the Makers ontology is incorrect if it portrays them only as users.

These sorts of tensions and conflicts are visible in the diffraction grid below, where I have used this project's four ontologies as the framework to examine and be examined by. Each cell in the grid gives an example of what one might say in a design review of the ontology in the “data” position (horizontal axis) when assuming the ontology in the “framework” position (vertical axis) is the “real” reality of curricular change.

Table 8.5. Diffraction grid of faculty roles in the four ontologies

	Makers (data)	Inheritors (data)	Embodiments (data)	Collaborators (data)
Makers (lens)	Chapter 4: Faculty make curriculum for the benefit of their students.	Faculty are responsible for making the curriculum work for their students regardless of what situation they inherit.	Faculty should prioritize making the curriculum fit their students, not their own interests and personalities.	Faculty are the makers of curriculum; students shouldn't be burdened with collaboratively fixing it, so they can focus on beneficial learning.
Inheritors (lens)	Curriculum is not ahistorical; faculty inherit contextual elements that limit their abilities to make whatever curriculum they want.	Chapter 5: Faculty inherit curriculum and students.	The curricular situations that faculty inherit can become formative experiences that shape how they embody their roles.	The student populations that faculty inherit can become collaborators who teach them the curricular cultures of their campus.
Embodiments (lens)	Faculty cannot prevent their individual differences from influencing how they make and teach even a supposedly "standardized" curriculum.	Curriculum is something faculty arrive already embodying; they do not solely inherit it.	Chapter 6: Faculty embody curriculum encountered by students.	Faculty and students both embody past experiences and individual quirks in ways that shape their collaborations.
Collaborators (lens)	Faculty do not need to exclude students from collaborating with them on making the curriculum.	Faculty can collaborate with students to shape the curriculum they inherit from the past.	Faculty and students collaborate to form a curriculum they are collectively able to embody.	Chapter 7: Faculty collaborate on curriculum with students.

The content listed in the diffraction grid above is not exhaustive. Rather, it highlights the utility of the tools developed in this project by showing the sorts of things made-visible in the interaction of multiple ontologies. Later in this chapter, I will show a case study that will explore some of these ontological interactions in more depth. For now, the idea I am illustrating is that while individual ontologies can assist with understanding when used separately, they can make things visible in entirely different ways when diffracted through one another. Not only can we use the ontologies (and other ontologies and frameworks more generally) as things to think with about the reality of curricular change (or other aspects of the reality we inhabit), we can use them as cues to engage in metacognitive acts of thinking about how we think about and embody those realities.

In order to be diffracted, these ontologies need to be both separate and interacting, and their conflicts must be embraced rather than hidden. Far from being errors or "bugs" to resolve, the tensions and conflicts are generative ones. If I revisit the earlier example of tensions between the Makers and Collaborators ontology, I can give examples of how the conflicts raised in the table above can also spur questions on how to live within those tensions. For example, if faculty are both makers of and collaborators on curriculum, how might it be possible for faculty to both make curriculum for student benefit and to collaborate with them on its creation? What might it look like for faculty to create learning experiences that benefit students by having them learn about curricular creation through engaging in it in a scaffolded and mentored manner? What others sorts of things might fit the design constraints implied by both ontologies – or how might it inspire us to discard constraining assumptions from both? In our example, interventions that might live in the space of generative tension include hiring students as course design assistants, training undergraduate TAs, or having students take lecture topics and take turns teaching the course content to their classmates. The table below gives examples of the kinds of generative questions that can be raised by the tensions shown in the diffraction grid. Again, this table is not exhaustive, but rather a starting point that demonstrates the kinds of questions that are possible.

Table 8.6. Generative tension examples in the diffraction grid

	Makers (data)	Inheritors (data)	Embodiments (data)	Collaborators (data)
Makers (lens)	Chapter 4: Faculty make curriculum for the benefit of their students. How else might we see this?	What are the constraints of faculty agency and influence on the curriculum they are responsible for?	To what extent should a faculty member's individual personality and preferences be separated from their curricular designs?	When is student participation in curricular change a good learning experience for them, and when is it a distraction?
Inheritors (lens)	What histories and contextual factors might faculty be erasing when they are portrayed as makers of "new" curricula?	Chapter 5: Faculty inherit curriculum and students. How else might we see this?	How might faculty think of curricular change projects as customized formation experiences for their own personal and professional development?	How can we collaborate on curricular change with students in ways that make them more skilled collaborators with faculty who will teach them in the future?
Embodiments (lens)	How might faculty incorporate the unique traits they embody into the curriculum they make?	How might the personalities and past experiences of faculty influence the ways in which they are able to inherit curricular situations?	Chapter 6: Faculty embody curriculum encountered by students. How else might we see this?	How might faculty envision future roles their students might embody, and tailor curricular collaborations towards helping students grow into those roles?
Collaborators (lens)	How might faculty involve students in making curricular change for themselves?	How might faculty approach the students they "inherit" as potential collaborators for creating curricular change rather than rigidly set elements that need to be worked around?	How might collaboration between students and faculty create a curriculum that can embody a diversity of needs?	Chapter 7: Faculty collaborate on curriculum with students. How else might we see this?

Using the diffraction grid highlights rather than eliminates tensions between the ontologies. The questions that spring from these collisions take advantage of tension as a source of generativity, awareness, and creativity. This is why multiple conflicting ontologies useful rather than detrimental within a field that often seeks to unify the disparate components of the world into a single working model with acknowledged limitations. This approach does not attempt to find a single working model; it deliberately works with multiple, inevitably limited ones. In doing so, it echoes previous work by a chorus of diverse voices within engineering education who advocated for "multiple perspectives methodology" as a way to broaden engineering education's vision into a "more inclusive problem formulation space... a space of conflict and confrontation, as different modes of inquiry interact to enable transformative knowledge" (Adams et. al., 2011, p. 50).

This work contributes concrete method and methodological tools for what Adams et. al. call “multiple perspectives methodology” in engineering education and links them to postmodern discourses on ontological multiplicity. In doing so, I contribute to the discussion on why this multiplicity is so crucial to engineering education as a field. Attempts to merge conflicting ontologies into a single, smoothed-over, self-consistent meta-ontology would also remove opportunities for the kind of innovation that often comes from embracing constraints as seeds for creativity. To smooth over these tensions is also to hide the fact that tensions are present in the world we live in; reality is complex and contradictory, and no amount of trying to erase that will make reality neat and placid.

8.1.4 Contributions and connections to existing work

This section connects this project’s contributions to a broader landscape of existing work on curricular change and the faculty narratives and roles therein. I list each ontology in turn, giving example of existing literature that connects to that ontology and/or shares its presuppositions about the underlying structure of reality with respect to faculty roles, engineering education, and/or curricular change. For each ontology, I also position the contributions of this project with respect to that literature.

The Makers ontology in engineering curricular change

The Makers ontology shows up in several places adjacent to curricular change. For instance, it appears in faculty and teaching team meetings whenever student needs are discussed. The rhetoric of "meeting student needs" and "getting to know our student population" (in the sense of characterizing them in order to determine what services to provide) all fit within the ontological depiction of faculty as makers of curriculum that is ordained towards the service of student learning. Examples of actions that can be framed within this ontology include such things as tailoring a review session to focus on topics that students got wrong during an exam, constructing homework problems so they draw on topics of interest to students, and starting an undergraduate research program so that students can have research experiences. These actions can be interpreted as acts of the faculty creating curricular environments and opportunities that will then positively impact student learning experiences, a shift from teacher-centered to learner-centered educational

approaches (Barr & Tagg, 1995). The Makers ontology supports and extends this work by further legitimizing the use of “making” and “designing” language when discussing faculty actions with respect to curricular change. The act of making requires time, space, and other resources, and the Makers ontology can be used along with literature on student-centered learning in order to advocate for the provision of those resources.

The Makers ontology also shows up in advertising for prospective students considering a particular program. "Here's what we do for students," some of those brochures and websites proclaim. It fits into the ontology of students-as-customers put forth by recent portrayals of higher education systems. Some of these portrayals paint the student-as-consumer mentality as positive and leading to accountability for good learning outcomes; others paint it as harmful to intellectual growth and academic freedom. All of them frame the curriculum as something created by the faculty and used to ostensibly benefit student learning. The Makers ontology contributes to this discussion by making room for faculty contributions to what may currently be considered the jobs of marketing and/or admissions departments.

The Inheritors ontology in engineering curricular change

Examples of the Inheritors ontology in existing curricular change work include faculty development settings, which also explicitly portray faculty as learners. New faculty orientations are a good example of this deliberate enculturation and introduction to an existing campus culture. Mentorship programs for new faculty, wherein more experienced faculty coach them through their questions, also fit within this ontology; the new faculty are developing a sense of cultural fluency so they may better encounter their course and students. The Inheritors ontology contributes to this discussion by placing everyday curricular development and testing/prototyping activities within the realm of “faculty development” alongside formal programs.

The Inheritors ontology can also be used to understand teaching assignments. For example, imagine a course that is a core part of a college's engineering curriculum, with many sections taught by multiple faculty over the years. A faculty assigned to teach a section of this course for the first time may be given instructions and materials for what topics need to be covered at what times, suggestions or requirements for textbooks and activities, and a heads-up on the current reputation that the course has among the student body. They may ask advice of faculty who have taught the course before or students who have taken it, recognizing that they can learn from past

events. Again, this sort of encounter can be framed as the faculty as a newcomer to an existing world of curricular-student culture. The Inheritors ontology contributes to the discussion on teaching assignments by giving it a specifically developmental twist, allowing faculty to advocate for their own teaching placements on the basis of personal growth rather than simply departmental efficiency.

The Embodiments ontology in engineering curricular change

Curricular change work also shows signs of the Embodiments ontology. For instance, it appears in literature on professional identity development (Dall’Alba, 2009) where the formation of a professional takes into account the individuality of learners engaging in a common practice. It fits nicely into narrative studies on the effect of past experiences on engineering identity, as well as case study research where the experiences of individuals are centered, and oral histories such as the Pioneers project, where engineering education luminaries were asked to narrate their career histories (Allendoerfer, Yasuhara, Turns, & Atman, 2016). This ontology contributes to and extends the discussion by using engineering faculty as another example for professional development, rather than only looking at the professional development of engineering students or early-career engineers in industry.

The Embodiments ontology also appears in the rhetoric of how faculty initially get to know each other: “what do you work on, and how did you get into that?” “Where did you get your PhD?” The presupposition is that these questions will tell us something about the person we are meeting, and/or their curricular practice: “Where did you learn to teach that way?” “Is that how everyone does it in Japan?” This affordance also resonates with Humboldt’s ideal of the faculty-scholar, and is one of the primary rationales for research, integrated with teaching, becoming a required part of the faculty job (Anderson, 2004). Framing teaching as something done in line with one’s passions is also aligned with theories of intrinsic motivation (Deci & Flaste, 1996); teaching is not an externally imposed requirement to suffer through and minimize, but something that adds intellectual fruitfulness and joy to one’s life. This ontology contributes to the discussion in engineering education by specifically validating personal fulfillment and flourishing as an important consideration in faculty careers; it is not only the students that the field must nurture, but the teachers and researchers as well.

The Collaborators ontology in engineering curricular change

The Collaborators ontology is challenging, as the tensions it points out in the context of curricular change are difficult to find in writing about curricular change and student involvement at the undergraduate level. However, graduate-level education, especially in the PhD, seeks to involve students as collaborators and build a sense of agency in them, at least in the research domain. More recently, undergraduate engineering students themselves have published research about their own involvement in curricular change projects at a very early stage, including the sophomores who re-wrote and re-taught an introductory course at the University of Texas El Paso (Fernandez, Delgado, Montoya, Gonzalez, & Vaughan, 2015) and the sophomores who researched their classmates in the elder-focused design course they were taking at Olin College (Lynch et. al., 2014). This ontology contributes to the discussion by providing a framing that can bring these examples together, so that what they have in common can be more readily shared and discussed as another way of conceptualizing curricular change in the field.

8.2 Putting insights into action: recognizing faculty as learners

I now take the synthesis of results from the previous sections and apply them to curricular change practice to show how this work can make a difference in the context of the academy. In the first section, I provide a case study of the four ontologies in action, working both within and across them in the context of a hypothetical new center for computing across the disciplines. In the second section, I discuss the notion of “faculty as learners” as a common thread through all four ontologies, and how ontological multiplicity can draw out the complexity of learning in the faculty role. In the third and final section, I step back to examine how the practices of faculty and faculty-adjacent practitioners might be impacted by this work.

8.2.1 Demonstrating the ontologies in action

In this section, I give a demonstration of how an engineering faculty member might put ontological multiplicity to work. I will use the four ontologies presented in this project and apply them to a hypothetical curricular change situation from the perspective of a faculty member involved. In this case, the hypothetical curricular change scenario is a university that seeks to build a new center for computing across the disciplines. I will engage this scenario from the perspective

of "Future Dr. Mel," a newly-minted engineering education PhD who has been hired to help develop new computing course offerings for non-STEM majors. Familiar with the ontologies and ontological multiplicities developed in this work, she seeks to move between many ways of conceptualizing this curricular change project, not just one. In the paragraphs that follow, I write in "Dr. Mel's" voice, moving between examining what each ontology and/or combination of ontologies helps me to understand and envision about my task.

One task I (Dr. Mel) might engage in is choosing what sorts of resources might be useful to students from non-STEM majors encountering computing for the first time. In this task, the Makers ontology provides guidance by framing my role (as faculty) as that of a maker of curriculum for the benefit of students. This ontology affords clarity and prioritization of student learning, so it validates my time spent on investigating resources that could help my students pick up basic computing concepts efficiently. These resources could include technologies (programming languages, software platforms, software projects, etc.) that are new to me, but if it will motivate them, I will use the ontological affordance of motivation to get myself learning those things so I can utilize them in the courses I design. The affordance of viewing curriculum broadly could assist me in thinking about conferences, internships, clubs, etc. as possible growth opportunities for students outside of class, and the affordance of goal unification could help me advocate for departmental resources by bringing other faculty together around how impactful this would be on student learning.

Simultaneously, I might engage in tasks informed by the Inheritors ontology, such as considering the history of how the university has previously taught computing, and what the experiences of non-majors in computing classes has been. The Inheritors ontology frames my faculty role as the inheritor of students with a background in other majors, as well as the inheritor of a college computing curriculum with existing cultures and classes. Using this ontology's affordance of making historical influences visible, I might investigate the history of the computing curriculum at my college – why are the courses structured as they are? – and also look into the history of computing education as a field to see what inspiration there might be to draw from (Dziallas & Fincher, 2016). Both engineering/computing and non-engineering/computing faculty might want to work on this cross-disciplinary program; the ontology's affordance of framing curricular change as a site for faculty growth could help advocate for these teaching assignments as a part of their development. After all, it would be great to have more engineering-literate arts

faculty, humanities-literate computing faculty, computing-literate engineering faculty, and so forth.

I might also bring my background in open source software into play, encouraged by how the Embodiments ontology frames my faculty role as an embodiment of my experiences, perspectives, and values in the computing curricular my students will encounter. In this case, my background working and running faculty workshops in open source industry shapes my desire to expose students in the program to real-world, large-scale projects from the beginning, as well as the contacts and skills that enable me to quickly do so. At the same time, my undergraduate degree is in electrical/computer engineering rather than computer science, so I will likely collaborate with CS faculty and computing education researchers to bring in that angle and their contacts in the computing education world; doing so utilizes this ontology's affordance of valuing faculty collaborations and co-teaching. All of us will be valued for our unique contributions, pointing to the affordance of faculty non-interchangeability.

Finally, the Collaborators ontology provides me with a way to frame my faculty role as collaborating on the curriculum with students in the program. I can use this ontology to advocate for opening opportunities to envision and build classes to the students who may someday take them. This ontology's affordance of metacognition might show up in course feedback sessions where students learn how to constructively critique curricula. In recognition of the affordance of intersubjectivity and its valuing of the inclusion of diverse voices, I might convene community circles where multiple parties – faculty, students, and staff alike – can hear each other's perspectives on the program's design as it progresses.

Tensions between the four ontologies might also inform my thinking as I work not just between, but across each of the four ontologies I am using. For example, the Makers and Inheritors ontologies carry a tension to examine: what are the constraints of my agency as a faculty member on the curriculum I am designing? Although the Makers ontology suggests that I have both free rein and responsibility to create what will be "best" for student learning, the Inheritors ontology suggests that notions about what "best" might mean are already present in the campus and disciplinary cultures I will encounter. For instance, computing educators have published a basis of disciplinary knowledge to help practitioners in their field prioritize what students are exposed to; I may want to look at this and decide (with my colleagues) which parts we do and do not want to

use. This tension between ontologies may help sensitize me to how I want to navigate between honoring history and breaking with it, using existing components and inventing new ones.

Similarly, working simultaneously with the Collaborators and Embodiments ontology might prompt me to ask how I as a faculty member might envision future roles my students might embody. The Embodiments ontology portrays faculty selves as shaping curricular experiences – but it also portrays past curricular experiences as shaping future faculty selves. Although students in a "computing across the disciplines" center may not become computing faculty, they are likely to be leaders and mentors on the topic of computing within their respective non-computing fields. Working with the Collaborators ontology and its assumption that students will be co-creators of their curriculum, I might engage students in course activities that help them teach computing within their field by embodying the computing knowledge they will gain from our classes. Simultaneously, I might recognize the unique opportunity my students will have to embody their home disciplines within computing courses, and ask faculty to model their own cross-disciplinary embodiments in class – for instance, I might use the gestural vocabularies from my backgrounds in dance and sign language to engage in visual-spatial/kinesthetic portrayals of abstract computing concepts.

These sorts of teased-out tensions and entanglements, as well as explorations within each individual ontology, can obviously go much farther than the example given in the paragraphs above. This section demonstrated this project's four ontologies in action on a specific hypothetical curricular change project. Other combinations of ontologies could have been used, including ontologies not listed in this project. I could also have applied any combination of ontologies to another curricular change project, such as the starting of a college, the redesign of a first-year experience, the retirement of a key person in a department, and so on. In all these examples, the act of working both within and across different ontologies brings a richness and multifaceted consideration of complexity to the design, and encourages multiple action framings, questioning of assumptions, and keeping things in motion.

8.2.2 Making faculty visible as learners

This section examines a thread that weaves in different ways both within and across all four ontologies: the idea of making faculty visible as learners in the context of curricular change. In the preceding section, the idea of faculty-as-learners showed up in different ways as I thought

(as a future faculty member) about a hypothetical program design. For instance, the Makers ontology motivated the learning of unfamiliar computing technologies so that I could build a curriculum that would allow students to use those tools. The Inheritors ontology highlighted how I would need to learn more about the history of computing education and the culture of my new college in order to understand the circumstances under which I would be building the computing program. The Embodiments ontology positioned faculty as learners in co-teaching experiences across the disciplines, and the Collaborators ontology pointed at the sorts of things I and my fellow faculty might learn from student voices.

More generally, each ontology speaks to faculty learning in a different way. The four ontologies presented here are four of infinitely many possible portrayals of faculty as learners in their curricular change activities; other ontologies contain yet more portrayals of faculty learning waiting to be explored. In combination, they provide a multifaceted view into the complexity of the faculty role, and the corresponding complexity of learning as it lives within that role(s).

The Makers ontology speaks to the what, why, and where of faculty learning by giving them an external goal (fostering student learning) to aim towards. The clarity of curricular priorities that a student-focused mindset brings is also a clarity that can guide the "what" of faculty learning in curricular change. This ontology makes-visible the unification and motivation of faculty towards their common goal of serving students, but their unity and motivation is also towards how they need to learn and develop in order to do so. Finally, the broad notion of curriculum afforded by this ontology gives a sense of "where" – an enlarged sense of the curricular, and therefore the curricular change, domain that faculty learn both towards (in the sense of developing their skills to serve a broader sphere of curriculum) and within (in the sense of a broader space in which they develop those skills).

The Inheritors ontology speaks to the space faculty learn within, frames faculty as learners, and shows the kinds of things they learn and who they learn from. The curricular history shaped by others provides a sense of the environment with/in and from which faculty learn. This ontology also portrays them explicitly in the learner role, placed deliberately in teaching and curricular design experiences for the sake of their own development. It makes visible the breadth of things faculty learn in curricular change circumstances, and the contributions students make to faculty learning.

The Embodiments ontology speaks to a sense of personal history on the part of faculty, highlighting framings of their identities as learners. The intertwined influences of past curricular experiences, present-day faculty identities, and future curricular design speaks to faculty as learners not only in the present, but in the past and future as well, with personal histories of learning that cannot be temporally separated. Making-visible the way faculty needs and wants drive curricular development and change speaks to the inclusion of faculty needs as fellow learners involved in curricular change projects. This ontology also explores the boundaries of the faculty member as a unit of analysis, which points towards the ways faculty are conceptualized and assessed as learners – individually, in groups, with evaluation starting and stopping at particular points in time.

The Collaborators ontology speaks to faculty as learners alongside students, and the high degree of self-awareness and complex self-authorship learning of this type requires. This ontology makes-visible reasons to distinguish between faculty and student roles, which points out the uniqueness of faculty as learners, as compared to students they design for. Intersubjectivity and student voices are beneficial to faculty learning – hearing voices different from their own can give new insights to faculty members. Learning to foster student participation in curricular change is specifically called out as a skill faculty can and do develop, and when faculty model metacognition, they are doing an in-the-moment exposure of their thought processes as mature learners.

The above examples show how ontologies can present different facets of learning within the faculty role(s). One implication is that the lifelong learning touted as part of the engineering student experience is also applicable to the engineering faculty role. On the one hand, this is not a surprising result; radical curricular change is such an intense and involved process that anyone associated with it, especially as intimately as faculty are, cannot help but be changed as they pass through it. On the other hand, it is a twist, an unexpected angle; in curricular change and in other areas of their daily lives, faculty are usually framed as teachers – facilitators of the learning of others – rather than as learners themselves.

The role of faculty as learners in curricular change is a complex phenomenon, and a language that aims to articulate faculty learning in that domain needs to be able to highlight that complexity. A single model is insufficient to capture this complexity; the faculty members they represent are messy and contradictory, and any set of models aiming to point at that complexity must also acknowledge that they themselves are contradictory and incomplete. Practices of

unification and standardization and the desire to resolve conflicts between frameworks clash with the notion of perspectival fluidity. To acknowledge the complexity and fluidity of faculty practice in curricular change, that push towards standardization and unification must sometimes be set aside.

Curricular change is a difficult, lengthy, labor-intensive process. Articulating faculty as learners in a complex way helps to fill in a gap of making-visible in the praxis of the academy. Without ways to make-visible the intense development and work of faculty within curricular change engagements, we limit our abilities to discuss this valuable labor and growth in the context of faculty evaluation, promotion, and tenure. Language that is limited to not speak of faculty as learners within curricular change contributes to a marginalization of curricular change work. By extension, affordances for articulation of faculty as learners becomes a prerequisite for legitimization. Consequently, a language that makes-visible faculty as learners in the context of curricular change can contribute to curricular change's status in in the academy.

8.2.3 Implications, limitations, and opportunities for faculty and faculty-adjacent practitioners

In this section, I explore the possible implications of this project for the practices of both faculty and faculty-adjacent practitioners. I have primarily created the four ontologies as examples of ontological multiplicity to be of use to faculty members engaged in curricular change. However, both they and the methods I created for this project may also be useful to professionals who support those faculty members. For example, university administrators such as department chairs, college deans, and provosts, faculty development professionals might make use of multiple conceptualizations of curricular change roles and relationships in speaking with faculty about their projects. Faculty development professionals such as staff members in Centers for Teaching and Learning (CTLs) can use these ontologies as conceptual “vocabularies” in working with their faculty clients, as well as examples of other ontologies they might develop for their own settings. In the paragraphs below, I will discuss implications for practice for faculty, faculty developers, and administrators in turn, along with pointing out how limitations of this study point towards opportunities for future explorations for each group.

Implications for faculty

One implication of this work on faculty practice is how it can increase metacognitive awareness of their faculty roles. A knowledge of one's own practice is useful for looking critically at that practice. Faculty involved in curricular change generally already know that their work is intense and difficult and involves a great deal of time; this work can aid in articulating where that time goes and why it is valuable time spent. The various ontologies give structure and language to some of the things and qualities and elements that happen in curricular change, moving beyond "I spent 30 hours a week on it this semester" to talk about what those 30 hours can look like from varying points of view. Having a language to articulate practice helps in externalizing it and seeing what aspects to keep and what aspects to change. It is a tool for thinking that gives transparency to both faculty and those they work with.

One clear limitation of the study in this regard is that it is based on the stories-of-practice of only six faculty members from two institutions, meaning that different ontologies and configurations may be more useful for other faculty with other projects at other places. However, this also points out an opportunity for faculty to extend this work in their own context, treating it as a starting point for considering what sorts of ontologies might describe their own specific practices and thus building a larger library of ontologies to be shared with other engineering faculty. This kind of work might be carried out in places where engineering faculty gather, using the four ontologies presented above as the starting point for discussing the many possible viewpoints of faculty roles in curricular change. In this way, the study would also contribute to a shared interrogation of how engineering education as a field tells narratives about curricular change, the assumptions made in those narratives, and the sorts of things that might be made-visible by interrogating the ways in which those narratives are viewed.

Another implication of this work on faculty practice is an explicit and increased attention towards and valuing of intersubjectivity. By externalizing and discussing multiple curricular change ontologies, faculty would be encouraged to collectively make sense of their and their colleagues' multiple and simultaneous and contradictory worldviews. Instead of attempting to converge immediately on a single worldview, the conversation could turn to allowing multiple takes on reality while temporarily converging towards curricular implementations that can be beheld from within multiple ontologies. Instead of assuming only one version of reality can be correct, that it ought to be optimized towards, and that the others are wrong (or less-optimal), this

study encourages faculty to generate and appreciate multiple creative approaches to the same situation.

The notion of intersubjectivity points towards a fourth limitation/opportunity of this project: it is based only on the narratives of faculty. As I mentioned in the first chapter, curricular change has many different types of stakeholders, and faculty are one of many – administrators, employers, professional organizations, working engineers, and so forth would be interesting to examine in a similar manner. Students may be a particularly fruitful group to work with in this manner, as suggested by the “Collaborators” ontology, which emphasizes the partnership between students and faculty in the context of curricular change. The research question and methodologies developed for this project could be extended and applied to any of these groups.

Finally, this project's discussion on making faculty visible as learners can help faculty see and advocate for themselves as learners to others. The faculty role allows for ongoing growth and reinvention of self, but it is often easy to get caught up in serving the needs of others and leaving scarce time for personal development. Sabbaticals are one feature of faculty life that provide space for renewal and a way to address one's own personal learning needs, but they occur only every seven or so years and are subject to other resource and life constraints such as family situations, funding, and so forth. This study positions everyday curricular activities as potential sites for faculty learning, and thus gives faculty a way to think about – and advocate for resources for – their own development during the seven or more years they often spend between sabbaticals.

Implications for faculty developers

The notion of faculty as learners in their everyday curricular change work is also a starting place for looking at the implications for this work on the practice of faculty developers. Here, I consider "faculty developers" to include anyone responsible for the career growth of other faculty who specifically do not report to them; the case of faculty considering their own development is covered above in the "implications for faculty" section, and the case of faculty considering the development of other faculty who report to them (as in the case of a department chair or college dean) is covered below in the "implications for administration" section.

Much of the current faculty development literature looks at faculty development in formal contexts: faculty attendance at workshops, participation in scaffolded mentorship programs, and so forth. This would be akin to only focusing on the learning of college students in the context of

formal instruction in the classroom. Just as the literature on student learning examines dormitory living, clubs, informal conversations and advising, etc. as significant contributors to student growth, faculty developers can look at the everyday lives of faculty as a venue to more fully and differently understand where, how, and why faculty grow. Since this project focused on faculty roles as told in their in-situ stories, as opposed to an in-depth look at faculty roles as they have been portrayed in faculty development literature, one limitation of this work is in its linkage to and usage in the faculty development world; this also presents a clear opportunity to take it there.

Faculty developers can also directly implement some of the methods I developed for this project. For example, they can use the intersubjective, iterative interview process that I used as a form of faculty development rather than as a research data collection tool. Since faculty are often siloed away from the stories of others, getting them to repeatedly reflect on their stories and the stories of others can build connections across colleagues who may not otherwise have time to speak. Additionally, the protocol builds deliberate space and time for scaffolding reflection skills. In summary, this is about looking in different places for faculty development, and using some different methods for faculty development. Faculty developers could also expand the prompt progression technique as a faculty development intervention as well as the start of an oral history repository for their institution. For instance, I have used the Olin faculty interviews as a way to introduce new Olin faculty to some of the personalities and background stories of the institution they have just joined.

Implications for administrators

In terms of impact on administrative practice, this project has implications for promotion and tenure by suggesting ways to frame and give credit for the curricular change work that faculty do. Similar to how faculty gain a language to articulate and thus revise their own practice, administrators similarly can use the language and maneuvers from this study to understand and recognize faculty growth from multiple perspectives. The four ontologies and their corresponding faculty roles suggest multiple answers to the question of what it might mean to do well as a faculty member engaging in curricular change. This project does not explicitly explore that question – it is limited to exploring a few variants of what faculty roles might be, rather than metrics for how "well" one is doing in each version of the role. However, that exploration is another opportunity

for future work, since having a language and a means of articulation is the first step towards deciding what is the desired goal.

This shared language – and more importantly, shared metalinguistic practice of language generation – can work across administrators, faculty developers, and faculty to help them make their work both legible and legitimate to one another. The ability to discuss and validate new kinds of work as within-scope, to give words to it, and make it not-invisible, increases the chances that those kinds of work can be done at all. By working with ontological multiplicity, the dialogue becomes one of building versions and understandings of reality that make sense and work for the people involved.

The qualitative nature of this project is a limitation of this study that serves as a pointer towards future work that could particularly affect administrators. At the outset of chapter 1, I noted that I was going to focus on setting forth and describing ontologies, and that I would specifically not be working to determine how frequently each one was utilized. Earlier in this chapter's discussion, I also focused on existence (i.e. that a wide variety of combinations of ontologies, narratives, and narrators were possible and that they might appear at all) rather than frequency (i.e. how often certain combinations appeared). Part of this was motivated by my desire to show that narrators, narratives, and projects were not *inherently* bound to one or more ontologies – that they could be interpreted using multiple ontologies, and that this interpretation was in large part in the eye of the interpreter. In other words, I worked within the qualitative and focused on interpretative possibilities; I deliberately excluded work on quantitative trends.

However, now that I have demonstrated that multiple ontological usages are possible, it would be instructive to examine how those possibilities are or are not evenly used. A future effort could look at quantitative trends *of interpretation*, investigating whether there are statistical patterns in how practitioners, researchers, etc. apply the four ontologies as tools. For instance, if the four ontologies are presented to a group of faculty and administrators and they are asked to spend time working within multiple ontologies, how much time might they spend proportionately in one ontology versus another? In turn, this sort of finding might point towards ways we tend to favor seeing the world, and suggest which alternate views of reality we might want to scaffold via programs, stories, examples, and so forth so that it is easier to envision, experience, and experiment with.

8.3 Looking back

In this part of the chapter, I reflect on the main choices made during this project, lessons learned, and possible future work focused on both curricular change narratives and postmodern methodologies within engineering education. I first look at how engineering education can benefit from the postmodern turn by unpacking how this project can shed light on existing practices in the field. I then turn to the postmodern and ontological turns in engineering education *research* and lay out several possibilities for future contributions to methodology. Finally, I summarize the theoretical contributions that this work makes in regards to ontological multiplicity.

8.3.1 The postmodern turn in engineering education

This section examines elements of the postmodern turn used in this project and how they impact the engineering education world. As engineering education heads into diverse and decentralized territories such as the maker/hacker movement, distributed online education (such as MOOCs), and valuing multiple and alternative points of view rather than creating a monolithic narrative of able-bodied, middle-class, straight cis male global north whiteness, it enters the sorts of territories that postmodern educational research was created to articulate. This project only begins to scratch the surface of how postmodern philosophies, methodologies, and language can help engineering educators and students make sense of their world. Here, I discuss several areas where this project points towards possibilities for the postmodern turn in engineering education. The areas are ontological multiplicity and the ontological turn, low-context language usage, working against structure, and challenges to power that open new avenues of diversity and inclusion. Future work could extend many of these ideas, started in the literature review in chapter 2, into a more fleshed-out exploration of where philosophies are embodied by the field.

Moving beyond epistemology to include (multiple) ontologies

The ferment of the ontological turn has followed in the wake of the postmodern one in several fields. By recognizing engineering education as a living example of the ontological turn in an educational field, we can join the conversation in academic fields already steeped in postmodern (postcolonial, poststructural, etc.) philosophies. This takes engineering education's existing emphasis on epistemology (what engineering knowledge is, who learns it, how one learns it, etc.)

and brings ontology up beside it as an inseparable sibling, no longer silenced. It also makes engineering education available as a world for postmodern educational researchers to explore, and offers engineering educators the tools and insights on those researchers in increasingly accessible and legible ways. This project serves as an example of what it can look like to bridge both worlds.

The emphasis and playful exploration of multiplicities and tensions present in these fields can also be of use to educators teaching engineering to students who will work in an increasingly diverse and complex world. This project presented multiple ontologies of curricular change, ontologies that are at once in tension/contradiction and resonance with each other. In doing so, it serves as an example of how explicit ontological recognition and multiplicity can help make sense of curricular change & faculty roles in complex ways that are not afforded by "cleaner" options. The exploration loses something when it reaches towards coherence and simplicity: having only one ontology, having wholly separate (rather than intertwined and interacting) ontologies, assigning ontologies an inherent hierarchy, and so forth do not make the same things visible that interacting multiple ontologies can. While ontologies seen within themselves make certain things visible within the world they claim as their reality, as chapters 4-7 and the diagonal of the diffraction grid show, ontologies seen through each other make things visible about those ontologies, thus helping us uncover some of our most deep-seated assumptions about the reality we live in and train our students to change.

Legitimizing low-context language usage within engineering's high-context culture

Another way this project points towards engineering education's gains from the postmodern turn is by standing as an example of language play. High-context disciplines (such as engineering) and low-context disciplines (such as education) have different ways of using language, and this has been a challenge for engineering educators trained in one domain and learning the other (Borrego, 2007). Specifically, high-context disciplines assume that language ought to converge on a standardized and shared meaning, whereas low-context disciplines assume that constant renegotiation of those meanings is a key ongoing practice. By interrogating ontologies (the nature of being and reality), this project also interrogates the language that we use to point to and within those realities.

These language practices of low-context disciplines, and the hermeneutic, intertextual, and intersubjective nature of communication they imply, could improve collaboration and

communication in engineering education. As a discipline that sits at the intersection of engineering (a high-context culture) and education (a low-context one), engineering education stands to benefit from increased fluency in and recognition of these language practices. Instead of working towards only convergent understandings, engineering educators can work towards plural understandings. This sort of thinking already shows up in engineering education; for instance, the introduction of design thinking has brought heavily intersubjective review and dialogue practices into the engineering field. By calling out explicit switches between the convergent/modernist dialogues in engineering and the divergent/postmodernist dialogues in design thinking and other arenas of engineering education where negotiation of plural meanings takes place, we can articulate the challenges and discomforts of learning to bricolage these very different practices into use within our field. Language is powerful; it's how we express and encode our conceptualizations of the world, and we act according to those conceptualizations.

For example, this project explored faculty roles using multiple ontologies, thereby playing with notions of what the word "faculty" might refer to. What is a faculty member? What does that role entail, and what is and isn't permitted within it? Every time someone utters a comment such as "faculty can't do that," it presupposes that there's a particular thing meant by the role of "faculty," that they're thinking of someone acting outside the boundaries of that role as "wrong," and that they have the authority to call this out as an error. More insidiously, assumptions such as "Asians are good at engineering" and "women are bad at math" continue to shape the perceptions and performance of engineering students, faculty, and practitioners (Trytten et. al., 2012; Steele & Aronson, 1995). Improving our ability to do and teach this sort of language play can help disrupt the stuck places and patterns that harm engineering learners and educators. By changing practices, roles, and our usage of the words referring to them, we change the ways we understand reality and act within it. By using language practices that reflect the plurality, multivocality, diversity, and fluidity of curricular change, we gain the ability to think and act more clearly and communally about it.

Using poststructuralism to question structure

Since I have included poststructuralism under the umbrella of the postmodern turn, I now turn to poststructuralism in this project and its implications for engineering education. Poststructuralism works against the structuralist philosophies commonplace in engineering.

Structuralism, which is concerned with finding or setting structures, meanings, and relationships in things, is a basic principle in much of engineering discourse. It includes the practice of categorization, which is also a form of ontologizing (via taxonomizing). Within engineering education specifically, structuralism shows up in the search for clarity in our categorizations, such as the split into engineering sub-disciplines are split (such as mechanical vs electrical engineering). By utilizing poststructuralism to question and challenge structuralist habits in engineering education, I aim to open different questions: why are there categories, why are they these particular categories and not some other set, and what things don't fit cleanly into any of those categories? Via engaging ontological multiplicity in this project, I demonstrate poststructural questioning and moves in the context of engineering education, opening up different questions: what is a faculty member, and what doesn't fit cleanly within the various definitions we have of that role?

Poststructural thinking shows up in multiple arenas newly explored by engineering educators. Examples include the maker movement, where learners often journey on pathways that weave in and out of formal engineering education structures (Jordan & Lande, 2013), open source software communities, whose spontaneous decentralized decision-making practices often clash with academic structures requiring advance planning (Ellis, Hislop, Chua, & Dziallas, 2012), and student-run curricular development, where undergraduates design and teach engineering courses to their peers in a subversion of the usual undergraduate student roles (Fernandez et al., 2015). In these and other poststructural arenas, roles are fluid, hierarchy is shifting and nonlinear, and boundaries of belonging and contributorship are fuzzy. They do not fit into the lines and ways of thinking currently taught in most of formal engineering education at the college level and beyond. The paradigmatic differences between these new (and very old) informal spaces and learning in formal spaces require languages and practices that can work against as well as within structure. Poststructuralism provides these kinds of tools to think and live with.

Poststructuralism (and postmodernism) and its constant actions of sifting and dismantling are not necessarily places to stay forever; they are, however, spaces that help us question where we are and help us to be hyper-conscious of the choices we are making. Structure is sometimes needed, and postmodernists acknowledge that we often need to use the tools of modernism and structuralism in order to accomplish other goals. The ability to operate simultaneously in modern and postmodern frames of mind is not framed as an error, but rather as a way to see things differently, and to see different things. By using multiple ontologies to both reinforce and

destabilize one another, this project demonstrates how engineering educators can work both within and against existing structures in our field.

Cutting loose the ties of power and inclusion

For me, the most exciting contribution of this project to engineering education practice and theory is showing postmodernism's ability to reveal, challenge, and change structures of power and inclusion in engineering education. As a field, we know we have work to do in diversity and inclusion, which is one of the five core areas defined by the Steering Committee of the National Engineering Education Research Colloquies (2006). The current structures of engineering education are set up to privilege access to certain groups over others; disrupting these structures (with poststructuralist tools) and talking about them in different ways (with postmodern and low-context language usage) and examining a broader multiplicity of ways to be (ontology) an engineer can open new engineering ways of being to people who are currently marginalized by the field's power structures.

Like all communities of practice, engineering education has its narrative accrual and its determinations of who gets to read and write the stories of the field. Between the two, write access is far more powerful; it's the kind of access that allows a person to contribute stories to that narrative accrual, and to edit which ones it contains. Potential writers need the skills to craft the story so that it can enter the dataset, but they also need a community willing to accept their contributions. This also means that choices about format are also socially constructed: the community decides what it means to have sufficient "quality," "impact," or whatever terms the community of practice uses to judge what is "worthy" of entering the accrual.

These kinds of discussions of power have long histories in critical, postmodern, and critical postmodern discourse. One of the reasons postmodernists place so much importance on questioning categories, optimization, and so forth is because those things disrupt power and privilege dynamics when they are disrupted. If there are power structures that are problematic, postmodernism gives us tools to break down those walls. By using postmodernist tools to make-visible this sort of experimentation and fluidity within engineering education, I contribute to the ability of others to participate in the process. This project opens up different possibilities for seeing curricular change processes and what they are and what they might be, and thereby opens possibilities for who might be able to participate in them.

8.3.2 The postmodern and ontological turns in engineering education research

The preceding section discussed possible influences of this work on engineering education practice; this section looks briefly about how I might bring parts of this project forward to contribute to engineering education research. I first discuss how I might work through the ontological turn within engineering education as a contribution to research in that field, as well as in educational studies and faculty development. I then turn to post-qualitative methodological contributions whose seeds appear in this work and which I hope to take up in later publications.

The move from epistemology to multiple ontologies, discussed previously as a contribution to engineering education, is also a contribution to engineering education research. The inclusion of ontology is a potentially significant change to what has been defined as one of the five core research areas in engineering education (Colloquies, 2006) which currently only mentions epistemology. Continuing work on "ontology as methodology" and the ontological turn within engineering education contributes to engineering education research as a field, as well as positioning engineering education research as a field that can contribute to others.

Future work includes bringing this work into the realm of educational studies, which has a history of post-qualitative education research and moving forward the postmodern turn in methodology. Additionally, I also plan to bring this work on faculty roles into faculty development research, which is currently in the midst of early discussions about rigor in its research, similar to engineering education research discussions a decade ago (Streveler & Smith, 2006). Translating and extending this work across research domains may also extend engineering education research into publication and conference venues it has not yet touched.

I also anticipate moving forward my methodological and theoretical developments both within and from engineering education. The two are intertwined, as the notion of "theory as methodology" is one of the contributions of this work to engineering education research as a field. Contributions to methodology include:

- The four postmodern theories converted into methodological "tools" in chapter 3
- Grounded indigenous coding and realtime captioning as an interview technique that challenges conventional researcher/participant dynamics
- The diffraction grid as a way to use theories simultaneously as frameworks for analysis and data to analyze

- Development of generative and emergent methodologies to include not only methodologies that produce emergent results, but methodologies that generate methods and methodologies, including methodological self-modification

By developing practices for developing methodologies, I contribute to our capacity to create custom-made methods for engineering education research. I also position engineering education as not only a borrower/adaptor of methodologies from other fields, but a place of methodological development that can be used by other fields.

Finally, the postmodern turn re-frames our roles as engineers, engineering educators, and engineering education researchers in the light of all these roles as intersubjective autobiographical narrations. As practitioners of combinations of these things simultaneously, we take on narrative roles in our own stories and in the stories of our field(s); this role of narrator is a high-agency one. Glesne speaks of the writer/narrator role as threefold: (1) artist, (2) translator/interpreter, and (3) transformer (Glesne, 2011, p. 219). Narrators decide how to create (as artists) a story-telling moment and how to translate it for their audience (and themselves) in order to elicit the desired reaction/transformation. Extending the idea of performing mastery of a community's language and narrative accrual to display membership in that community, the positioning of self and narrative can be a way to situate the narrator or the interpreter with respect to power in that community. Agency and the potential for communicating and transforming power dynamics is heightened even more when the narratives are about one's own past, as in the context of this project, where faculty narrators told stories about their own curricular change projects. Autobiographical narrators paint themselves as characters in their own stories, drawing from their prior experiences and using their agency in the present to articulate their agency in the past. This "intentional state entailment" is a key feature of narratives; without characters with agency who make choices, we cannot have narratives at all (Bruner, 1991, p. 7). Telling stories about oneself – or people identifiable as similar to oneself – is a way to communicate and either reify or transform the nature of the reality one lives in, and one's position in it. Telling stories about faculty roles and curricular change in engineering education, in the context of consciously postmodern articulations and engagements, is a way to reify and transform those parts of our existence.

8.3.3 Summary of ontological multiplicity

In this section, I summarize the theoretical contributions of this project that relate to the key theme of ontological multiplicity.

1. Multiple ontologies can (co)exist.
2. Ontologies do not have a one-to-one correlation with situations/stories or people/narrators. Every situation (and its stories) can be described within multiple ontologies; every ontology can be used as a basis for making sense of multiple situations. Similarly, people can simultaneously work within multiple ontologies, and ontologies can be utilized by more than one person.
3. When multiple ontologies for the same situation interact, they both conflict and resonate. They are not separate pieces of a larger unified whole; there is no grand meta-ontology that resolves all tensions. Simultaneously, they are also not wholly separate from each other.
4. Complex ontologizing makes sense of a complex lived reality. Having multiple simultaneous ontologies in sometimes-contradictory play illuminates messy and contradictory curricular change complexities in ways that more simplistic arrangements do not.

Curricular change stories and faculty roles are full of paradoxes, tensions, etc. and we have historically had to choose one to the exclusion of others, or to try to merge together things and make them fit, acknowledging the imperfection of that fit. Here, we do not do either/or, but rather both/and; by embracing as many things as possible and questioning the assumptions that this should be untrue or contradictory, we cut loose more possibilities for interrogating meaning, making sense, and taking actions that may make sense in one interpretation but not another.

In the postmodern paradigm, we are not separate from the reality we claim to observe; we are part of it, interacting with it, and our observations can never be separated from the vantage point of our existence. There is no such thing as objective neutrality, as every viewpoint is situated, partial, and perspectival. It is impossible to operate without an ontology, as to do so would be to operate without any assumptions whatsoever regarding the nature of reality. The ontological perspective we gaze upon this toolbox with may not be a lens from the toolbox itself, but it is a lens nevertheless. This acknowledgement of the inevitability of positionality is important because

it shapes the values we assign to the things we look at – what a lens is “good for,” or even whether we consider a lens “good,” depends on how we determine what is good/desirable or not.

APPENDIX A. EXERCISES FOR THE READER

In keeping with this project's overtly postmodern approach of breaking the fourth wall to engage the reader (you!) as coauthor, here are some reflective questions to consider.

First, think of a curricular change story of your own, either one you have been involved with or one you have heard about. What is the story of that project, and what role (if any) did you play in that arrangement – faculty, curriculum, student, or something else? Tell the story in as brief or long a format as you like. We will revisit the same curricular change story four times, once through each of the four ontologies.

The Makers ontology frames faculty as makers of curriculum for the benefit of the students. Where have you seen the Makers ontology in action? Retell your curricular change story as a story about faculty making curriculum for the benefit of the students. (How does this feel – natural, awkward, challenging, fascinating, etc.? What insights do you get from the act of trying to make sense of that curricular change story from the perspective of this ontology? Remember that we sometimes learn the most from what *doesn't* work – if you don't feel like you can tell that story from within this ontology, why do you think that might be?)

The allegory for the Makers ontology is that of a restaurant kitchen, where skilled chefs make tremendous amounts of complex, delicious food at high speed in order to nourish and serve a huge number of diners with all sorts of different tastes and preferences and allergies. Take the specific faculty, curriculum, and students from the story you had in mind, and imagine them as chefs (faculty), food (curriculum), and diners (students) in the kitchen allegory. Fill in details: what kind of restaurant is it? What kind of food is being served? Which part of the kitchen interaction does your story portray? (How does this process feel, and what additional insights – if any – does it give you?)

The Inheritors ontology frames faculty as inheritors of curriculum and students. Where have you seen the Inheritors ontology in action? Again, retell your curricular change story, this time as a story about faculty inheriting curriculum and students with histories, personalities, etc. (And again: how does this feel, and what do you learn from the process?)

The allegory for the Inheritors ontology is that of a house renovation, where new owners inherit a quirky old house in need of repair, constantly being renovated, and full of existing tenants

who sometimes modify the building themselves. Take the specific faculty, curriculum, and students from the story you had in mind, and imagine them as new landlords/homeowners (faculty), a house (curriculum), and tenants (students) in the renovation allegory. Remember, the house is under active renovation, and the tenants are already living there. Fill in details: what does the house look like? How do the tenants treat it, and what is their relationship with the new landlord? What are the repairs needed? Does the landlord know how to make the repairs? (Again: how does this feel, and what do you learn?)

The Embodiments ontology frames faculty as embodiments of the curriculum encountered by students. Once more: where have you seen the Embodiments ontology in action? For the third time, retell your curricular change story, this time as a story about faculty embodying the curriculum – the implicit and explicit curricula they encountered as students themselves, the interests and values and beliefs they have about their work and teaching, their personalities and preferences and quirks, their skills and strengths and weaknesses – and that embodiment being encountered by students. (How does this feel, and what do you learn from the process?)

The allegory for the Embodiments ontology is that of a learn-to-scuba-dive program, where young divers encounter and then fall in love with the ocean, grow to like and specialize in particular aspects of diving or specific dive sites or types of equipment, and then come back to teach newer divers on their first encounters with the sea. Take the specific faculty, curriculum, and students from your answer to the above question. Imagine them as experienced divers (faculty) passing down knowledge of the ocean (curriculum) to subsequent generations (students) in the diving allegory. Fill in details: how do the novice divers feel about entering the water? Do the more experienced divers have memories of similar scenarios? How did they start diving in the first place? What sorts of things under the ocean are they eager to share with the new divers? What sorts of challenges might they face in getting into the water and working with their equipment? (Again, how does this feel and what did you learn?)

Finally, the Collaborators ontology frames faculty as collaborators on the curriculum with students. Where have you seen the Collaborators ontology? Tell your curricular change story one last time, this time as a story about faculty collaborating on the curriculum with students – what collaboration means, how people come to learn what it means, how the collaboration goes, and so forth. (Again, how does this feel, and what do you learn from the process?)

The allegory for the Collaborators ontology is a theatrical production. Take the specific faculty, curriculum, and students from your answer to the above question. Imagine them as actor/directors (faculty) collaborating on a theatrical production (curriculum) with other actors and theatre practitioners (students). Fill in details: what play are they performing? What does the stage and set look like, and how involved are the actors in its creation? What style of direction does the director/actor have – or perhaps there are more than one? What do rehearsals look and feel like; what are the dynamics? Who is the audience (and is your show wheelchair-accessible, autism friendly, ASL-interpreted, captioned, voice-described, close to public transit, affordable in terms of ticket costs, running at times where people can come see the show, etc.)? Are there other people involved (an orchestra, a producer, the bartender in the lobby, the set designer, techies running lights and sound, stage managers, ticket agents, marketing/publicity, etc.)? (And finally, how does this feel, and what do you learn from the process?)

Take a moment to step back from the four ontologies. Are there other ontologies or allegories you want to consider? You can also come up with your own ontologies and allegories. If you can think of any, try them now; use the patterns from the four ontologies above if they are helpful.

Now consider all the ontologies and their allegories together. What kinds of additional insights (if any) did each allegory give you about your curricular change story? What kinds of things does the allegory (and the ontology) not capture – what does it miss or obscure? What are the strengths and weaknesses of one allegory (and ontology) over another, and how might you put more than one of them in play at the same time in order to describe the multi-faceted nature of your curricular change story, and/or curricular change and engineering education more generally?

APPENDIX B. SUPPLEMENT TO CHAPTER 3 (METHODS & METHODOLOGIES) ON HOW I ENDED UP WITH THE FOUR ONTOLOGIES PRESENTED IN THIS WORK

This appendix explains how the four ontologies presented in this dissertation (faculty as makers, inheritors, embodiments, and collaborators) came into being. It is a retrospective look at process that aims at traceability, not replicability.

Where I started and what I thought I was going to do

I began this project with a philosophical commitment to postmodernism that showed up in my methodology and methods, as described more fully in chapter 3. I had not yet identified that multiple ontologies would become a central concept. Instead, I began with a focus on faculty-as-learners (as opposed to faculty-as-teachers) within curricular change. I had facilitated curricular change workshops for faculty members both as an engineer in industry and as a graduate student (Chua et al., 2012; Chua & Dziallas, 2012; Chua & Ellis, 2012; Ellis et al., 2011, 2013). I had seen messy, complex faculty learning occur in those spaces, and wanted to bring a postmodern lens to them.

Initially, I expected my results to take the form of a list of different ways faculty could be seen as learners in their narrative interviews of curricular change. However, as I progressed through the project, I realized that notions of how faculty learning could appear (in the context of curricular change) were deeply influenced by underlying assumptions about what faculty were (in the context of curricular change). I ended up examining faculty roles in curricular change within four ontologies, each one with its own assumptions about what faculty were and how they related to students and curriculum in the context of curricular change. Traces of my original starting point can be seen in the results chapters (chapters 4-7) on each ontology, which each contain a section on faculty learning and development opportunities suggested by that chapter's ontology.

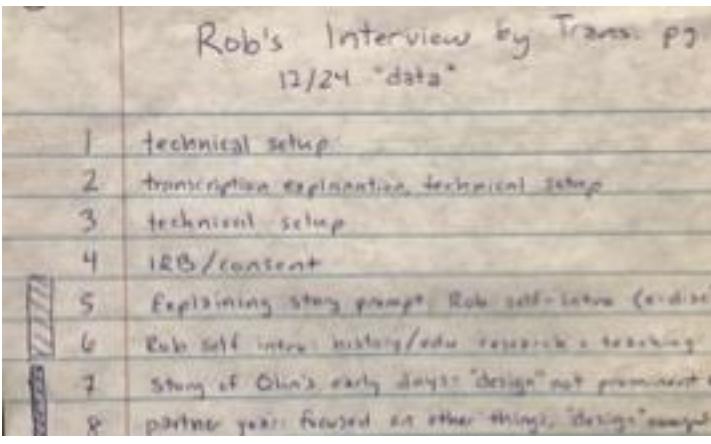
Interview prompt creation as inadvertent thematic analysis

As explained in chapter 3, I decided on a narrative interview approach because such methodologies had previously been used in both postmodern educational research and in engineering education. This common ground provided a potential starting place for bridging the two fields.

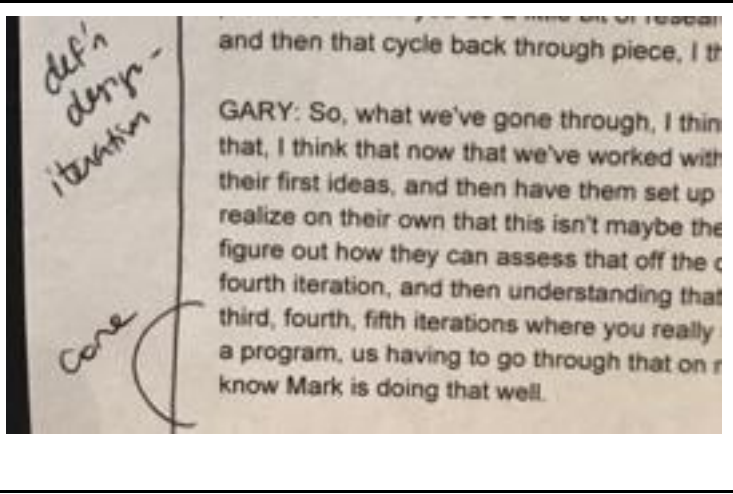
As a reminder for context, this project had six participants; three faculty narrators from Olin College of Engineering (Olin – Jon, Lynn, and Rob) and three faculty narrators from Berea College’s Technology and Applied Design department (TAD – Alan, Gary, and Mark). All three Olin narrators had worked together on a curricular change project, and all three TAD narrators had worked together on another. More details on participants and study sites can also be found in Chapter 3.

My research methods for collecting data inadvertently laid groundwork for my eventual shift to multiple ontologies. As explained in chapter 3, my narrative interview protocol involved multiple interviews with each participant. Interview prompts consisted of verbatim excerpts from previous interview transcripts in the study. Although I had not explicitly planned to use thematic analysis, I found that I was clustering my memos and interview prompts around emergent themes so that I could present participants with multiple perspectives on topics they and other participants had brought up.

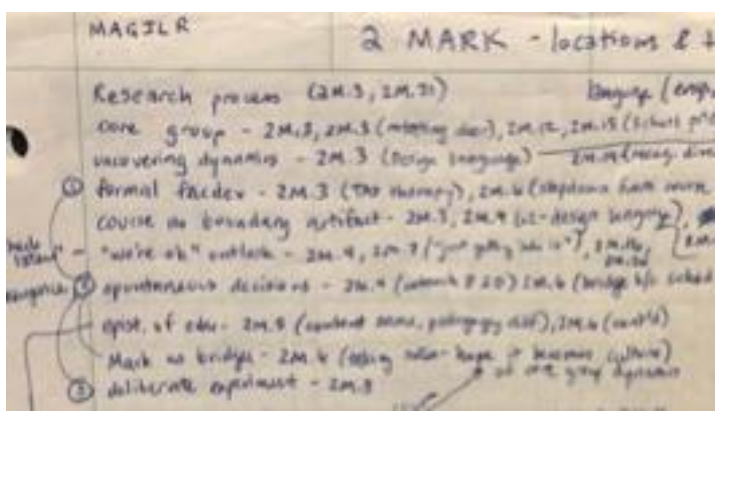
Table B.1: Process for creating thematic memos and interview prompts

<p>Step 1: I created a table of contents for each interview, describing the broad thematic strokes on each page of the transcript. This photo shows one of Rob’s interviews; page numbers run down the left, themes for each page are listed on the right (“Rob self-intro,” etc.).</p>	 <p>Rob's Interview by Trans. pg 12/24 "data"</p> <table border="1"><tr><td>1</td><td>technical setup</td></tr><tr><td>2</td><td>transcription explanation, technical setup</td></tr><tr><td>3</td><td>technical setup</td></tr><tr><td>4</td><td>IRB/content</td></tr><tr><td>5</td><td>Explaining story prompt, Rob self-intro (circle)</td></tr><tr><td>6</td><td>Rob self intro, history/edu, research & teaching</td></tr><tr><td>7</td><td>story of Olin's early days: "design" not prominent</td></tr><tr><td>8</td><td>partner year: focused on other things, "design" emerged</td></tr></table>	1	technical setup	2	transcription explanation, technical setup	3	technical setup	4	IRB/content	5	Explaining story prompt, Rob self-intro (circle)	6	Rob self intro, history/edu, research & teaching	7	story of Olin's early days: "design" not prominent	8	partner year: focused on other things, "design" emerged
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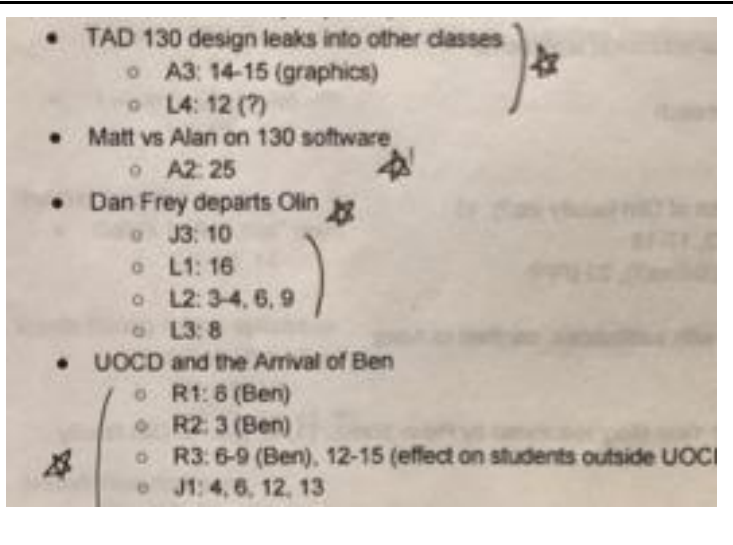
Step 2: After gathering themes across multiple interviews, I went back to the data to find them in transcripts other than the ones where they had first appeared. The photo shows a transcript from one of Gary’s interviews: working themes (“def’n design – iteration” and “core”) are on the left margin, with overlapping margin lines denoting where they are on the page.



Step 3: I created an index for each transcript with the themes found in each. The image shows an index for Mark’s 2nd interview. For instance, on the second line of this page, “Research Process (2M.3, 2M.21)” means the “Research process” theme was found in Mark’s 2nd interview page 3, and Mark’s 2nd interview page 21.



Step 4: I compiled a codebook of themes across all interviews (#TODO appendix X). Ex: “TAD 130 design leaks into other classes” was found in Alan’s 3rd interview on p. 14-15 (and was related to graphics) and Lynn’s 4th interview on p. 12 (with an open question). Stars denoted especially juicy clusters I wanted to use for memos, interview prompts, or some other future investigation. I later converted page numbers into line numbers to be more precise about location.



Although I am portraying these as sequential steps for ease of writeup, they often occurred in parallel, with later theme reworkings and discoveries necessitating returning to “earlier steps” in the process and updating indexes to reflect the updated themes. Themes included a wide range

of things, such as: specific courses being revised (Stuff of History, TAD 130, etc.), characters in the narratives (including “faculty bios” for each of the participants), events (the “8-year curriculum discussion” or “the Arrival of Ben,” etc.), other shared aspects, patterns, or topics such as “formal faculty development” or “definition(s) of design,” and others.

Assemblage components (faculty, curriculum, and students) appear early on

As I engaged in thematic analysis via prompt creation as described above, the same three components recurred in narrative after narrative, and thus theme after theme: faculty, students, and curriculum. In fact, the overwhelming majority of themes only referred to one or more of these three components, and did not mention others I might have expected (administrators, accreditation boards, employers, etc.).

As I tried to figure out the relationships these components had to one another, I drew on the concept of assemblages, which are a fundamental postmodern concept introduced by Deleuze and Guattari. Assemblages are fluid collections of components and relationships between them, all of which might have permeable boundaries, and all of which might shift over space and time (Deleuze & Guattari, 1987). I expected to see assemblages in the context of curricular change that involved and/or depicted faculty-as-learners. Furthermore, I expected assemblages to involve faculty, curriculum, and students. I kept these three assemblage components in mind as I continued to iterate through the incoming data.

The “for the students” theme (the precursor to the Makers ontology) appears as a potential metanarrative to be challenged

As I created interview prompts, conducted interviews, and continued reading and sifting through the resulting transcripts, I interrogated the data and my approaches to it using the postmodern methods tools explained elsewhere in Chapter 3. The Makers ontology started as a theme I initially called “for the students.” That exact phrase appeared early and repeatedly in the data, across different participants and across both institutions. Examples from the data can be found in Chapter 4 on the Makers ontology. However, the “for the students” theme wasn’t an ontology yet, or even an assemblage – it was a theme stemming from a phrase that was repeated often in the data, alongside other themes.

The frequency with which the phrase appeared suggested to me that "for the students" might be a metanarrative, which is a narrative that is used to exclude other narratives (Lyotard, 1984). Lyotard also defined postmodern as a skepticism (or incredulity) towards metanarratives, which is one of the postmodern methods I described earlier in Chapter 3. Bringing my incredulity to bear on that metanarrative, I thought about how I might challenge the notion of curricular change being something that was only "for the students." In particular, I wondered if centering student learning in curricular change might be deflecting attention from faculty learning that might be happening as well.

Searching for examples of "faculty as users of curriculum" leads to the image of "faculty as inheritors" (the precursor to the Inheritors ontology)

I tried flipping the repeated phrase of "for the students" on its head to see if I could find ways that curriculum could be "for the faculty." Since both Olin and TAD curricular changes had focused on design thinking and creating things for users, several participants had described students as "users" of curriculum and curricular change. In an early memo along this vein, I mused:

"...are students 'customers' of the curriculum revision? ...we use the rhetoric of student as users [of curriculum] and almost ignore the faculty as users. So all the faculty as users bits get rephrased into 'student as user' language... [because] we're used to thinking about accommodating our students."

Spurred by this thought, I looked for examples of faculty as *users* of the curriculum in ways that also framed them as learners (examples from the data can be found in Chapter 5, which details the Inheritors ontology). I first spotted the pattern in the stories of abrupt faculty departures (at both TAD and Olin) leading to faculty members scrambling to cover and create or re-create a class they had not expected to teach. Getting up to speed on unfamiliar tools and terms was a kind of learning! In a memo from around that time, I wrote: "Faculty are curriculum users as 'inheritors' of classes previously taught by someone else."

Using the method of looking for multiple and slipping meanings also detailed in chapter 3, I looked for other ways that faculty might be "inheritors" in a curricular change setting. Participants described how students in more advanced classes were influenced by their experiences in prerequisite classes. In a sense, faculty were also "inheritors" of students who had been through someone else's curriculum. I added the theme of "faculty inherit curriculum and students" to the

mix of themes and patterns I was looking for in the data and presenting to my participants as interviews continued.

The “faculty learning alongside students” theme (the precursor to the Collaborators ontology) appears as another counter to the “for the students” metanarrative

As I went through my notes on individual courses and continued conducting interviews with participants, I was now looking for instances of “for the students” and “faculty as inheritors” themes. As I did so, I noticed a third pattern that was about neither faculty as makers nor faculty as inheritors. This was the idea of faculty as learners *alongside* students as learners, collaborating on curricular change together. This first came up when I was examining participant stories narratives about the Olin course called “Stuff of History.” In a memo at the time, I wrote:

“...the shared experience of co-designing Stuff of History brought students and faculty alike into the broader space of co-designing the entire college. this is an important piece of the learning... how it happened, who was involved...”

My positionality as an Olin graduate helped sensitize me towards the framing of faculty/student collaboration on curricular change, since student involvement had been openly discussed on campus and I myself had been involved in curricular change as an undergraduate at Olin. I did not know if TAD had a similar culture of including students in curricular change, but when I looked in the TAD data, I did find examples of student involvement. These and other examples from the data can be found in Chapter 7 on the Collaborators ontology that grew out of this theme. I tentatively labeled this as a theme of “faculty learning alongside students,” with a corresponding assemblage of faculty-and-students working together on the curriculum.

Thinking visually

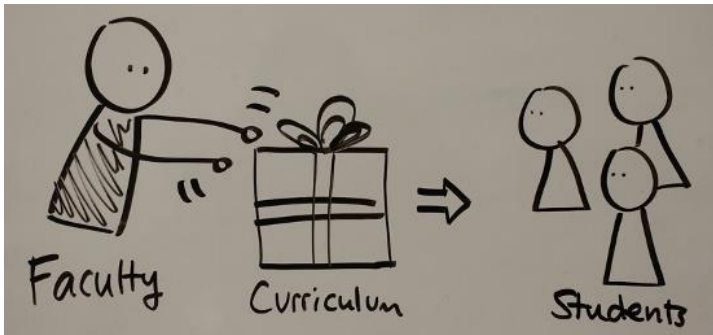
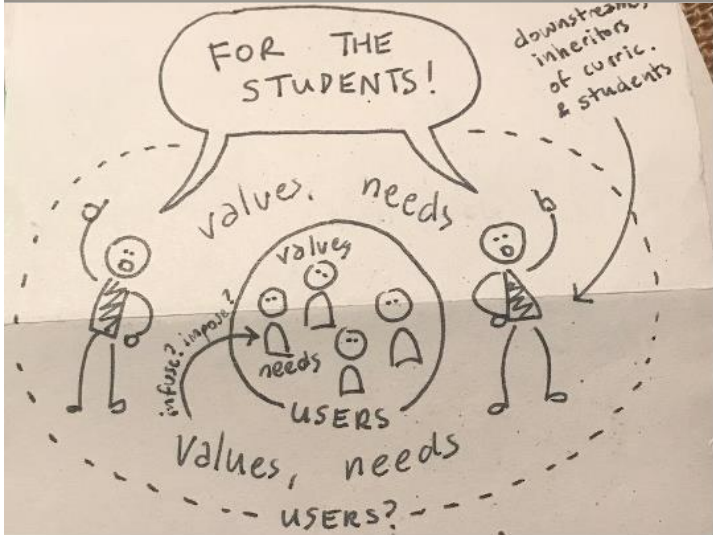
With the addition of “faculty learning alongside students,” I now had three examples of themes that showed up across institutions, courses, and narrators *and* involved faculty, curriculum, and students. They were:

1. Faculty framing themselves as *not* learners, and instead placing students in the role of learners and making curriculum **“for the benefit of students”**
2. Faculty as learners in the sense of **“faculty as inheritors”** of an assemblage of students-and-curriculum

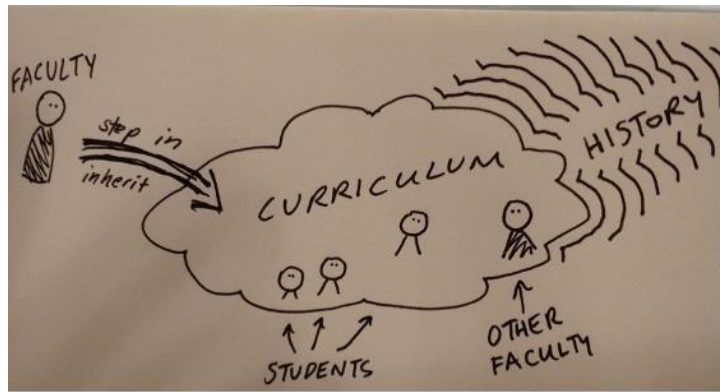
3. **“Faculty as learners alongside students”** in a faculty-and-students assemblage of learners when they worked together on curricular change

I was still foregrounding my original focus of faculty-as-learners. I was also starting to sketch some of the patterns and assemblages I was seeing as a form of visual memo creation. Some examples of sketches from visual memos around this time are shown below. Note that the first four sketches below eventually turned into ontologies, and the remainder did not; I am presenting several more to give an idea of the other kinds of ideas I was exploring at this stage.

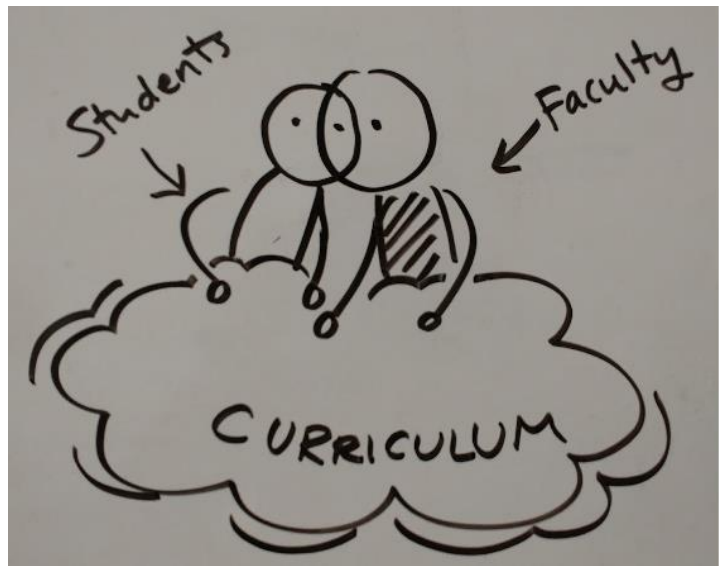
Table B.2: Examples of visual memos for themes

<p>These images show two different renditions of the “for the benefit of the students” theme. The first shows a faculty member actively gift-wrapping a box labeled “curriculum.” An arrow indicates that the curriculum is going to be given to three students, who sit passively, waiting to receive it.</p>	
<p>The second shows faculty saying the phrase “for the students!” as a justification for imposing their needs/values on students (labeled here as users of curriculum).</p>	
<p>This theme later became the Makers ontology.</p>	

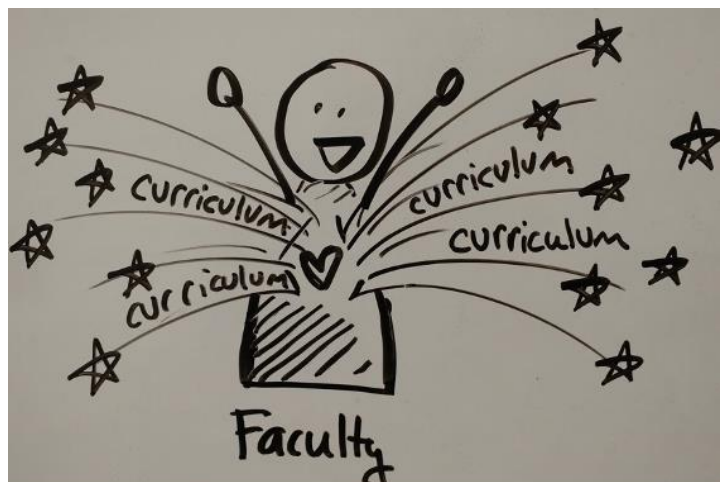
This sketch portrayed the “faculty as inheritors” theme which later became the Inheritors ontology. The curriculum sweeps through time (“history”). Figures labeled “students” and “other faculty” are embedded within the curriculum cloud, and a faculty member is poised to “step in” or “inherit” the assemblage.



This is a sketch of the “faculty as learners alongside students” theme; it later became the Collaborators ontology. Here, the faces of a student and a faculty member overlapping so that they share one central eye as all four hands work with a cloud representing the curriculum, shaping it together.

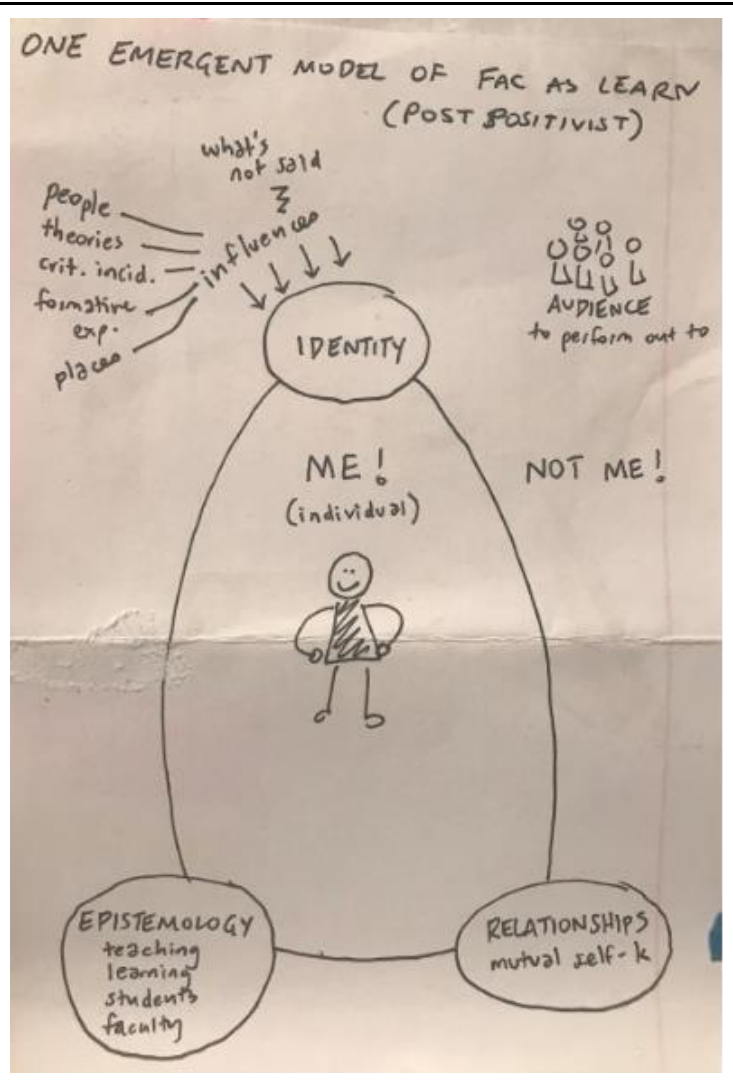


This sketch shows the curriculum bursting out of the heart of a faculty member. It originated with the narratives I got from faculty participants when I asked how they wanted to “introduce themselves” to readers. They often explained what had influenced their beliefs about teaching and learning and how curricula ought to be. Although this was originally intended and labeled as a “faculty biographies” theme, I realized later that it was a fourth ontology (Embodiments).



This sketch was an early attempt to synthesize themes related to the concept of “faculty as learners.” An individual faculty member is in the middle. Surrounding them are:

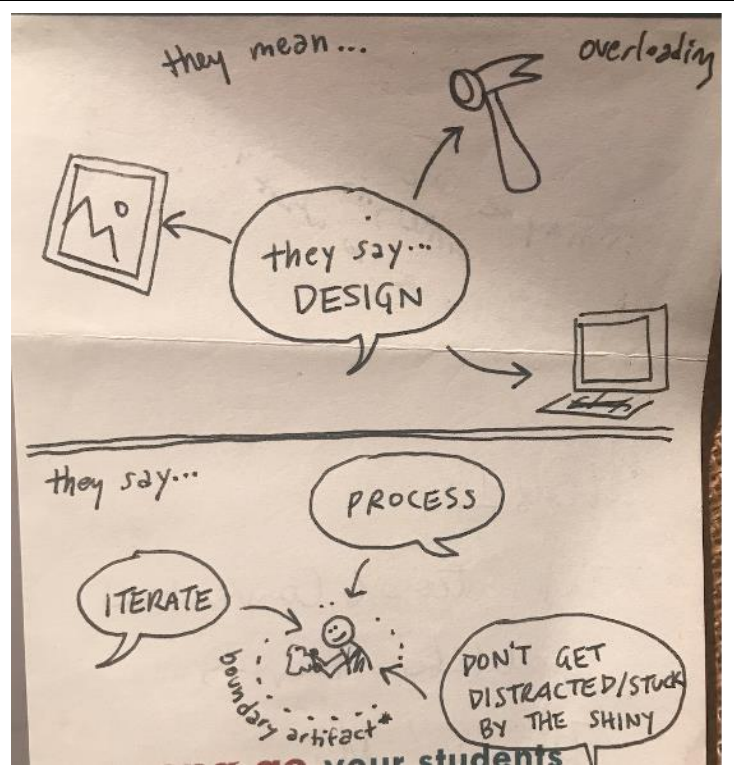
- 1) Their identity and influences on it, which later became the Embodiments ontology
- 2) Their epistemolog(y/ies) in a precursor to the eventual ontological turn of this project
- 3) Relationships with others, including an audience “to perform out to.” This point was largely dropped, and remnants folded though the relationships between faculty and student assemblage components in later results.



These notes were a visual representation of how I saw slippage of meaning (another postmodern method I explain in Chapter 3) occurring in the language of study participants.

Slippage of meaning and finding these language usage patterns is not unique to this project, nor is it a novel concept. I include this sketch to show that I was noticing and sensitizing to these sorts of language moves while working through my data.

The top sketch depicts the “same word” (“design”) being used to refer to different things, and the bottom sketch shows the “same thing” being discussed using different words.



Spatial relationships between faculty, curriculum, and students emerge using ASL

For reasons unrelated to the study, I had also moved back to Boston at this point in time, where I became part of signing Deaf communities for the first time. Although I had already created graphical scholarly works (Chua, 2018), signing with other deaf scholars pushed me towards an even more visual-spatial way of thinking. Although it took me a while to realize it, discussing my work in ASL was an important part of my process. I spent a long time (4+ years) trying to write my methodology sections as if they had all taken place in English, only to realize belatedly that they had not, and that the particulars of ASL vs. English differences were relevant to how I ended up with the four ontologies that I did.

When using American Sign Language (ASL), signers will typically assign specific locations in space as belonging to characters, objects, abstract concepts, etc. and refer to those throughout the conversation. For instance, signing in the high-middle of the space might always refer to faculty; signing low and to the left might be curriculum, and low and to the right might be students, as pictured in the diagram below. The linguistic term for this is the use of "spatial referents" (Winston, 1991).

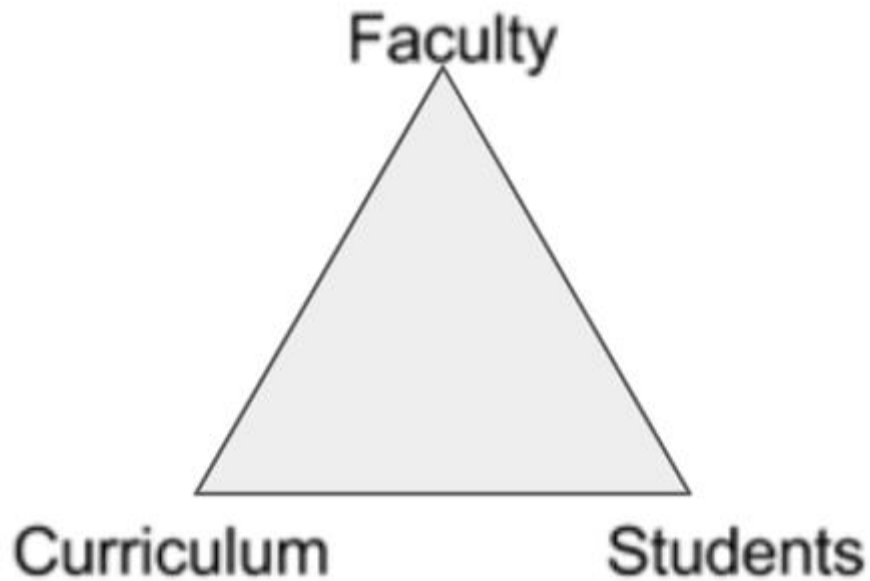
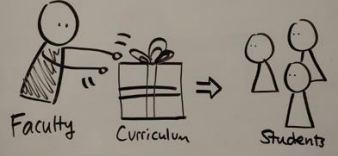
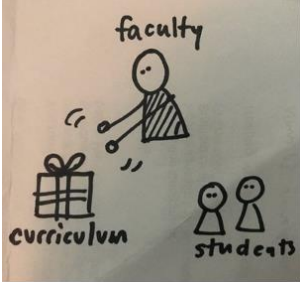
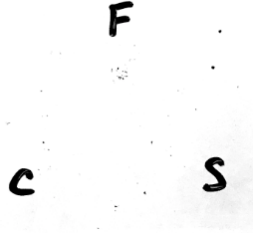


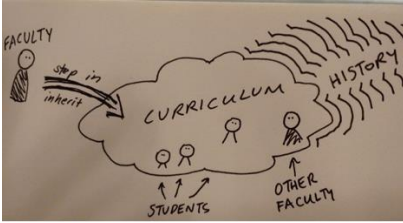
Figure B.1: Spatial locations for faculty, curriculum, and students

I began to use spatial referents as a direct consequence of discussing my work in ASL with other signing researchers, and fairly quickly settled on the abovementioned (arbitrary) set of locations for those three components. In my visual memos, the drawings of some themes began to shift and use those spatial referents, as shown in table B.3 below. The leftmost column shows a theme's sketch as previously presented, and the middle column shows the same theme redrawn using the abovementioned spatial referents: faculty at middle-top, curriculum bottom-left, and students bottom-right. These drawings in turn suggested clusterings of assemblage components, shown in the rightmost column of the table.

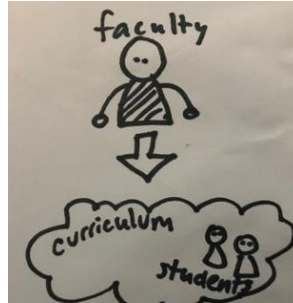
Table B.3: evolution of visual memos and component relationships for selected themes

Visual memos of selected themes (previously shown)	Redrawn with consistent spatial referents (images recreated in 2021)	Simplified version of component relationships for this theme
<p>“For the benefit of the students”</p>  <p>Previously shown and described in table B.2, row 1. Spatially speaking, all three components are arranged on a line; faculty on the left, curriculum (gift box) in the middle, students on the right.</p>	 <p>Same components as the image in the left column, rearranged to match the triangular positioning of Figure B.1. The faculty member in the top-center wraps the gift on the bottom-left, with students waiting to receive it on the bottom-right.</p>	 <p>Same triangular arrangement as the center column, with single-letter labels instead of stick figures. F(aculty) top-center, C(urriculum) bottom-left, and S(tudents) bottom-right stand as individual components, none grouped together.</p>

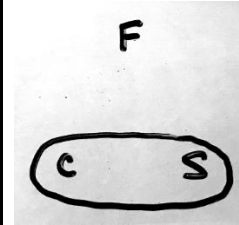
“Faculty as inheritors”



Previously shown and described in table B.2, row 2. Spatially speaking, the curriculum cloud sweeps horizontally from the top right corner into the center of the scene, taking up most of the space. Students (and other faculty) are present in the centermost “curriculum” cloud. The faculty member steps in from the left edge.

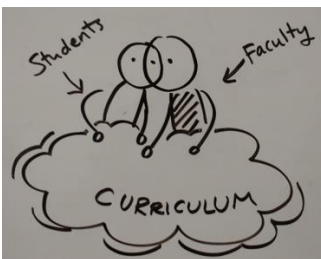


Same components as the image in the left column, rearranged to match the triangular positioning of Figure B.1. The faculty member steps into the curriculum cloud from the top-center. The cloud itself stretches left to right across the bottom, with the “curriculum” label in the bottom-left of the cloud and stick figure students in the bottom-right of the cloud..



Same triangular arrangement as the center column, with single-letter labels instead of stick figures. F(aculty) in top-center are separate from C(urriculum) on the bottom-left and S(tudents) in bottom right, which have been circled together into a group. This parallels the “cloud” enclosure of the curriculum label and student stick figures in the center column.

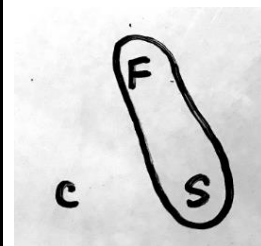
“Faculty as learners alongside students”



Previously shown and described in table B.2, row 3. Spatially speaking, the curriculum cloud stretches from left to right across the bottom of the image. The overlapping student and faculty figures are centered above it, with the student figure on the left and the faculty figure on the right.



Same components as the image in the left column, rearranged to match the triangular positioning of Figure B.1. The faculty figure is now in the top-center, with the curriculum cloud in the bottom-left. The student figure is still physically linked with the faculty figure, but below and to the right.



Same triangular arrangement as the image in the center column, simplified to single-letter labels in place of the stick figures. F(aculty) in top-center and S(tudents) in bottom right have been circled into a group. C(urriculum) stands alone in the bottom left.

Changing some themes into statements about faculty roles about “faculty as learners”

At the start of this appendix, I mentioned that I had expected my results to list the ways faculty could be seen as learners (in their narrative interviews of curricular change). As I progressed through the project, I saw that the examples of faculty learning in the data were often justified or explained by participants via references to one or more of the three themes listed in table B.3. For instance, one example from Chapter 3 (the Inheritors ontology) shows Gary and Alan from TAD noticing how the current students they were “inheriting” had less hands-on experience than previous student generations. In turn, this motivated them to learn about and enact curricular changes to better meet student needs. Other examples and expansions can be seen in each of the four results chapters that cover a specific ontology.

As I saw that faculty took roles (in which they were learners) in relation to students and curriculum (the other two recurring assemblage components), I slowly began to center the faculty roles themselves. I began thinking about how notions of faculty *learning* (in curricular change) were deeply influenced by underlying assumptions about the *nature of faculty roles* (in curricular change) – what they were and/or what they were supposed to be, according to the narrators.

Turning the above three themes into statements about faculty as learners gave me:

- If faculty *were supposed to* make curriculum “**for the benefit of the students,**” they *could or should learn* beneficial content/skills to teach students, and ways to teach and change curriculum in ways that benefited students.
- If faculty *were supposed to* be “**inheritors**” of curriculum and students, they *could or should learn* the nature of departmental, disciplinary, student body, etc. histories they were inheriting, and how to change (or not-change) curricula in consideration of that.
- If faculty *were supposed to* be “**learners alongside students,**” they *could or should learn* how to effectively collaborate with students on curricular change.

The ontological turn for this project

Around the same time, I had been reading about ontologies as part of my continued philosophical and methodological explorations into postmodernism. As explained in more detail in Chapter 2, ontological inquiry delves into questions about (a) what exists, and (b) the features and relationships between things-that-exist (Hofweber, 2021, para. 23). In the context of plural

ontologies, each ontology can be understood as a set of interrelated truth claims about what *is* (the nature of reality).

As I continued data collection, I also continued to see that the above themes seemed to be taken-for-granted by different narrators at different times. They were narrating as if one or more of these statements was true (ex: speaking matter-of-factly as if *of course* faculty collaborated with students on curricular change, and then speaking matter-of-factly as if *of course* faculty inherited curricula and students from others as part of the process of curricular change). I wondered if these specific themes were ontologies - a kind of underlying basis of reality that faculty narrators were assuming and the foundational axioms of their narrative worlds, so to speak. If they were ontologies, that might explain why they kept showing up in relation to faculty learning (and everything else) over and over again.

Based on the above postmodern definition of ontologies, I came up with a way to turn the statements about faculty learning into ontological statements about what faculty *were*, with those statements serving as a sort of launching point for “if this is what faculty *are* (or should be), what sort of learning might they engage in (in the context of curricular change)?” For example, using the “for the benefit of the students” statement:

Table B.4: Example of turning a theme statement into an ontological one

<p>Theme statement about faculty as learners: “If faculty were supposed to make curriculum “for the benefit of the students,” they could or should learn... (etc.)”</p>	<p>Ontological statement version: “Faculty are those who make curriculum “for the benefit of the students.” In a reality where this is an axiom, faculty as learners might... (etc.)</p>
<p>Ontological criteria (a) – show what exists. All three assemblage components (faculty, curriculum, and students) are here, and there is an implied to-be verb (“are” those who) declaring that this is an axiomatic definition (perhaps partial) of what a faculty member <i>is</i>.</p>	<p>“Faculty [are those who] make curriculum “for the benefit of the students.” In a reality where this is an axiom, faculty as learners might... (etc.)</p>
<p>Ontological criteria (b) show the features and relationships between things-that-exist. Since there are three components, there will be three relationships between them.</p>	<p>Faculty-curriculum relation: faculty make curriculum.</p> <p>Faculty-student relation: faculty do things for the benefit of students.</p> <p>Curriculum-student relation: curriculum is made to benefit students.</p>

I then applied that operation to the other theme statements about faculty-as-learners that I had been working with, as shown in the next table. Note that the word “inheritors” (noun) was changed to “inherit” (verb) in the second entry; this will come up again later. Also note that the third entry underwent the largest change, because I wanted declarations of what faculty *were* to be separate from the exploration of what approaches to faculty learning were suggested by each declaration. For that statement, I switched the phrase about faculty “as learners” with the phrase about faculty “as collaborators with students” – otherwise the ontological statement would read as “Faculty learn alongside students on how to collaborate on curricular change. In a reality where this is an axiom, faculty as learners might learn how to effectively collaborate with students on curricular change,” which is redundant and tautological.

Table B.5: Ontological versions of theme statements

Theme statement about faculty as learners	Ontological statement version
<p>If faculty <i>were supposed to</i> make curriculum “for the benefit of the students,” they <i>could or should learn</i> beneficial content/skills to teach students, and ways to teach and change curriculum in ways that benefited students.</p>	<p>Faculty [are those who] make curriculum “for the benefit of the students.” In a reality where this is an axiom, faculty as learners might... (etc.)</p>
<p>If faculty <i>were supposed to</i> be “inheritors” of curriculum and students, they <i>could or should learn</i> the nature of departmental, disciplinary, student body, etc. histories they were inheriting, and how to change (or not-change) curricula in consideration of that.</p>	<p>Faculty [are those who] “inherit” curriculum and students. In a reality where this is an axiom, faculty as learners might... (etc.)</p>
<p>If faculty <i>were supposed to</i> be “learners alongside students,” they <i>could or should learn</i> how to effectively collaborate with students on curricular change.</p>	<p>Faculty [are those who] “collaborate with students” on curricular change. In a reality where this is an axiom, faculty as learners might... (etc.)</p>

These actions centered my inquiry around the *ontologies* of faculty (and curriculum and students in the context of curricular change). Based on these statements of what faculty members *were* in the context of curricular change – in other words, an axiomatic/ontological statement about faculty *role* – I could then discuss faculty-as-learners from within each ontology. This operation was the ontological turn for this project. It also led to the revision of my research question into its final form: in what ways might we make sense of faculty roles in their narrative ontologies of curricular change?

Wordsmithing the ontological statements

With the ontological turn underway, I wanted a consistent shorthand for referring to each ontology. Instead of highlighting the themes they originally came from, I focused on the first part of each phrase, which used the same pattern: “Faculty [are those who] {make, inherit, collaborate}...” etc.

However, “make,” “inherit,” and “collaborate” are all verbs. Since these were ontological statements, I wanted to focus not on faculty *doing* something, but *being* something. Recall that in the previous operation, “inheritors” (noun) was changed to “inherit” (verb) in the second entry. I realized that I could simply change that back to a noun, and reword the other phrases with each verb changed into its noun form. The noun form could then stand as a shorthand reference to that ontology. Doing so yielded more or less the final forms of three of the four ontologies in English:

- Faculty are **makers** of curriculum for the benefit of the students.
- Faculty are **inheritors** of curriculum and students.
- Faculty are **collaborators** with students on curriculum.


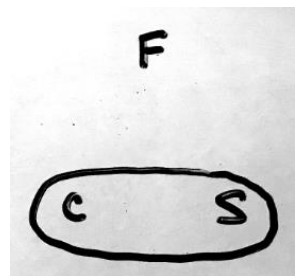
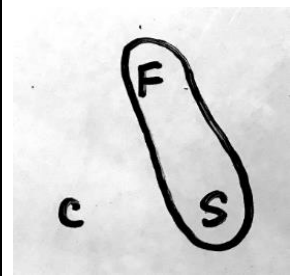
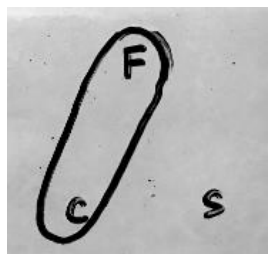
A missing piece: the Embodiments ontology

At this point, I had three ontologies, but I wasn’t sure if I had a complete set. Although I acknowledged that there could be an infinite number of ontologies for curricular change and I would only be able to present a finite set, I was unsure whether I should stop with the three I had, or continue on to find others. Even if I recognized that faculty, curriculum, and students were the three assemblage elements early on, I didn't know what kinds of relationships they might have - for instance, there might be other ontologies with the same English structure as one or more of the three I had already found, such as "faculty make curriculum for students... faculty find curriculum for students... faculty revise curriculum for students... etc.”

It was once again the sidestep into visual/spatial formats that made me realize there was a missing piece in the permutation of relationships between components. When I looked at the three ontologies I had so far in a spatial format, I saw where the missing piece would need to go. The simplified versions of the component relationships (from the rightmost column of table B.3) had a logical gap. As shown in the table below, which uses the same triangular positioning as Figure B.1,

I had one ontology where all three components were separate (Makers), and two ontologies where two components were grouped together. (Inheritors combined curriculum and students, Collaborators combined faculty and students). Was there a fourth ontology that combined faculty and curriculum?

Table B.6: Missing logical combination of components suggests a missing ontology

Makers	Inheritors	Collaborators	New ontology?
 <p>Faculty, curriculum, and students as separate components.</p>	 <p>Faculty as a separate component; curriculum and students are grouped together.</p>	 <p>Curriculum as a separate component; faculty and students are grouped together.</p>	 <p>Students as a separate component; faculty and curriculum are grouped together.</p>

The answer was yes. Going back to the fourth entry (fifth row) in table B.2, I already had a theme (“faculty biographies”) where the faculty and curriculum were grouped together. In giving me their biographies, the faculty were also explaining how their curricular creations and change actions sprang forth from *who they were* – another to-be verb present as a hint (“were”) that this might be an ontological statement.

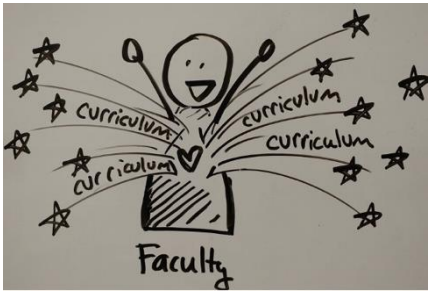

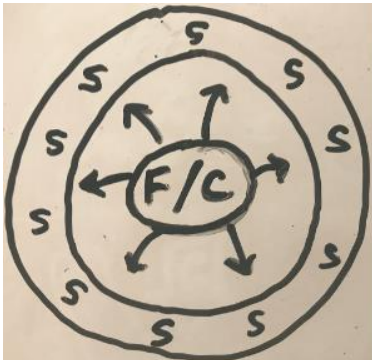
Could an ontology related to the “faculty biographies” theme help explain the bits of data that didn’t quite fit into any of the three ontologies I already had? It seemed likely; the remaining data largely involved faculty justifying and explaining statements and stories on curricular change based on their prior experiences. Examples can be found in Chapter 6 on the Embodiments ontology.

Interestingly enough, when signing about the “faculty biographies” theme to others, I was not (yet) using the triangle of spatial referents I was using for the other three ontologies. Instead, I used another ASL linguistic technique known as “role shift,” where the signer *shifts* to embody

the *role* of a character in the story they are portraying (Padden, 1986). The spoken language parallel would be adopting different character voices, for example as when telling a story to children.



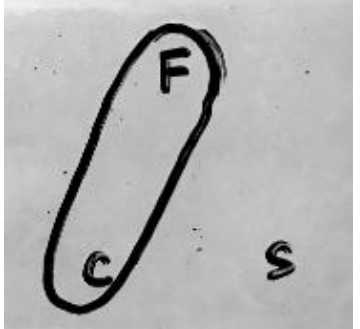
In signing the “faculty biographies” theme, I role-shifted to embody the faculty/curriculum combination, moving my opening hands outwards from my chest in the ASL sign for “expression” to denote the curriculum as coming from the core of a faculty member’s being. To make this another ontology of the same type as the previous three, I needed to place the remaining component of “students” in the picture somehow. Since the faculty-curriculum combination was being expressed towards students, I drew them surrounding the faculty/curriculum. The table below shows the progression from the visual memo to an ASL rendering and from there into a simplified spatial relationship.

Table B.7: “faculty biographies” theme that became the Embodiments ontology

Visual memo of “faculty biographies” theme (previously shown in table B.2)	ASL rendering matching this visual memo (with author as model)	Simplified spatial relationship between components (with students)
 <p>Previously shown and described in table B.2, row 4. Spatially speaking, the faculty member in the image faces the viewer head-on, with the curriculum bursting out radially from a heart in the center of their chest.</p>	 <p>Photo of the ASL sign for “expression,” with the signer facing the viewer head-on. The sign is being produced from hands bursting out radially from the center of their chest, matching the sketch in the left column. Arrows drawn on the photo show the sign’s outward motion.</p>	 <p>A simplified diagram of the spatial relationships in the left and middle columns that uses single-letter labels instead of stick figures or a photo. F(aculty) and C(urriculum) are combined in the center of a bullseye shape, with arrows pointing radially outwards towards S(tudents) arrayed in a circular outer rim.</p>

This new fourth ontology now featured a faculty-curriculum combination with a relationship to the student component, even if this had not yet been expressed in English. I then did a geometric translation to make this new ontology match the spatial referents in the other three ontologies. This was easy when working with a signed language in 3D: all I had to do was turn to one side, and my body as a role-shift embodiment of the combined faculty/curriculum components were on the left extending towards a spatial referent for “students” on the right, as shown in the table below.

Table B.8.: Embodiments ontology, rotated to match the spatial referent schema of the other three ontologies

“Embodiments” ontology signed straight ahead (from table B.7)	“Embodiments” ontology signing, side view (towards implied students on the right)	Redrawn with same spatial referents as the other ontologies
 <p>Same as the center column of the previous table: a photo of the ASL sign for “expression,” with the signer facing the viewer head-on and arrows indicating the (radially outward) direction of movement.</p>	 <p>The same signer/sign as the left column, but with the signer turned 90 degrees to face the right of the image instead of head-on towards the viewer. As the signer’s hands move outward from their chest, their new directional facing means their hands moving out from their chest now move left to right across the image (motion shown by arrows drawn over the picture).</p>	 <p>A simplified diagram of the spatial relationships in the middle column that now matches the triangular arrangement in Figure B.1. Single-letter labels for F(aculty) in the top-center and C(urriculum) in the bottom-left have been circled into a group. S(tudents) stand alone in the bottom-right.</p>

An awkward first rendition of this ontological statement in English might be: If faculty *were* whoever they said they were in their “**faculty biographies**,” they *had learned* how curriculum “should” change and what it “should” change to from their past and present experiences, affiliations, identities, etc.

While looking for a streamlined statement of the same structure as the other three ontologies, I went back to the ASL linguistic technique of role-shifting, where the signer *embodies* that which they are portraying. I realized that my shifting to *embody* the faculty members was akin to the faculty *embodying* the curriculum their students would encounter. I therefore chose the noun form, “embodiments,” to create the last statement: Faculty are **embodiments** of curriculum which students encounter.

I now had the four ontologies that are in the intertext and results chapters (4-7).

- Faculty are **makers** of curriculum for the benefit of the students.
- Faculty are **inheritors** of curriculum and students.
- Faculty are **collaborators** with students on curriculum.
- Faculty are **embodiments** of curriculum encountered by students.

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