THE INTERPLAY BETWEEN POSTSECONDARY FACULTY BELIEFS ABOUT COURSE DESIGN AND THEIR CURRICULAR DECISIONS

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ABSTRACT

The postsecondary curriculum lies at the heart of disciplinary and institutional politics, embodying the identity, values, and vision of both academic fields and educational institutions. Postsecondary faculty members hold significant power in designing courses, a critical aspect of their professional responsibilities. However, little is known about how faculty navigate the processes of course planning, teaching, and revising. This study employs qualitative methodology and the Contexts for Agency framework (Landy et al., 2022) to explore the following research question with nine faculty participants: In a Science-focused Residential College (SRC), how do science faculty beliefs about course design interplay with their curricular decisions? The analysis revealed five key dimensions that shape the interplay between faculty beliefs and curricular decisions: 1) perceived organizational context, 2) faculty's goal for student learning, 3) sources of faculty's passion in teaching, 4) evolution of faculty's curricular decisions, and 5) institutional settings. The discussion highlights the intellectual stimulation faculty derive from course design and emphasizes the importance of institutional trust in empowering faculty to make meaningful curricular decisions.

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CHAPTER 1: INTRODUCTION

As the global economy has shifted to a knowledge-based model in the last several decades, knowledge is dismissed as something to be transmitted, and curriculum reform in higher education has emerged as a national agenda (Barrier et al., 2019; Shay, 2015). Its primary focus lies on effectively imparting knowledge and skills while preparing college graduates to apply their learning towards contributing to national economic growth (Shay, 2015). The main concerns in policy discussions about curriculum reforms are the endpoints of curricula. Effective teaching and learning methods and a skill set for college graduates to have as future members of the workforce are driving questions in the curriculum reform (Annala et al., 2021).

In the current societal context at the time of this study, national and institutional agendas often assume that programs and faculty members can or will adjust their curriculum supervision criteria and course plans for the national goals (Annala et al., 2021; Louvel, 2013). This approach to curriculum reform reflects the lack of understanding about the specificity of higher education curricula. Curriculum debate is a highly political issue in general, but the political aspect of higher education curricula may not get as strongly publicized as school curricula (Barrier et al., 2019). This is because the value of higher education historically centers on the academic freedom of faculty to research and teach following their academic interests which is an invaluable asset for college students to learn diverse perspectives (Lackey, 2018). Classrooms are typically faculty's grounds while procedural rules are followed regarding administrative matters (credit hours, course validation, etc.) (Barrier et al., 2019). Nevertheless, many political debates and research about higher education curriculum focus on better student outcomes and effective teaching methods while overlooking the issues that individual faculty members face at the course level (Annala et al., 2021; Louvel, 2013).

Concerning this matter, researchers have advocated that comprehending the curriculum from educators' perspectives should be accompanied by curriculum reform led by a government or educational institution (e.g., Annala et al., 2021; Cotton, 2006; Österholm, 2010b; Roberts, 2015). Researchers show that faculty do not simply cooperate with national or organizational curriculum change agendas but challenge and negotiate them (Annala et al., 2021; Brogger, 2014; Louvel, 2013). Unless faculty find agreeable values and convincing explanations for the curriculum reform, predetermined directions by government, subsequently institutional administration, are adopted on a superficial level even in a highly hierarchical institutional environment (Louvel, 2013). Thus, autonomy of faculty in their teaching should be recognized for a meaningful curriculum development (Annala et al., 2021; Louvel, 2013). However, less is known about how faculty members maneuver through their course planning, teaching, and revising their activities.

Purpose of the Study

Curriculum is at the center of disciplinary and institutional politics as it encapsulates the identity, values, and visions of an academic field as well as those of an educational institution (Mody & Kaiser, 2008). Also, educational institutions are living sites where knowledge claims and their values are reproduced and generated by teaching and learning processes, rather than the places to pass down knowledge which they are often considered to be. Michel Foucault (1977, 1994) and Thomas Kuhn (1962)—who provided philosophical and sociological thought about schooling and knowledge production—emphasized the role of educational practices, including teaching in classrooms, training exercises, and shadowing in the knowledge production process. In addition, they pointed out that teaching practices are deeply related to knowledge production, as the teaching activity itself reflects which knowledge is valuable in society (Mody & Kaiser,

2008). One of the popular misconceptions about teaching is that once a better or newer knowledge is proposed to the world, teaching can be adjusted naturally, but this perspective overlooks that teaching takes on an essential role in knowledge production out of a research site on a wider scale. Teaching is a dynamic activity that cannot be equated to the mere delivery of knowledge.

In the past four decades, however, the educational relationships among knowledge production, teaching, and social contexts of education have not been considered as an unified system in research and have been divided into two main directions. Academic scholars have studied the organization of content knowledge and teaching strategies; and historians and sociologists have taken the social and institutional approach to education and curriculum (Barrier et al., 2019). This divided understanding of education mistakenly assumes that each area is mutually exclusive, while any content knowledge and teaching activities cannot be free from institutional and social contexts, and vice versa. Therefore, this study aims to delve into the breadth of undergraduate curriculum through the lens of faculty perspectives, encompassing the organization of content knowledge, the impact of teaching practices on curriculum design, and the influence of institutional contexts on curriculum.

The reason to study curriculum from a faculty point of view is that faculty members are the primary agents in curriculum development and revision, even though the curriculum is subject to change according to the educational environment and sociocultural context (Annala et al., 2021; Barrier et al., 2019; Lattuca & Stark, 2009; Louvel, 2013). It is common that national or institutional visions for “innovative” curriculum are not effective when the proposed visions simply assume that faculty will make changes to curricula following the prescribed vision (Annala et al., 2021; Louvel, 2013; Shay, 2015). Especially at a course level, curriculum reflects

individual faculty's expert knowledge, educational values, and how they perceive their academic fields and institutional contexts (Lattuca & Stark, 2009). Thus, this study focuses on the curriculum at the course level, where individual faculty members have the most autonomy in the design.

Faculty perspectives of curriculum is an understudied topic, and there is little terminology that describes faculty understanding of curriculum. However, to investigate faculty perspectives on curriculum, I utilize the concept of teacher beliefs (Kagan, 1992; Nespor, 1987; Pajares, 1992), which is developed in the context of school systems. It is possible to apply this concept to the higher education context since the conceptualization of teacher beliefs concerns relatively stable and settled constructs of teachers' opinions about schooling, education, and teaching. Teacher beliefs can provide important constructs to understanding how postsecondary faculty perceive curriculum and the relevant educational practices, and thereby add important understanding to how their curricular decisions evolve. The purpose of this study is to investigate postsecondary faculty beliefs about curriculum in consideration of institutional contexts and the organization of knowledge for teaching.

Research Question

I propose that faculty beliefs about curriculum play a critical role in course design. The research question driving this study is:

In a Science-focused Residential College (SRC), how do science faculty beliefs about course design interplay with their curricular decisions?

Definition of Terms

Curriculum

In the higher education context, curriculum has been a flexible and pragmatic construct to serve a purpose, and a shared understanding of curriculum has not yet been established across the academy and postsecondary practice (Barnett, 2000; Hicks, 2018). Modern colleges and universities are often institutions in which the priorities and decisions made are highly dependent on resources, opportunities, possible solutions, and feelings of stakeholders at a given time (Cohen & March, 1972). The institutions must pick up the problems at hand according to the societal or student needs. Thus, curriculum could mean the general course structure in a college, the aggregate courses of study for a program, syllabi, or any (un)intentional educational experiences in school.

In this study, I consider *curriculum* as a heuristic course plan that reflects the faculty's curricular decisions. At a course level of curriculum, individual faculty members have the most autonomy in planning, modifying, teaching, and evaluating while negotiating the organizational contexts and other stakeholders' interests. Curriculum as a heuristic is an important aspect in this study as it acknowledges the faculty's journey to create better courses over time with continuous trials of designs and teaching activities. To investigate the curricular decisions that faculty make, I adopt the eight elements proposed by Lattuca and Stark (2009)—purposes, content, content sequencing, learners, instructional processes, instructional resources, evaluation, and adjustment.

Faculty Beliefs

I define *faculty beliefs* as opinions that individual faculty members hold. Although the word *belief* is commonly used, the scholarly definition has not yet come to a consensus. The mechanism of belief acquisition, retention, alteration, and rejection is under study, and many

studies suggest their own definition according to their research purpose (Österholm, 2010a; Skott, 2009). Nevertheless, there is agreement on the assumptions about belief across disciplines that offer solid foundations for belief research (Pajares, 1992). First, beliefs play a role in defining tasks and framing problems which allow humans to select a cognitive strategy to understand a situation and assess relevant resources to have a solution. These mental processes lead to a creation of a unique individual knowledge structure that automatically processes information (Nespor, 1987; Pajares, 1992). Second, beliefs persist to the extent that discovering illogical pieces of one's own beliefs is not enough to replace the existing beliefs. Third, beliefs exist in clusters, and the cluster of beliefs about a specific subject is called a *belief system*. Although one construct may connect to another set of beliefs, each set operates within its own boundaries. For example, beliefs about politics and human relationship can be seen as separate sets of beliefs, even though they may influence each other.

Ultimately, this study focuses on the faculty's educational belief system centered on curriculum. Borrowing from Pajares (1992), I use *faculty beliefs* to signify the established professional perceptions that only faculty can hold about curriculum related affairs.

Significance of the Study

Curriculum is a comprehensive area of research to understand how the courses or programs are designed and why a certain set of contents, pedagogies, and assessment schemes are selected (Barrier et al., 2019). These issues are relevant to variety of questions such as what influences the form of education, what are educational purposes, how is knowledge shaped in different contexts, how is knowledge transformed to be teachable knowledge in higher education, and how is knowledge reproduced in classrooms (Barrier et al., 2019; Bernstein, 2000). Despite the interconnectedness of these issues, educational studies on curriculum often do not address

their connection. For example, content organization frequently would not be the focal point considered in a study on teaching or assessment schemes. While taking a comprehensive approach to curriculum, this study seeks to contribute to the curriculum literature in higher education from the faculty point of view. Faculty beliefs about curriculum have been understudied, even though they are the significant players in key aspects of course design.

This study also provides insights into how curricula are created specifically in natural science fields at a teaching-focused college within a larger research institution. Selecting a specific educational context is necessary because the educational values and purposes of college faculty members tend to vary by academic field and institutional type (Lattuca & Stark, 2009). First, different fields of study take different views to knowledge, and curriculum is built upon the specific disciplinary logics and legitimation mechanisms of educational knowledge (Bernstein, 2000; Shay, 2013). Each academic field has its overarching purposes and principles of curriculum structure. Although several fields might deal with the same scientific concepts, a curriculum may look considerably different depending on the field of study covering the concepts (Shay, 2013). For example, concepts about living organisms are situated differently in the curricula of biology, bioengineering, and medicine.

In this study, I have chosen to examine science fields because the gap between popular perceptions of the fields and the nature of scientific knowledge is so large. Scientific knowledge is commonly misunderstood as an "accumulative body of facts," and this misconception leads to the idea that the teaching and learning in science fields entails little understanding about culture, history, or subjectiveness (Mody & Kaiser, 2008). Such an idea fundamentally contradicts the nature of both knowledge and education because knowledge is a product of a human society and history, and teaching and learning takes place by communication between teachers and students.

I have also chosen to focus on a Science-focused Residential College (SRC) where the main responsibility of faculty is teaching. Although research universities educate a greater number of undergraduate students, their distinguishing feature and value are in constructing an intellectual reservoir for a society via research; thus, faculty members in research universities allocate the greatest amount of their time to research activities, compared to those in other institution types (Owen-Smith, 2021). Research universities also often rely on doctoral students for undergraduate teaching (Park, 2004; Rao et al., 2021). Yet, teaching-focused colleges—existing mostly in the form of liberal arts colleges—are a unique type of higher education institution found in the United States. In these institutions, civil discourse and frequent interaction between faculty and students are believed to be the best way of learning, and thus they are known for small class-sizes as well as residential settings that foster interaction and collaboration (Chopp et al., 2014; Detweiler, 2021), even when nested within larger university settings. In terms of faculty responsibilities, these colleges give more weight to teaching than to research when evaluating faculty. At the same time, faculty have greater autonomy in teaching, including implementation of a course and revisions to course plans. Therefore, by selecting a specific educational context, this study provides deeper knowledge for the given context as well as opportunities for future curriculum studies that explore and expand insights to additional or broader contexts. Taken all together, the significance of this study is to approach curriculum from the faculty perspectives while maintaining a comprehensive and holistic view toward curriculum in the contexts of science fields at a teaching-focused college.

In this chapter, I introduced the social and political landscape of undergraduate curriculum and why I am looking at it from faculty perspectives. I stated my research questions and provided how I am using the key terms—curriculum and beliefs—in this study, which are

abstract in nature. This chapter then concluded with how this study contributes to curriculum studies in higher education. The next chapter reviews the relevant literature on the relationship between knowledge and curriculum, faculty beliefs, and the sociopolitical nature of undergraduate curriculum.

CHAPTER 2: REVIEW OF LITERATURE

The word curriculum stems from the Latin verb *currere*, meaning to run, and the curriculum refers to a racing chariot or a course of a race in ancient Greece (Egan in Kahn and Law, 2015; Smith, 1999, 2000). However, current definitions of curriculum appear diverged from their origins. Meanings of curriculum tend to evolve locally, and the term is a common name for educational plans in various situations and levels (Barrier et al., 2019; Lattuca & Stark, 2009). This ambiguous definition is a long-standing issue in educational sites and research. Despite many studies that have examined curriculum issues in higher education, these studies do not operationalize curriculum similarly. Also, in institutional settings, individual faculty, administrators, and staff tend to understand curriculum differently (Stark & Lattuca, 1997, 2009). Individuals might see curriculum as a syllabus, imposed rules that programs should follow, teaching activity plans, or the overall goals of an institution, a program, or a course.

Nevertheless, there have been efforts to establish a shared definition of curriculum. For example, Fraser and Bosanquet (2006) employed phenomenography to investigate different understandings that academics hold about curriculum. They found that these understandings could be grouped into three categories: technical interests (subject matter), communicative interests (making the meaning of the subject matter), and emancipatory interests (achieving autonomy by learning). Yet, scholars call for more discussion about what underpins the implicit assumptions about curriculum and how to conceptualize it. As the discussion provides a means for educators to navigate their own expectations and goals for the curriculum and teaching, they can communicate with each other with more clarity and commit to educational improvement with a shared vision (Bovill & Woolmer, 2018; Fraser & Bosanquet, 2006; Stark & Lattuca, 2009).

This chapter starts with a general overview of the literature on the nature of curriculum in terms of one's understanding of knowledge and how that then is transformed into the form of a curriculum. The second part of this chapter presents the nature of human beliefs and, more specifically, the ways of conceptualizing faculty beliefs. The following section addresses the sociopolitical stakes of the faculty's curriculum choices in science disciplines. The chapter concludes with presenting the Contexts for Agency framework (Landy et al., 2022), the conceptual framework of this study, which integrates the autonomy of educators, the institutional contexts, and the expected impacts of educators' decision-making.

The Relationship between Curriculum and Knowledge

It is widely accepted that educational practices should be understood as social and contextual because faculty choices are influenced by contextual elements such as local, disciplinary, institutional, and public atmosphere, as well as the external powers such as accreditation system or professional groups who engage in knowledge legitimacy processes. However, given the faculty's autonomy in developing curriculum, it is also essential to examine what nature of knowledge faculty consider valid for curriculum to understand the underlying beliefs of a particular curriculum. In addition, a more sophisticated understanding of the nature of knowledge can address educational and intellectual inequalities (Bernstein, 2000; Maton, 2011).

Social realism is coming to the fore in addressing the relationship between knowledge and curriculum. The nature of knowledge is not only social but also real in that the truth conditions to create knowledge are socially constructed, and so-called approved knowledge has its tendency, power, and property that bring effects to learners in a society (Maton, 2011). This perspective aligns with Morrow's idea of 'epistemic access' that highlights the purpose of higher

education to be a meaningful pathway to knowledge and, ultimately, to theoretical and systematic thinking skills (Muller, 2014). The concept of epistemic access is a strong reminder that a college degree should not be regarded as sufficient proof of education when considerable social attention has been given to the issue of student access to higher education institutions and socio-economic inequity created by degree attainment. The fundamental purpose of higher education and the core of curriculum studies is based upon recognizing the full worth of knowledge that leads to creating a genuine learning space for students' self-realization and increasing intellectual power.

In the rise of social realism, Basil Bernstein (2000) provided a cyclic model, *pedagogic devices*, useful in understanding how knowledge transforms in the process of knowledge production to student learning. Pedagogic devices suggest three different areas in which knowledge is realized: Knowledge production, Recontextualization, and Reproduction. The area of knowledge production refers to the research activities that scholars negotiate and build on each other's knowledge, which is beyond the scope of this study. The main concern of this study, curriculum planning and teaching, focuses on the latter two.

Recontextualization refers to the knowledge transformation taking place in value judgments of whether some knowledge is valid to teach and learn. Curriculum planning is a set of choices of the knowledge that is valid for education, including a plan for sequencing, pacing, and evaluating while simultaneously considering disciplinary and institutional norms (Bernstein, 2000). At the same time, recontextualization can also be viewed as decontextualizing from its research form as educators make knowledge teachable. Recontextualization is an arena of struggle for faculty members to decide how and how much they should transfer the knowledge from the research form to teachable knowledge.

Next, this teachable knowledge transforms into educational knowledge in the field of reproduction while knowledge is being taught and learned in classrooms. The idea of knowledge reproduction provides important insight into teaching and learning, namely the fact that both curriculum and particularly course content cannot be determined and dictated by entities that are not directly involved in the classroom and interacting with students. While various teaching methodologies are grounded in solid research, the interactions between students and teachers are continuously forming in the classroom, making it impossible to follow a 'recipe.' Considering the impacts of faculty members on knowledge transformation in curriculum planning and teaching, the educational outcomes likely will never be and do not need to be the same. From the perspective that the overall process of knowledge production is a cycle, knowledge reproduction at sites of learning continuously establishes the base for the further knowledge production.

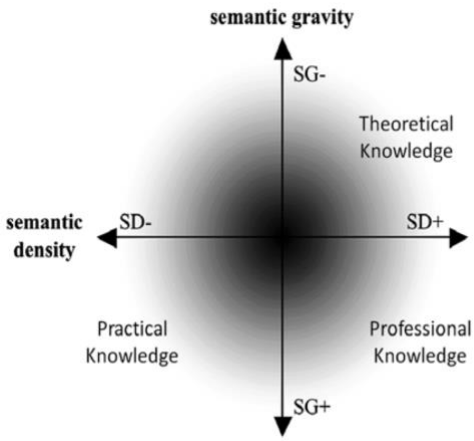
In addition to conceptualizing how knowledge is transformed within the different contexts, and because the criteria for determining valid knowledge are different depending on learning purposes or educational fields, Bernstein (2000) also proposed the categorization of knowledge. He suggested that knowledge is broadly grouped into everyday knowledge and systematically principled knowledge; systematically principled knowledge is then categorized into horizontal and hierarchical knowledge. In terms of academic disciplines, the former would be English literature or sociology, which move forward by consistent accumulation of new concepts and theories; and the latter would be physics or chemistry, where the fields advance by integrating previous knowledge as propositions of new theories. This attempt to structure different types of knowledge provides a foundation to investigate the distinctive mechanisms of validating knowledge and attributes of knowledge transformation in different academic fields (Bernstein, 2000).

While acknowledging the need to delve into the structure of knowledge, Maton (2011) took a semantic approach to his work and developed *Legitimation Code Theory*. This conceptual framework presents four types of knowledge, using a continuum consisting of two criteria—semantic density and semantic gravity. Semantic density (SD) describes the degree to which meanings or ideas are viewed as generalizable; and semantic gravity (SG) describes how many concepts and principles are associated with the specific context and practice. This conceptualization of knowledge can be visualized into four quadrants as depicted in Figure 1. Knowledge is categorized into theoretical, professional, practical, and knowledge in development. The knowledge taught in education is coherent and systematically principled with relatively strong semantic density, so they are mostly situated in the two quadrants on the right. This study focuses on the upper-right quadrant where the natural science fields are situated. However, *Legitimation Code Theory* is not directly applicable to curriculum studies as it draws on knowledge production from Bernstein's pedagogic devices (Shay, 2013).

Figure 1

The Semantic Plane in the Field of Knowledge Production

(Adapted from Maton, 2014).

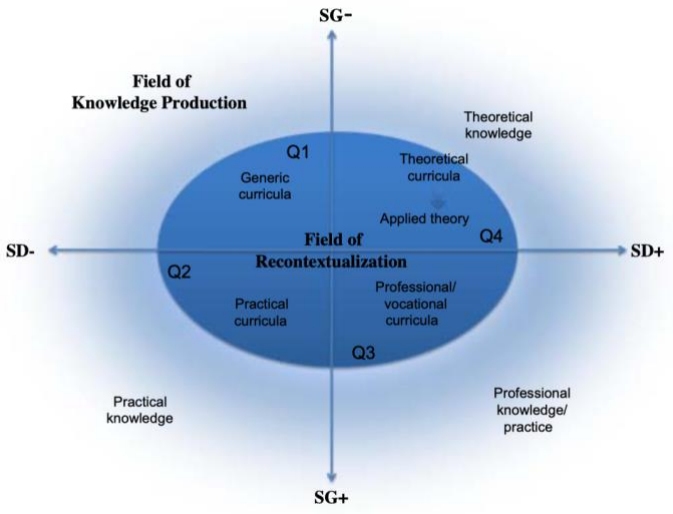


As discussed earlier, in the field of recontextualization (Bernstein, 2000) knowledge is transformed in the process of becoming teachable knowledge. Thus, Shay (2013) adopted Maton's Legitimation Code Theory (2011) to examine disciplinary configurations of curriculum. Conceptualizing the characteristics of knowledge according to semantic density and semantic gravity, Shay (2013) groups curricula into four types—theoretical, professional, practical, and generic curricula (Figure 2.). The different characteristics of curricula suggest that faculty choices for their courses would differ based on their field and the goals of their program. As this study looks at natural science disciplines, the focus is on the upper-right quadrant (Q4), theoretical curricula.

Figure 2

The Semantic Plane in the field of Knowledge Recontextualization

(Adapted from Shay, 2013).



In summary, this section explains why this study examines the curriculum from faculty perspectives within a limited set of fields. Faculty choices in transforming knowledge into

teachable forms are central to understanding the higher education curriculum. These choices are grounded in the validation mechanisms of disciplinary knowledge.

Faculty Beliefs

Over the last century, it has been widely accepted that human beliefs are critical not only for performing a task but also for self-fulfillment. Philosophy and science studies have strived to map the human belief construct, and professional fields such as medical, legal, and business education have been interested in beliefs to understand why individuals behave in a certain way and how professional attitudes and values develop (Pajares, 1992). While this area of research investigates the complexity of human beliefs, establishing a definition of belief and its construct is an ongoing issue. Research communities have not yet come to an agreement on the mechanism of human beliefs, such as how beliefs are acquired and modified and how beliefs are associated with behaviors. It is not only the elusive nature of human beliefs that make it hard to create a definition, but also the different definitions are adopted by researchers according to the purpose of their studies, which complicates the process of creating a shared definition of teacher beliefs (Kagan, 1992; Nespor, 1987; Österholm, 2010a; Pajares, 1992; Skott, 2010).

In teacher education fields, research about teacher beliefs has evolved on the premise that belief is a main determiner for understanding why teachers employ certain teaching practices, which greatly impact student learning (Pajares, 1992; Skott, 2010). For example, to foster student agency of their leaning, belief research examined whether teachers should realize their beliefs about the meaning of learning and valuable knowledge; and if so, whether teachers should communicate their beliefs to have students model their teachers (Maggioni & Parkinson, 2008). Research on teacher beliefs has contributed to helping teachers reflect on their aspirations for both their teaching practices and their particular goals for student achievement (Maggioni &

Parkinson, 2008). Studies about teacher beliefs demonstrate that beliefs influence overall class management, knowledge acquisition about teaching, and ways of perceiving student development. Ultimately, teacher belief research challenges the idea of uniform curriculum or pedagogy, so-called, "teacher-proof" curriculum or "best practices."

Teacher beliefs is recognized as an irreplaceable research area because beliefs oversee how a teacher perceives, judges, and behaves in a situation and thus, how classrooms develop (Kagan, 1992; Österholm, 2010a). Studies on teacher beliefs provide a foundation for the current study about faculty beliefs of the curriculum in that educators' beliefs influence their educational decisions. Teaching is a self-directed, intellectual activity where educators are entitled to have autonomy and flexibility in teaching manners (Kagan, 1992). Therefore, what faculty believe about curriculum—including planning, teaching, and revising their courses—at an individual level is the key to understanding how student learning and undergraduate courses evolve. Investigating faculty beliefs regarding curriculum would contribute to faculty professional development in curriculum design. Furthermore, it would provide valuable insights for administrators, shedding light on the meaning of teaching to faculty members and their aspirations for their professional growth as educators. Recognizing faculty beliefs as the starting point for discussions on curriculum is crucial for the advancement in undergraduate education.

Criticism of Teacher Beliefs Research

Despite the value of understanding educators' perspectives of teaching, the topic is often criticized for the lack of clarity in defining human beliefs and the claims of it being affective and episodic, thus making it not substantial enough to study (Österholm, 2010a; Pajares, 1992). The complexity of human beliefs is actually of value to beliefs research, yet there are two trends in

the research on teacher beliefs that tend to hinder drawing attention to the topic (Österholm, 2010a; Skott, 2009).

First, a common position that knowledge is superior to belief has been reinforced through the studies of the relationship between what teachers know and what they believe. These studies have been motivated to address the gap between what teachers learn in teacher education programs and how they teach in practice. They have suggested that what teachers learn will change their beliefs on teaching and learning. The social property of knowledge has been referenced to distinguish knowledge from beliefs; whether or not ideas are adopted depends on the beliefs of the local community (Kagan, 1992; Österholm, 2010a). Belief, on the other hand, is more often highlighted as an individual, psychological process. At the same time, a person is aware that others may hold another belief about the same issue. However, this distinction rests on a dubious premise in which social support is an essential component for some ideas to advance to the status of "knowledge." Conversely, knowledge can be demoted to a random idea when the power of social support to persuade diminishes. This is not to say that belief is an individual process. If individuals are cognizant of the possibility that others may hold different beliefs, belief then also has a social property (Österholm, 2010a).

In the same vein, knowledge is deemed as stable, logical, and objective due to the social agreements while beliefs are often characterized as affective and episodic (Österholm, 2010a; Pajares, 1992; Skott, 2010). However, beliefs themselves cannot be affective. Although beliefs can arouse certain emotions and shape attitudes and values, so does knowledge (Österholm, 2010a). It cannot be said that knowledge is non-affective because it is impossible to know how a piece of certain knowledge relates to individual emotions and experiences (Österholm, 2010a; Pajares, 1992). Therefore, even though the philosophical analysis of the relation between

knowledge and beliefs is important, insofar as a research purpose is to examine what teachers think about educational issues and why they practice in a way, the term, *beliefs*, serves as a linguistic tool (to refer to the way in which something is perceived) regardless of where the line between knowledge and beliefs is (Österholm, 2010a).

Second, contradicting or inexplicable findings of teacher beliefs research are often attributed to the tacit knowledge or subconscious practices of study participants (Österholm, 2010c). It is unreasonable to assume some beliefs, which cannot be theorized, are unconscious. Also, if the theory of beliefs used in a study does not address the unconscious parts of beliefs, the attempt to cover unconscious beliefs is not necessary or even inappropriate (Österholm, 2010c). For the unknown parts, it would be more constructive to communicate with teacher participants about their dilemmas and struggles and suggest other methods to elicit beliefs rather than labeling them as unconscious.

Ironically, despite the elusive and obscure nature of beliefs, its perseverance is a grounding characteristic of human beliefs. It is significant to note that there are boundaries within which beliefs operate coherently. In other words, beliefs exist in clusters, and subconstructs are recreated within shifting contexts and situations (Österholm, 2010a). Consequently, beliefs research identifies a cluster within which a set of beliefs resides and recognizes the realm where beliefs operate. Otherwise, sizable beliefs cannot help but remain ironic, contradictory, or mysterious. Hence, research on educators' beliefs focuses on the educational belief system of educators (Pajares, 1992).

Towards a General Agreement on Educators' Beliefs

Unpacking beliefs could be a cryptic task, but examining shared key assumptions about belief among different definitions provides a solid foundation to build the meaning of the belief

system of educators. The first working assumption of human beliefs is that belief is a cognitive strategy, relatively stable and self-perpetuated (Kagan, 1992; Nespor, 1987; Österholm, 2010a; Pajares, 1992; Skott, 2010). Unlike the common misconception of human beliefs being abstruse and emotional, beliefs tend to persist even when logical and convincing evidence that challenges one's beliefs is provided. Although beliefs can change either by lived experiences or external stimulus, belief creation or alteration requires recurring interpretation of one's experiences relevant to a belief. This persevering characteristic creates a foundation of judgment and discernment by selectively perceiving what is happening around oneself and imparting personal meanings (Kagan, 1992; Nespor, 1987; Pajares, 1992). In other words, belief systems play a critical role in reducing dissonance with others or their surroundings and help humans to manage confusion in diverse situations.

Another assumption is that a belief system is comprised of subsystems wherein beliefs interact in specific ways. For example, although an individual may hold religious beliefs, they may not be activated within the educational belief system. Therefore, in research on educators' beliefs it is important to refrain from attempting to cover beliefs that do not align with the educational belief system. Furthermore, research could focus on a specific domain within an educational belief system, such as self-efficacy, self-perception, teacher efficacy, epistemological beliefs, or beliefs about disciplines or subject knowledge (Pajares, 1992).

Lastly, teacher beliefs do not control teaching practices. Researchers highlight that teaching occurs through social interaction with students in that students also take a significant role in teaching and learning. Besides, classrooms exist in broader social and institutional settings. Teacher belief research, however, tends to make a causal relationship between teacher beliefs and instructional decisions, as if the beliefs of individual teachers are the only factor for

teaching practices (Skott, 2010). This perspective on teacher beliefs is not only at odds with general perception of education as a social interaction but also burdening teachers to take total responsibility for student learning (Pajares, 1992; Skott, 2010). A more problematic perspective towards the causal relationships is that understanding teacher beliefs can be of help in modifying their teaching in a certain direction. Teacher beliefs fields are often expected to discover a set of beliefs for effective teaching and student learning (Nespor, 1987; Skott, 2010). However, teaching is a highly private affair that requires creativity depending on the situation, although teachers demonstrate patterns of behavior in teaching (Kagan, 1992; Nespor, 1987). Modifying educators' existing beliefs in a certain direction is not a research purpose of beliefs studies, and imposing a belief is not only impossible because the mechanism of belief acquisition is not known but also some might argue that it verges on unethical.

In summary, I presented the value of studying human beliefs, common criticism against beliefs research for the lack of clarity and working assumptions about human belief that teacher beliefs studies share. In today's society, faculty face growing constraints in curriculum design, driven by institutional hierarchies, external accountability demands, and the broader political climate. These pressures include standardized curricula, performance metrics, and diminished control over course content. Nevertheless, a fundamental value of higher education lies in providing students with opportunities to learn from the diverse academic perspectives of faculty members. This is why faculty have historically retained significant autonomy in course development and instructional decisions. Examining faculty beliefs about curriculum provides valuable insights into the teaching practices they adopt, the learning goals they set for students, and, ultimately, how classrooms evolve, and student learning takes place.

Sociopolitical Stakes of Curricular Choices

Curricula of colleges or universities represent the quality and direction of their education since the curriculum review processes encapsulate their educational values, missions, and visions (Khan & Law, 2015). This process, however, does not solely depend on the institution's educational visions or program leaders. Higher education institutions face pressure to respond nimbly and smartly to the needs of external entities—such as social trends, political pressures, government, industry, professional groups, accreditation boards, and the public—while they keep up with peer institutions (Barrier et al., 2019; Joseph, 2015; Khan & Law, 2015; Klassen, 2022). Taking a broad view, curriculum is a battlefield where the desires of diverse social and political entities conflict. This fight over the curriculum is vital for social groups because the group whose narratives make it into the curricula of educational systems means that their perspectives take a socially dominant position. Then, the underlying assumptions and values are less likely to be questioned over the generations. Narratives around the Science, Technology, Engineering, and Mathematics (STEM) education is a typical example that successfully dominates the current era.

Science Faculty Becoming Entrepreneurs

One of the primary missions of higher education institutions is to produce and disseminate knowledge for the betterment of society through scholarly means such as academic publications, conference presentations, and consultative activities (Van Dusen, 2013). Faculty members play a crucial role in this mission, traditionally valuing research for its contribution to knowledge production (Etzkowitz, 2002; Van Dusen, 2013). Additionally, these institutions aim to educate future generations, balancing their role in knowledge production with teaching and mentoring students (Etzkowitz, 2002).

However, for many postsecondary institutions, the funding structure within academia has shifted, requiring scientists to seek financial resources from private or public sectors that recognize the commercial potential of their research (Etzkowitz, 2002). This shift has led science faculty to focus more on public relations, grant writing, and attending conferences, often at the expense of time spent in labs and classrooms. Many higher education systems, including research universities, increasingly favor faculty with expertise in commercially viable research areas over those skilled in both teaching and research in their hiring and incentive systems (Van Dusen, 2013).

The role of principal investigators in securing funding has grown, covering costs for lab space, equipment, and personnel. Simultaneously, many higher education institutions have aggressively invested in technology transfer offices, which aim to generate revenue through patents and licensing deals, sometimes conflicting with faculty interests (Eisenberg & Cook-Deegan, 2018). Consequently, the educational value is often perceived as secondary to the research mission of higher education especially for research universities (Van Dusen, 2013).

Politics over Undergraduate STEM Education

The value and importance of STEM education are predominantly known for a close association with national security and economic competitiveness (Millar, 2020; Mody & Kaiser, 2008; Zouda, 2018). STEM degrees are touted by the public, students, and their families, especially for the high graduate salary, so economic values are tightly related to STEM studies. However, there has been minimal discussion challenging the assumptions and validity of the prevailing narratives, such as how the STEM workforce contributes to the national economic power more than other fields, or what constitute STEM fields. The attributes of their disciplinary

knowledge, strength of argumentation style, or societal values embedded in professional practices are rarely recognized as worthy attributes of the disciplines.

STEM has become remarkably popular along with favorable national funding systems and within a few decades, educational institutions—especially research universities—have carried out curriculum reform aligning with desirable skills for industry and the country (Sharma & Hudson, 2021). This fast and effective action was only possible with close cooperation between government and industry groups, positioning the STEM workforce as a solution to boost national security and economic well-being (Millar, 2020). Meanwhile, the dominant narrative of STEM being needed for national prosperity has made a potent impact on the disciplinary culture of STEM fields. Because the idea of competition lays the foundation of STEM-related national and institutional policies, the overall culture in STEM has not only glorified the victory but also increased anxiety and fear of falling behind (Millar, 2020; Zouda, 2018). Consequently, STEM curricula have highlighted teaching and evaluating methods that can measure student learning, such as skill-based or problem-based learning (Millar, 2020; Zouda, 2018). It is widely acknowledged that anxiety hinders learning in general, and numerous educators in STEM fields have expressed concerns about the competitive culture (Millar, 2020; Zouda, 2018). However, the curriculum has never been an exclusive realm for educators to directly address this culture.

The STEM networks among public, private, and non-governmental organizations have taken over a substantial role in overseeing the systems of colleges and universities by establishing a strategic partnership providing research facilities, different types of funding, or internship opportunities (Sharma & Hudson, 2021). Meanwhile, the government utilizes the dynamic of the networks to push through the national education reform to expand the STEM workforce efficiently (Sharma & Hudson, 2021). This closed network gained control of the

political decision-making about education while the public got further away from both the national workforce and educational issues (Sharma & Hudson, 2021). In other words, the public is losing its influence on how future scientists develop an awareness of their societal impacts through their knowledge and practices. This is an important public issue because scientific and technological development continues to intervene in infrastructure and human lifestyles at an unprecedented rate (Cutcliffe, 1993; Millar, 2020; Mitcham, 1999). Nevertheless, the word 'STEM' has successfully dominated society, as STEM became exclusive fields with high barriers that limit entry to only STEM professionals. The assumptions behind the value of STEM education remain unexamined, and the curricular issues got depoliticized and silenced (Millar, 2020; Sharma & Hudson, 2021).

What is STEM though?

It is critical to note that while government and external entities support STEM education, the disciplines deemed to be under STEM are challenged to be categorized together (Develaki, 2020; Millar, 2020). As presented in the earlier section, each field of study has been established based on distinct ways of knowledge validating processes and argumentation styles (Bernstein, 2000; Maton, 2010; Shay, 2013). For example, mathematics is an abstract entity where the consistency and completeness of mathematical modeling is only validated by logic, and conjecture has little value (Develaki, 2020). On the other hand, natural sciences concerns how to explain and predict phenomena in the real world (Develaki, 2020). In the case of engineering studies, they create models to intervene in natural phenomena for a purpose, so that issues and conditions of the real world have significant control over the conclusion of the studies and practices (Develaki, 2020).

Nonetheless, these disciplines have had to shoulder the mission of fostering a STEM workforce together. Furthermore, they are expected to grow into an interdisciplinary field with the hope of bringing creativity, and funding opportunities for making STEM interdisciplinary are emerging in the public and private sectors (Millar, 2020). Yet, there has been little discussion about how to organize the different epistemologies of each field and justify STEM as an interdisciplinary field. The latest visions and teaching practices that STEM communities have shared are engaging the real-world problems in their curricula and moving away from teacher-centered pedagogy (Millar, 2020). In essence, the higher education curriculum is political enough to be driven by decisions made outside educational institutions and is at the center of a power struggle among diverse social organizations.

Science and Teaching Science

Even prior to the emergence of 'STEM' in the twenty-first century, sciences held immense cultural authority in modern society. People have long believed that science and technology could enhance their quality of life and improve society, often without recognizing the intricate interconnection between advancement in scientific technology and their daily lives (Cutcliffe, 1993; Mitcham, 1999). Significant social and financial decisions regarding scientific development —decisions that can profoundly impact society— are often reserved for a small scientific community, leaving many people uninformed or unaware of the implications of their society's trajectory (Millar, 2020; Mitcham, 1999). Thus, higher education was called on to encourage students to critically interrogate how science evolves and is situated in a society.

In the 1960s, scholars—especially in history, philosophy, and sociology—pondered the excessive growth of science and technology studies across the world. This led to the emergence of new fields of study, such as Science, Technology, and Society (STS). Scholars argue that

education should empower people to actively choose what to know, understand how society is structured, and navigate life in a world shaped by science and technology (Cutcliffe, 1993). However, critical societal decisions regarding science are often made without corresponding efforts to educate people on understanding science in social and cultural contexts. For the decisions already made, society or humankind has yet to have enough time to observe the long-term effect of scientific developments (Cutcliffe, 1993). Still, the societal decisions are made at a faster pace. The idea of 'scientific' facts being objective, value-free, and universally true has successfully captivated the world. Science-related professions and degrees became enviable for prospective students and their families even though scientists are often characterized as being less caring and empathetic to others for the materialistic way of thinking (Millar, 2020; Zouda, 2018).

Reflecting this criticism, national goals of science education since the 1990s have included producing citizens who understand science as knowledge built within layers of history, culture, and social structure, in addition to strengthening economic competitiveness and national security. Educational communities, accordingly, have made efforts to situate science as a social and cultural entity in science and engineering curricula (Millar, 2020). However, the newly added national agenda remains the same over decades, and the promised objectives have yet to be sophisticated (Alsop & Fawcett, 2010; Mutegi & Momanyi, 2020). This slow progress may be frustrating, but it could be a reasonable consequence.

The goals in the agenda pursue essentially different figures of educated citizens with little room to be integrated. The longstanding goals seek to produce competitive professionals who can readily demonstrate a specific set of learning goals that conform to the needs of the job market. Others prioritize an ability to appreciate the civic values of science although such

thinking skills are hard to show in a short period of time. Considering the continuous global financial crisis in the twenty-first century, the relevant anxiety of students and their families, and the competition among peer institutions, educational institutions are under great pressure to streamline their education to market needs. Notwithstanding, there has been research in science fields striving against the dichotomy of competitive science and science as culture in higher education.

A Role of Pedagogy and Faculty Autonomy

Education aims to provide students with epistemic access to socially powerful views and knowledge of the world (Muller, 2014). In this context, many science education studies critique the dangers of modern science's claim that scientific knowledge is neutral and objective—an idea that has long dominated socially powerful perspectives in education. Over generations, this notion has limited students' opportunities to reflect on the nature of science and to understand scientific knowledge in broader societal contexts, leaving them with only a partial appreciation of its value. However, these studies often fall into the trap of conflating the activity of studying the nature of scientific knowledge with that of teaching the nature of science. They assume that increasing faculty engagement in discussions about the nature of science will automatically transform their classrooms (Mody & Kaiser, 2008). This assumption may stem from the fact that the same individuals—faculty—are responsible for both teaching and knowledge production. .

This misunderstanding reflects fundamental issues in comprehending higher education curriculum design. It underestimates the persistence of faculty beliefs in shaping curricular choices and overlooks the fundamental distinction between the pedagogical role of faculty and their role in research. Going back to Bernstein's pedagogic devices (2000), the form and nature of knowledge transform both during planning for teaching and in the moments of teaching and

learning. When knowledge becomes content knowledge in the education system, accumulative cultural and political value judgments are made. These judgments determine what is valid and valuable enough to teach the next generations, whom and who to teach, and how to organize knowledge for teaching and learning—in other words, how course design unfolds. In essence, scientific knowledge that raises and trains students is recontextualized knowledge that is designed to fulfill the educational goals for a given time and setting and, ultimately, reproduced knowledge in a class, instead of knowledge in the form of research. Redefining the nature of scientific knowledge is a separate issue from how the knowledge will be presented in science curricula. Therefore, faculty roles as curriculum designers and teachers need substantial attention in discussions of undergraduate education.

In summary, this section explored the sociopolitical nature of undergraduate curricula, particularly in STEM fields, highlighting how external political pressures have shaped curriculum-related discourse while overlooking faculty's role in teaching. While much of the existing literature focuses on policy-level curriculum reforms or student learning outcomes, this section highlights critical gaps in the research that this study of faculty beliefs about curriculum design aims to address. I started with discussing the shifts in science faculty's role as a principal investigator and politics over STEM education. Next, I presented how the nature of knowledge and the teaching of knowledge are different. I then discussed how faculty play a critical role in transforming knowledge into educational knowledge. The next section describes the conceptual framework that provides a foundation of how to situate faculty work within diverse contexts.

Conceptual Framework

Teaching undergraduate courses has traditionally been a self-directed activity of faculty (Barrier et al., 2019; Kagan, 1992; Wallace, 2014). Understanding educators' beliefs is crucial

due to their profound impact on curriculum-related practices shaping student learning. However, policy discussions have focused more on curriculum format and learning outcomes, often overlooking the imperative of understanding the faculty perceptions regarding course design and teaching within institutions. Therefore, this study aims to delve into faculty beliefs of curriculum, acknowledging the critical role of faculty members in undergraduate education.

To understand the beliefs of science faculty about curriculum in a Science-focused Residential College (SRC), I use the Contexts for Agency framework (Landy et al., 2022). This framework was developed during the Covid when educational developers—including all personnel engaged in student learning—in higher education had to be extremely resilient and take on new responsibilities for leading change while dealing with turbulent societal and institutional unrest. Designed to explore how individual educators navigate decision-making within their unique contexts, the framework provides a structured tool for understanding these dynamics. Its relevance to this study lies in its ability to explore how faculty interpret their roles in course design within their institutional environment and determine the most effective next steps.

The framework aligns with the concept of agency in Bandura's social cognitive theory (1989), which recognizes the reciprocal relationship between an agent and one's environment. This view on relationship fundamentally differs from a behavioristic perspective, which asserts that human behaviors are primarily shaped by the environment and can be controlled through proper reinforcement and punishment. Instead, the social cognitive theory focuses on human agency, analyzing how self-beliefs operate within reciprocal relationships among personal factors, behavior, and environment (Bandura, 1989). Landy and her colleagues (2022) have

identified three pivotal contexts associated with educational developers' agency in their framework: identity, institution, and impact.

The first context, identity, encompasses the personal and professional roles individuals hold, such as instructor, faculty member, caregiver, or citizen. This dimension highlights the interconnectedness of daily life and professional responsibilities, recognizing that personal circumstances influence professional contributions and vice versa. It also considers the emotional resilience and personal strengths that support collaboration and sound decision-making.

Next, institutional context focuses on the alignment between institutional priorities and an individual's work. It considers factors like navigating workplace politics, identifying strategic collaborators on campus, and evaluating the significance of decisions for students, faculty, and the institution.

Additionally, the context of impact pertains to the outcomes of decisions, requiring educators to strategically balance shared goals with potential problem-solving benefits and the stress decisions may cause for stakeholders and team members.

Given the diverse responsibilities and versatile roles required for faculty, this framework provides a valuable lens to understand faculty beliefs about course design and how faculty navigate a complex institutional environment to act on their beliefs about course design.

This chapter demonstrated that curriculum building and delivery are highly political processes, with the government, accreditors, professional groups, and industrial networks all vying for greater influence over higher education institutions' decision-making, including determining what gets taught in specific fields (Joseph, 2015; Klassen, 2022; Louvel, 2013). External entities participate in curriculum politics by demanding a certain set of graduate attributes and meaningful learning experiences (Joseph, 2015). Higher education institutions are

to deal with the political forces and sometimes create programs or courses to meet the needs of society and students, leaving faculty to take on the tasks (Joseph, 2015; Klassen, 2022; Louvel, 2013).

At the same time, faculty are active actors in the overall process of curriculum development and delivery, and their curricular decisions are integral in every part of the knowledge transformation—from research to curriculum planning to teaching (Bernstein, 2000). Faculty members argue they are entitled to exert autonomy in course planning and have leeway in handling the classroom environment under the protection of the moral convictions underpinning academic freedom, a foundational tenet of higher education institutions (Lackey, 2018). Despite intensive interruptions by external entities that lead to a dysfunctional hierarchical culture in curriculum development, faculty members still strive to strategically manage the organizational change for curricula (Louvel, 2013). They grasp the political reality and still manage to coordinate resources to improve the quality of their courses. Moreover, at the time of this study, the final decision of how to deliver the curricula in their classes rests with the faculty even with the high level of constraints over curricula. From this perspective, I view faculty as active agents in course design who strive to enhance the quality of their courses, employing various strategies aligned with their beliefs while navigating the political dynamics of their programs and institutions. This perspective guides my examination of the interplay between faculty beliefs about course design and their curricular decisions.

CHAPTER 3: METHODOLOGY

My goal in studying faculty beliefs of course design is to understand how these beliefs interplay with curricular decisions. The subject of faculty beliefs has often been overlooked. Although the research about educators' beliefs spans several decades, many of these studies have inadvertently reinforced the notion that human belief holds less weight as scholarly knowledge than cognitive human knowledge due to its inherent uncertainty (Österholm, 2010a). This tendency can be traced back to the influence of the positivist paradigm, which seeks eternal and value-neutral *truth* and has held great power for recent centuries. Positivism asserts that knowledge production revolves around pursuing absolute and unchanging *truth* in any context and has shaped the perception of valid knowledge as empirical and replicable, emphasizing demonstrable evidence (Hesse-Biber, 2016). In this global social context, the elusive and intricate nature of human belief is deemed deviant by many in the knowledge system. However, both beliefs and knowledge need relevant experiences and information as well as recurring and ongoing interpretations that create coherence, becoming a mental construction. Beliefs cannot be considered as merely capricious. Recognizing that beliefs serve as criteria to place oneself in the surroundings and give personal meanings to their judgment (Österholm, 2010), this study investigates undergraduate science courses through faculty beliefs and their curricular decisions.

In this chapter, I address how the research design of this study sheds light on the interplay between faculty beliefs about course design and their curricular decisions. I start by presenting the paradigm in which my worldview is situated and explain the rationale for the qualitative research design. I next describe why I selected my research site and participants, and how I collected the data and maintained confidentiality. Then, I discuss how I analyzed the data, my positionality in the research process, and how I attempted to ensure trustworthiness in this study.

Paradigm

A paradigm is a set of foundational assumptions and beliefs that provide fundamental elements to make sense of the world and guide how an individual engages in every aspect of society (Hesse-Biber, 2016). The areas of assumptions include the nature of existence and reality (ontology); the nature of human knowledge and how to justify knowledge (epistemology); and the nature of values and what are valuable matters (axiology). I align myself with a critical framework which recognizes every part of society holds some power. These power dynamics intricately thread through any context spanning familial micro units to the global society.

Among the critical approaches, specifically post-structuralism resonates with me. I consider existence itself or reality is insubstantial and incorporeal; yet, only the perspective of an observer embodies the reality. The perspective is realized with social symbols and gains significance within social and cultural groups that share the interpretation of the symbols. Therefore, both social symbols and what the symbols refer to are arbitrary in nature, so are reality and existence. The arbitrariness applies to the notion of truth as well. Since the elements of any truth claim are inherently conditional and subject to the socially constructed meaning systems, truth is provisional in nature. Considering these assumptions of reality and knowledge, producing knowledge within post-structuralism investigates what society has missed or dismissed, as well as how to move forward with an acknowledgment that some knowledge has been disregarded (Hesse-Biber, 2016).

At the same time, I do not argue that exposing weaknesses or flaws in the underlying and prevailing social structures will rectify problematic cultural issues. Humanity has witnessed countless times that various forms of discrimination persist even after the systemic practices are unveiled (Nealon & Giroux, 2012). For example, although societal consensus declares

discrimination against gender, race, economic status, age, ability, or any other criteria that is morally, ethically, and logically unacceptable, the constant problematic actions feed the structure that overlooks the intolerable practices. Also, even if social symbols and language use may be changeable and malleable, the cultural patterns perpetuating pressing issues like discrimination can endure (Nealon & Giroux, 2012). Therefore, I concur with the post-structural perspective that emphasizes the dynamic interplay between structure and cultural practices rather than focusing on social structure that controls people's practices separately or independently.

Faculty are the main agents nurturing scholarly and disciplinary norms, and higher education institutions are obligated to secure academic freedom for faculty to explore their intellectual curiosity without fear of retaliation (Lackey, 2018). However, with the rise of the academic capitalist regime, faculty at many research universities are increasingly compelled to engage in profitable work in academia to keep their positions for both research and teaching purposes. Moreover, compared to the considerable emphasis on faculty productivity or guidelines tailored to meet the student needs for learning, how faculty envision their roles and responsibilities as educators have yet to be largely recognized. Still, within demanding circumstances, faculty find areas to demonstrate their commitment to undergraduate education (Klassen, 2022; Louvel, 2013). Therefore, navigating faculty beliefs and ways to align their curricular decisions with beliefs is an effective approach to supporting faculty in exercising autonomy, maintaining integrity as educators, and improving undergraduate education.

Qualitative Research Design

Qualitative research seeks social meanings of human experiences and the meanings of those experiences reflected in any objects (Hesse-Biber, 2016). A key to qualitative research is to lay out subjective human experiences with rich contexts. Faculty belief, a lens to study

curriculum in this study, is intrinsically a subjective construct. Studying human beliefs inevitably entails the work of eliciting participants' thoughts and making inferences considering the contextual details as much as possible (Kagan, 1992; Pajares, 1992). Whether an educator has solid propositions about their educational beliefs or not, belief is a mental process than a stagnant mental object (Österholm, 2010c; Skott, 2009). Beliefs can exist as surface level representation, but importantly in order to gather all relevant experiences and thoughts, specific data collecting methods are needed to stimulate a person's retrieval of those experiences and thoughts.

It is unreasonable to assume that faculty have explicitly pondered their conception of course design and have organized their conceptions into propositions readily available when asked. That is why beliefs need to be elicited, and researchers cannot use survey questionnaires to directly ask faculty about their beliefs (Österholm, 2010c). Observations of teaching practices or written statements, for example, are secondary to skillfully elicited responses because beliefs can be revealed in diverse ways and to different extents (Pajares, 1992; Skott, 2009). Thus, I attempted to follow participants in their mental processes about their beliefs of curriculum and assist them in unpacking how they perceive their curricular decisions within various contexts tied to these beliefs. The beliefs collected in a study result from the interaction between the researcher and participants, as well as the researcher's interpretation, rather than being objects to discover that are possessed by participants (Österholm, 2010c). Qualitative research recognizes that meanings are constantly negotiated throughout the research process (Bhattacharya, 2017), so a qualitative research design is ideal to learn relational and multiple truths about faculty beliefs.

I employed a semi-structured interview process to explore faculty beliefs and collect detailed, nuanced data. Using a combination of prepared core questions and the flexibility to delve into emerging topics during the conversation, I aimed to generate rich descriptions of their

experiences within their perceived institutional environment. The domains of inquiry included the background of obtaining a faculty position at the institution, educational beliefs about course design, teaching goals, perceptions of disciplinary and organizational contexts, and experiences in making curricular decisions.

Site Selection

I selected a Science-focused Residential College (SRC) housed in a large research university in the Midwest United States. Founded over fifty years ago, SRC emphasizes teaching as its primary mission. The college exclusively offers undergraduate programs and employs over fifty faculty members, approximately one-third of whom are designated as teaching professors. Tenure-track faculty engage in both disciplinary-based educational research and scholarship, either within their respective fields or across interdisciplinary domains.

The educational mission of SRC is to cultivate an understanding of science through humanistic and societal lenses, while also guiding students in comprehending the interdisciplinary dimensions of becoming scientists. The college offers a broad spectrum of majors and minors across the natural sciences, mathematics, social sciences, and humanities. Although undergraduate science programs are traditionally characterized by tightly structured, hierarchical knowledge (Lattuca & Stark, 2011), SRC distinguishes itself through its innovative and integrative educational vision. Additionally, a notable feature of SRC is its intentionally designed physical environment, which integrates residential and learning spaces. Classrooms, laboratories, faculty and staff offices, and communal facilities are housed within the same building, fostering close connections between academic and co-curricular experiences. This unique institutional setting aligns with my research interest in investigating faculty beliefs about

course design in an environment where faculty dedicate significant time and effort to teaching supported by institutional structures.

SRC provides an optimal setting for exploring science faculty beliefs, particularly in disciplines often perceived as adhering to “rigid” curricular traditions. Moreover, faculty at SRC are well-positioned to offer insights into the advantages and challenges of their institutional setting for course design, as some faculty members hold dual appointments with another science college in a traditional setting within the larger campus.

Participant Selection

Each academic field is built on different arguments, reasoning styles and purposes in knowledge production. Faculty, thus, tend to hold different educational values and goals of the curriculum by academic fields (Lattuca & Stark, 2009). Using Shay's quadrants of recontextualized knowledge for teaching (2014) and Biglan’s classification of academic disciplines (1973), I narrowed down the field of study to natural sciences for this study.

In Shay's classifications of curricula (theoretical, professional and practical curriculum, and curriculum in development), science studies are generally situated in the theoretical curriculum. In addition, Biglan's classification is helpful in narrowing down disciplines within science fields. Biglan (1973) categorizes academic disciplines into four groups: hard-pure (e.g., natural sciences), soft-pure (e.g., humanities), hard-applied (e.g., engineering), and soft-applied (e.g., social sciences). He then added a dimension of “life” that separates biology-related disciplines and non-life disciplines such as physics, astronomy, and chemistry. To explore faculty beliefs of curriculum in-depth, I delimit the academic fields of participants to hard-pure disciplines, encompassing both life and non-life sciences.

Within the research site of this study, there are faculty members who take charge of biology, physics and chemistry courses, with their primary responsibility being teaching rather than research. I contacted all faculty in the selected disciplines via email listed in the faculty directory on the SRC website. Nine faculty members from three different disciplines agreed to participate in the study. Of these, three are teaching faculty, while six hold tenure-track positions. In terms of teaching experience, six faculty members have more than twenty years of experience, and three have more than ten years.

Data Collection

The interviews took between 45 to 60 minutes, were either in-person or virtual of participants' choice, and I audio-recorded the interviews. Considering that this research study examines the interplay between faculty beliefs about course design and curricular decisions, the broad topic areas that the interviews need to address are: faculty perception about course design and teaching work, goals that faculty want to achieve for themselves in their courses, what goals they negotiate to carry out the course, and how their beliefs about curriculum design and teaching evolve with teaching experiences. At the same time, the conceptual framework—the Contexts for Agency Framework—also guided the development of the interview questions. This framework emphasizes the influence of three key contexts on faculty decision-making: personal or professional identities, the institutional environment, and the anticipated impact of their decisions. Together, these elements shaped how faculty navigate and act upon their educational beliefs in practice. Before conducting interviews for the study, I conducted several pilot interviews with faculty from teaching-focused colleges and science fields outside SRC to refine the interview questions and prepare strategies for guiding faculty when they have difficulty articulating their beliefs. Pilot interviews revealed potential ways the conversation could unfold

and helped me identify a more effective order for the questions. For instance, a question I had intended as a light opening unexpectedly sparked deep conversations right at the beginning. Additionally, I learned that, although the research site is a science-focused residential college with a unique institutional context, it was more effective to ask separately about organizational and disciplinary influences on participants' beliefs about course design. Based on these insights, I finalized twelve questions (see Appendix A).

Moreover, considering that both the main concepts of this study, curriculum and beliefs, have fluid definitions, I started the interview with the boundaries of the terms and reminded participants throughout a conversation as needed. I made clear that my questions asked their experiences and reflection about course-level curriculum work across course planning, teaching, and revising. If they needed example areas to reflect on course design, I gave eight elements of the academic plan by Lattuca and Stark (2008): purposes, content, sequence, learners, instructional processes, instructional resources, evaluation, and adjustment. Likewise, as belief can be an ambiguous concept to participants, I explained that beliefs in my questions refer to their values, attitudes or cognitive strategies that appear automatically to themselves regarding curricular issues.

The interview consists of four parts. In the first part, I asked about individual teaching journeys to tailor sub-interview questions and actively engage with participants' experiences in course design. Questions included years of teaching, the origins of their teaching interests, how they discovered their passion for teaching as a career path, how they joined a teaching-focused college, and how the department assigns courses. In the second part, I explored faculty beliefs about course design and their perceptions of their work environments. The third part focused on specific examples of fulfilling and distinguishing course design experiences. Lastly, I asked

follow-up questions based on participants' responses, comparing their experiences at different institutions, working on different aspects of course design, or using different communication styles. I also asked them to elaborate further on points they made during the interview.

Confidentiality

Maintaining the confidentiality of data is a key consideration of this study to an ethical research practice and especially to protect faculty who participated in my study. I have three provisions for confidentiality of privacy interests. First, I sent a consent form to faculty interested in participation, which described the brief introduction of myself as a researcher, contact information, the research purpose, areas of interview questions that would be made, and how the data would be stored. The consent form also identified that participation is voluntary, and they could withdraw from the study at any point of the research process without penalty. After receiving their agreement in written form, I also asked for their oral agreement at the beginning of the interview. Next, I transcribed by myself, utilizing auto-generated transcription. Lastly, I stored the locked raw data files on my personal computer and backed up data in two password protected cloud storage, *Dropbox* and *iCloud*.

Data Analysis

Qualitative data analysis proceeds with data collecting simultaneously (Hesse-Biber, 2016). As I collected data, I took analytic memos during and immediately after each interview, being mindful of why I interpreted the participants' responses to my questions and asked with the tailored sub-questions and how faculty experiences were similar and different from other participants. Memoing helped me be more reflexive about my positionality and especially dating the memos was helpful in keeping track of the logic I develop (Hesse-Biber, 2016). Also, I transcribed all the interviews within a few days after each interview based on roughly auto-

generated transcriptions of the recordings. Transcribing allowed me to review the conversations and catch the informal signals or nuanced details that I possibly wanted to clarify in member checks. This work was the beginning of organizing ideas for the elements of findings and grasping the overall thinking and experiences of the participants.

Although qualitative analysis is a non-linear process, I followed Saldaña's (2016) four stages in the evolution of qualitative analysis: code, category, theme/ concepts, and theory/ assertions. In the first round of coding, I freely labeled any parts of data with significant phrases or a thematic statement and created an initial list of codes. According to Saldaña (2016), coding is an exploratory analytic technique that simultaneously summarizes and complicates the data interpretation towards insightful and critical links between pieces of data (Saldaña, 2016). Codes served as not only a descriptive title of a portion of data but also a prompt for my reflection. Using numerous labels, I aimed to identify three to five categories that captured the nuanced responses of participants without distorting their meaning, guided by the conceptual framework.

After generating an initial list of codes and rough themes, I created separate files for each category, compiling response segments that preserved the context of relevant content. Over iterative cycles, I reorganized and refined the codes, themes, and categories to feature patterns and correspondences, including similarities between participants, notable differences, and potential causal relationships per Saldaña (2016). Then, the next step was finalizing themes. Saldaña (2016) describes that themes cannot be codes themselves, but the obtained meanings and insights that address the research question. Ultimately, I developed assertions for this study that speak to the explanations of faculty experiences in course design work.

While the Contexts for Agency Framework (Landy et al., 2022) used in this study provided fundamental insights into the three contexts of identity, institution, and impact that

influence how educational developers in higher education exercise agency in their professional decisions, it was not directly applicable as a primary structure for analysis. The framework addresses dimensions relevant to educational developers, including leadership and student affairs professionals, as individuals operating within larger groups in the decision-making process. However, the high level of autonomy in course design exhibited by faculty participants appeared to reduce their focus on political dynamics and the need for strategic campus collaborators, which are typically more prominent at the program or university level of curriculum design. Participants' responses included a significant focus on the context of impact, particularly regarding the educational outcomes of their curricular decisions. Although the institutional context did surface as a source of distress, particularly regarding its potential impact on tenure and promotion decisions, participants consistently distinguished between their college and university environments when describing their work settings. This pattern prompted me to create separate themes for contexts.

Meanwhile, I also focused on the directional influence between faculty beliefs and their curricular decisions in developing the analysis structure. An example set of themes from earlier iterations of the analysis structure included organizational context, faculty's goals for student learning, sources of motivation, institutional support, and persistent course design beliefs. The persistent nature of human beliefs reminded me that representing the developmental aspects of faculty beliefs about course design is more constructive and meaningful than merely emphasizing their stability—while acknowledging that the development of beliefs does not negate their stability. Over the course of the analysis, I refined these into five final themes that capture the interplay between faculty beliefs about course design and their curricular decisions: perceived organizational context, faculty's goal for student learning, sources of

faculty's passion in teaching, evolution of curricular decisions, and institutional settings that influence course design.

Researcher Positionality

I lived in a positivistic world growing up and was surrounded by communities that believe knowledge is static and an accumulation of absolute truth. Up until my undergraduate study in material engineering in South Korea, Western Science was taught as science with little explanation of how a culture and society produce and proclaim knowledge as truth and how the validity of truth is earned, just as what is often happening within educational systems globally. However, I started questioning who made the order of the courses, what becomes official knowledge, and why some insights last hundreds of years in history, while some are not part of the school knowledge and are labeled as irrational thinking. These questions drew me into the curriculum studies in higher education.

During my doctoral study, I arrived at the idea that knowledge production is all human activity of negotiation regardless of academic disciplines. Especially meeting a field of study about how science is situated in a culture and society has helped me to diverge from the materialistic view which adheres to absolute truth and demonstrable and replicable knowledge. Moreover, as I learned the institutional legacy of academic freedom and witnessed the autonomy of faculty and their sense of duty to educate future generations, my interest in the curriculum developed into faculty perspectives to curriculum. Although I have never been a faculty member, I am able to engage in science faculty experiences with my undergraduate experiences and educational research experience in a science college. Also, approaching science faculty as an educational researcher wanting to listen to their perspectives, instead of approaching them with an evaluative point of view, lowered the barrier to having a conversation.

I have only attended research universities in my education, but selecting a teaching-focused college as a research site was intentional. Although it is true that all colleges and universities are dedicated to undergraduate education, I have learned that teaching-focused colleges set more rigorous teaching standards than other institution types. I was curious about what possibilities with undergraduate curriculum can be opened when faculty fully commit to undergraduate education with institutional support for teaching.

Trustworthiness

The beauty of qualitative research is to build truth by getting an understanding of subjective experiences. It contrasts with the positivist worldview which assumes that social reality can exist independently from individuals, and truth is waiting to be discovered. Thus, unlike quantitative research, the trustworthiness of qualitative research does not rely on the probability of social phenomena happening in society. Instead, as knowledge is assumed to be built by dynamic and intersubjective social interactions of people, the interplay between the subject of study and researcher's reflexivity is critical for the trustworthiness of qualitative research. Thus, providing a rich description of the participants' experiences and how the logic of the study develops can persuade readers, thereby allowing them to transfer the logic to another context with appropriate alterations.

Throughout the conversation in interviews, I clarified if I understood the participants' experiences in a way that they intended and why they stated or believed things as they did. In addition, I provided a detailed description in this dissertation as to participants' experiences and my reflexivity in the interpretation and analysis process; for example, how I dealt with my perspectives on this topic and why the excerpts are a salient portion of this research. To allow the voices of the participants to come through, I contextualized the anonymous data and maintained

rich and nuanced narratives by recounting the findings with a peer reviewer. Also, I accounted for how the inquiry process takes shape such as code choices, coding processes, and how the concepts or themes emerge from multidimensional stories.

In this chapter, I described how I delved into faculty beliefs of curriculum and how their curricular decisions are related to their beliefs about curriculum. Explaining my perspective of understanding the world and research topic, I discussed how my qualitative approach using individual interviews allows me to analyze and render faculty perspectives to curriculum. More specifically, I presented why I selected my research site and participants as well as how I maintained confidentiality for my participants and enhance trustworthiness of this research.

CHAPTER 4: FINDINGS

In this chapter, I discuss five key dimensions that I identified as central to the research question—In a Science-focused Residential College (SRC), how do science faculty beliefs about course design interplay with their curricular decisions?: 1) perceived organizational context, 2) faculty's goal for student learning, 3) sources of faculty's passion in teaching, 4) evolution of faculty's curricular decisions, and 5) institutional settings.

At the beginning of each interview, I asked participants a light introductory question about what came to mind when they thought of course design. Their responses revealed a shared perspective that course design is not a linear process. Instead, it is a continuous cycle of reflection and adjustment that evolves throughout and across semesters. For example, one faculty member captured this dynamic process by enumerating the questions they grapple with while designing a course:

> I'm going to be thinking about what content do I want to teach? and why do I want to teach that content? As I pick that content, what types of stories do I want to tell in that space? Why do I want to tell those stories? How do I want to tell those? How do I want students to engage in that work? What do my students lives look like in the classroom in relation to each other in relation to this society or societal structure that we have, as they interact with each other as they interact with the content, what do they, what do their lives look like outside the classroom? So many different moving pieces. And how do they all fit together? That is kind of what I would think about.

The five dimensions discussed in this chapter are closely intertwined with how faculty navigate these various moving pieces as they strive to align their beliefs about course design and their curricular decisions.

Perceived Organizational Context

In this first theme, I explore four aspects of the perceived organizational context, as understood by SRC faculty participants, that influence their autonomy and flexibility in course design. These aspects include: why faculty joined SRC, interdisciplinary working environment, collaborative course design, and two sides of the collaboration.

Participants highlighted that alongside collaborative course planning that was part of the context of SRC, they enjoy a high level of autonomy in designing their courses. While working towards shared course goals with other SRC faculty, each faculty can decide their pedagogical approaches that will ensure students grasp fundamental concepts. This autonomy extends to selecting textbook materials, crafting examples and activities, designing quizzes and exams, facilitating exam debriefs, and determining instructional methods and session modality. Also, flexibility and adaptability are appreciated by faculty members, recognizing the dynamic nature of classrooms where students negotiate their understandings with course materials, their classmates, and a professor. The flexibility allows faculty to tailor their short-term plans or small elements of a class depending on how interaction goes with the given student groups in a semester and incorporate quick activities and adjusting pacing based on students' comprehension levels.

Why Faculty Joined Science-focused Residential College (SRC)

Why participants joined SRC shows how both the institution and faculty members are dedicated to teaching. All nine participants had a teaching interest as a career path when they were in the job market at the end of a doctoral program or post-doc position. Given the unique setting of this research site where SRC is housed in a Research 1 university, many participants shared that they were not aware of this institution until they learned about the job opening. Also,

a level of familiarity with an institution type such as teaching-focused college or residential college was different depending on the type of institutions they had previously attended. All participants stated that the clear teaching mission of the college was attractive when they were seeking teaching-focused positions.

Participants discovered their interests in teaching before they applied for a job. These interests in teaching started mostly in graduate school with teaching assistantships. Some participants stated that the teaching assistant role was not as hard as it was for some of their colleagues as they were used to and enjoyed tutoring or mentoring before they entered graduate school. Many participants shared that they found themselves energized and excited by teaching during doctoral studies. While they pursued science studies in their discipline due to their academic curiosity, teaching assistant roles introduced another intellectual curiosity and brought enjoyable interaction with students. Participants shared that they were interested in thinking about why students do not seem to learn, what can be improved, and how to help students to create their knowledge in learning rather than preparing them for tests. A participant said, "I found a lot more reward in working with students, and working one-on-one, and seeing the light bulb go off when they, 'oh, I get it now.'" Faculty mentioned energy they received from interaction with students as rewarding. Moreover, they provided events that had them realize that they were not only enjoying but also good at helping students and peers to learn more than their colleagues, such as when they were selected as a teaching assistant of the year or leaving mentoring-related meetings energized when others are disinterested or puzzled. Also, other participants undertook being a leader of teaching assistants or creating teaching development programs. One participant recalled the doctoral years, saying, "for many of them, they would like

to go teach because they had to, and then come back and do the research because they really wanted to. And for me it was the flipped experience."

Along with faculty's interests in teaching, an institutional setting that allowed faculty to take risks for creative teaching was a main reason that faculty joined SRC. One participant shared that "when they interviewed me, it was made very clear to me that … they wanted me to take big risks in improving teaching and innovation when they talk about tenure and promotion." Especially for tenure-track faculty members with research responsibility, being able to conduct discipline-based education research (DBER) as a core research activity was a selling point of their current position. One faculty specifically mentioned that whether an institution has a DBER community was a main criterion of the job search. Moreover, for some faculty, an interdisciplinary setting was interesting as opportunities to work with people from humanities and social sciences seemed well aligned with a teaching mission, highlighting innovative teaching and student-centered learning.

Interdisciplinary Working Environment

Faculty at SRC who participated in this study are dedicated to the strong teaching mission and culture, prioritizing student learning above all. Within this faculty community, participants believe there is a shared understanding that each faculty is focused on designing better courses. There is also a recognition that collaboration in course design can create a synergy, enhancing the overall educational experience for students and professional development experiences for faculty themselves. The level of communication among faculty members that participants shared encompasses formal and informal settings, both within and across their respective disciplines. Additionally, SRC's tenure system highlights criteria that strengthen the importance of effective and creative teaching. Despite the conventional association of tenure with publication output,

especially in R1 institutions, one faculty in the tenure system said, “we have this expectation to be excellent teachers first.”

Moreover, given the distinct feature of SRC that emphasizes the importance of understanding of what science and becoming scientists mean in society, participants mentioned that opportunities to share teaching ideas with faculty in other disciplines were fulfilling and enjoyable course design experiences. Especially the fact that faculty in humanities and social sciences have offices across from each other in the same building is considered as merit to being part of the college. Participants shared that a relationship with faculty in other fields is helpful to stretch their thinking and expertise by challenging each other in creative, fun ways.

A participant shared a course design experience for a lab course in how to increase awareness of structural inequities in science, saying, “when you see the ways that other disciplines run their classrooms, it kinda really opens up your world to the way that STEM talks about this being the norm, it doesn't have to be the norm.” This faculty added that a stronger curriculum emerges from productive challenges and conversations. Also, another participant shared a chance discovery in an informal conversation with a colleague in a non-science discipline when they found out a concept ‘claim evidence reasoning’ in a science course was called ‘claim warrant’ in a writing course. Faculty then decided to use the same language for a higher translation across the courses, which would lead to a greater coherence in student learning in the college.

Collaborative Course Design

SRC has three disciplinary groups of physics, chemistry, and biology in natural science fields, and each group works collaboratively in course design, especially regarding course goals. Faculty agree on core learning goals for different levels of courses, and faculty members who

teach the same course in different sections work closely to align fundamental concepts and topic areas. In addition, since lab courses are structured around lectures and taught by different faculty members, faculty are intentional about designing coherent lectures to provide a solid foundation for all lab courses. Although each faculty member may take different approaches or use different examples to cover a topic, there is a certain level of agreement about what should be covered, how to sequence and pace the lecture, and the emphasis for assessment. This allows general depth and breadth of the course to be consistent within each discipline.

A faculty shared that this alignment is important especially for first-year courses since it widely impacts students' early learning experiences in the college. Another faculty also found these agreements beneficial for students, especially in introductory level courses, saying, "our students are coming in and have no real ability to carefully select the style of class that they're interested in. So in general, we have tried to provide a similar set of experiences across all of our lecture sections."

Moreover, undergraduate learning assistances (ULA), who work 10 hours per week, help faculty be more collaborative in course design. Instead of lab technician or graduate teaching assistant supports, SRC hires their undergraduate students for lab courses to provide lab preparation support for faculty and peer support for students. Faculty are in charge of training undergraduate learning assistants in preparing their classes, and those students are often involved in other sections of the same courses. Faculty, thus, want to communicate with each other effectively, so they can utilize the limited time of the ULAs, maintaining the learning and working scope manageable for the students in these positions.

All participants shared that their course design work is collaborative. The levels of alignment and coherence at SRC lead faculty members to have weekly meetings in general in all

disciplinary groups. Throughout a semester, faculty share their next one- or two-week lecture plan and activities and debrief what is working and not working in their classes. In case of a discipline that has an agreement to maintain complete coherence in a lab course across over twenty sections, the faculty group has two-hour meetings every week to negotiate homework materials, answer keys, important deadlines, grading rubrics, as well as mentoring plans of undergraduate teaching assistants. A faculty in another discipline also shared that:

> We meet once a week in general. So there's a lot of sharing of our ideas. There's a lot of sharing of what you do and just talking about teaching. And so a lot of that like negotiation come in those spaces, in the sharing of the ideas and the talking through like why you're doing it, why you're spending time on it, why somebody might not. It's just constant talking about things.

Two Sides of the Collaboration

In all conversations with participants, the idea of active communication among faculty members emerged consistently. For instance, participants said, “that's sort of built into the teaching culture … that there is that place for collaboration and reflection to the degree that I want it in those courses,” and “there may be some deviation amongst a few things, but overall … we all work together.” One faculty described their working style, saying, “there’s a norm of communication [although] it is not a requirement” as they have touch base meetings once a week, or two weeks at the latest, sharing a progress and worksheet or student activities that are going to be used for that week. The level of communication extends to informal communication over brief messages, during lunch time or in the hallway. Faculty said that casual conversations sometimes provide ideas on how to improve or what to try for their classes while they talk about how classes are going in general, how students are doing with course materials, or how a

teaching method is working that they were going to try. However, many participants mentioned both advantages and challenges arising from the nature of collaboration.

Participants appreciated that they can get feedback before trying them out with students in the beginning of new teaching ideas, so that they can start with an improved version of their initial idea in the actual classroom. There was another perspective of collaboration that, “it probably also at times, you know, saves me work and making stupid choices because sometimes I would get enthusiastic about stuff” when they do not necessarily recognize the amount of preparation that would be required to carry out a plan. Additionally, participants shared that working with others could be satisfying when their ideas and feedback is appreciated by the group. They said that it is enjoyable when colleagues actively engage in their ideas to improve a course design, or when colleagues finally buy teaching ideas that they were using after they brought up to the full group for a while.

However, participants also shared inevitable disadvantages that accompanied various advantages of high-level of communication and collaboration in course design. Although they have collaborated for years, miscommunications happen. Sometimes a problem can arise at a point of the semester when faculty feel it is too late to redesign a course and to address an issue with other faculty in different sections of the same course. For instance, one faculty said that, “after all those conversations, we actually weren't in as agreement as I thought we were, and they were not giving me proactive feedback about the resources I was providing them … That was a particularly difficult interaction that semester.” Another faculty said, “I like teaching my own course from start to finish,” sharing a frustrating collaboration experience with co-teaching, in the form of teaching different parts of the same course instead of going into a classroom with another instructor. Contrary to positive expectations, a faculty felt frustrated when there was lack

of student learning to proceed to their parts, and students had little interest in the topics. These difficulties which participants shared tie back to why faculty appreciate autonomy in course design because faculty must independently address unexpected problems as they arise and continue to carry out the course for the rest of the semester.

On the whole, participants acknowledged the advantages of a collaborative culture in course design at SRC while being conscious of the nature of collaboration. One faculty said, "any group work, which I see students negotiating all the time, you make compromises, and you wanna respect your colleagues and their expertise and opinion." Another faculty also mentioned the necessary negotiating process in the collaborative course design when talking about the amount of time needed for weekly meetings for teaching. The participant considered course design experiences between the discipline groups as collaborative teaching that was not a norm in non-science courses at SRC, saying, "which is an advantage for them that they get to think independently, it means they don't have to collaborate about their teaching, but it also means they don't get to collaborate about their teaching… So, pick your poison."

Nevertheless, it is clear that participants prefer the benefits created from well-arranged collaboration. One faculty said, due to the high level of autonomy and individual expertise in course design at SRC, "I've not had to work with someone who's not aligned with me philosophically in course design. I could imagine that would be very difficult." This participant, however, added that more conversations are preferred, where people say, "'oh yeah, what if we asked them this?', 'this would be a great application', 'if it followed like this." Many participants were aware that their sparkling teaching ideas could only be great in their mind and expressed the need for more productive and effective spaces where they can regularly co-think and inspire each other.

Faculty's Goal for Student Learning

In SRC, each disciplinary group outlines the content areas for courses at different levels, and faculty design their courses independently and individually based upon the agreed goals of educating SRC students. In essence, the foundation of each course lies in the beliefs of each faculty member regarding the characteristics of competent scientists and how these can be cultivated within undergraduate science education. For instance, a participant said, "students should be doing science, so I think about what it means to do biology in the domain of my class. [The lecture and lab activities] are based on the things that biologists would do." Similarly, another participant said, "my goal is often to get students to think like chemists and understand things like chemistry because different disciplines do have different ways of thinking." Based on these fundamental ideas, participants discussed mainly three areas that they want students to develop in their courses: developing critical thinking skills, enjoying science and lifelong learning, and establishing a solid foundation of disciplinary knowledge.

Think Critically in a Disciplinary World and Society

Many participants highlight that students should be able to freely engage in thought processes associated with what competent scientists would do such as gathering relevant information, critically evaluating core ideas, applying ideas effectively and presenting their ideas creatively. They acknowledged that science education across all levels has often emphasized rote memorization, fostering a perception of science as primarily about precise measurement and calculation. However, faculty articulated that their aim was to break away from the traditional framework and embrace creativity in course design. One participant shared that, "I try to tell my students that if all you can do is memorize information and spit it back, you're obsolete because [electronic device] is what that's for." Furthermore, another participant highlighted that

developing critical thinking skills is a main goal of teaching, saying, “how to do some of the skills is mostly irrelevant for the vast majority of my students once they leave the classroom, or certainly once they leave the university.” Participants illustrated that developing critical thinking skills to construct scientific argumentation and design experiments accordingly is the primary goal of their course design.

Aligned with the mission of SRC to establish strong scientific foundations and cultivate an appreciation for the interconnectedness of various scholarly domains, participants articulated the importance of teaching fundamental concepts effectively. They highlighted that fostering a construction of a solid knowledge framework which is adaptable and expandable is essential. While undergraduate science courses may entail an extensive list of topics, individual SRC faculty members are entrusted with identifying core ideas and determining the depth and duration of coverage for a topic. For example, a physics faculty will cover momentum and translational motion, but not angular momentum or rotational motion. Although some might see those as advanced concepts, participants consider those as specialized topics that can be explored further by students as needed if they have strong foundational understandings. Similarly, a chemistry faculty underscored that regardless of a detailed topic, the core idea for students to walk away from the class is a way of thinking that the molecular structure influences its properties and the ability to visualize intermolecular forces instead of mere calculations of those forces.

Regarding the importance of critical thinking skills within a disciplinary domain for course design, many comments highlighted the faculty’s efforts to minimize the emphasis on mathematization in their courses. Previous educational experiences of students may have led them to perceive science primarily as a field of heavy calculations. Participants acknowledged

that while mathematical modeling is a significant research area within individual natural science disciplines, undergraduate science education has often placed heavy emphasis on numerical tasks in lectures and exams. Participants expressed a desire for students to move beyond the notion that scientific comprehension of natural phenomena is mainly achieved through numerical calculations. Thus, many participants shared their dedication to developing a course that prioritizes conceptual understanding and reasoning skills specific to their disciplines. One participant said, “why is that stuff purple? why is that stuff powerless? That's the cool stuff. And I really try to bring that home to the students. Yes, we still do some quantitative calculations, but I de-emphasize that a bit.” Another participant also addressed that “[mathematization] is not what I want to spend my time on…I don't think you need to do that to be a successful biology researcher.”

Additionally, a critical thinking skill that faculty aim for students to develop in their courses is the ability to reflect on responsible scientific practices and question the conventional notions of scientific objectivity. A participant shares a historical perspective about science that the idea of scientific objectivity has often disconnected the construction of scientific knowledge from its impact on discriminatory human decisions and political responsibilities, saying:

> So in doing the introductory biology, I want them to be able to articulate by historicizing the topics that we do. How can we teach genetics without acknowledging that the roots of genetics are in the eugenics movement? And even as we acknowledge eugenics, how can we continue to question values of normality that underlie the basis of what we do in a lot of genetics and in a lot of medical sciences? We name things as normal, and then everything else is abnormal. We create those binaries.

As long as the inequities stemming from scientific advancements are perceived as incidental byproducts in science education, it remains unlikely that students will become scientists who actively take responsibility for their work and consider larger ethical implications in society. A participant said, “I want my students to see science as spaces where they can enact social justice.” This sentiment underscores the importance of integrating discussions about how science can address social inequities into the course.

Enjoy Science and Learning

Next, what faculty aim for in their courses is to cultivate students’ willingness to engage in scientific practices and foster an appreciation for scientific phenomena. This aspiration is one of the main motivations behind participants’ contemplation of how to create positive and enjoyable learning experiences within their course designs. For example, a participant said, “I really try to bring that in a meaningful way, so that the students are getting to engage in the scientific practices. That's much more important to me than just the skill-based assessment or activities.” Many participants discussed the importance of being able to enjoy science and the learning process itself. They believe that this enjoyment would naturally encourage students to continue to pursue science outside of class and in advanced courses, leading them closer to becoming competent scientists. To achieve this, faculty participants want their students to not to internalize common notion of STEM classrooms and to be independent and responsible learners.

Not to Internalize Common Notion of STEM Classrooms

Participants illustrated their aim to foster a genuine interest in science and learning within their courses, particularly in light of how students can feel disconnected in the science classroom. Drawing from their personal journeys to become scientists and insights gained from discussions on STEM education nationally and internationally, they highlighted the common misconceptions

about learning science that students often carry into college. For instance, one participant spoke of a frustrating case where students preferred faculty-led demonstrations of problem-solving processes for exams over engaging in group work and co-thinking process, saying “then, it can be hard to encourage them to enjoy.”

Additionally, participants pointed out the rigid and unwelcoming atmosphere that can misunderstandingly characterize science classrooms. A physics faculty noted that even allowing that a majority of SRC students are not intending to declare physics as major, many students simply experience high levels of anxiety in an introductory physics course, “no matter how hard you're working to be supportive in the traditional physics content.” This participant has actively pursued course design strategies aimed at bridging physics with students’ personal experiences while drawing positive emotions. To achieve that, the faculty introduced arts-based activities such as creating time lapse and slow-motion videos or engaging in abstract process art to explore concepts of time and energy. These activities were adopted to effectively integrate physics learning with opportunities for self-expression. The success evidenced by positive student response and the quality of their work reinforces the faculty to emphasize ensuring students feel included in the classroom as an important goal of the course design.

More participants shared their learning experiences in uninspiring classroom environments that they aim to avoid perpetuating. For example, a participant commented on the prescriptive teaching and learning environment prevalent up to doctoral education in science fields, saying:

> In grad school, where I was very much like, you do this and then you leave, and we talk about the STEM and then you leave. This is all we talk about, right? Leave your identity outside. And those were increasingly spaces that I felt uncomfortable and that I felt like,

were not for me. I loved the work, the actual work of it. but I didn't like who you had to be to do that work.

This faculty, thus, is now contemplating course designs that can better integrate students' lives. Another comment addressed how antagonistic the faculty-student relationship can get in large, traditional STEM courses, where grading revolves solely around points, leading students often resorting to complaints to get more points. Overall, faculty bear in mind to move away from the negative characteristics commonly associated with science classrooms.

To be Independent and Responsible Learners

Participants expressed a desire for their students not only to excel in assigned tasks but also to critically examine how and why their efforts contribute to their learning, acknowledging the diligent academic atmosphere of SRC students and their efforts to achieve higher grades. A strategy to foster this learning mindset is through direct communication with students. Faculty shared that they try to articulate in class why faculty take a particular approach in teaching or assignment structures, sometimes they even share relevant educational literature. For instance, one participant reflected, "they have to buy-in and trust the system as it were. And we've had to take direct steps to show them. you know, like maybe they need evidence to be convinced just like us faculty." Faculty aim to cultivate a capacity in students to contemplate the developmental implications of their learning behaviors.

Participants also aspire for students to unlearn what they have been socialized to conform in traditional schooling and develop resilience in both their academic pursuits and lives. One participant underscored the importance of nurturing students' sense of autonomy in learning. This faculty have students plan their learning strategies and assessment methods and articulate the rationales, allowing them to adjust the plan as needed throughout the semester, saying:

> It's a lot of unlearning the ways that we ask them to show up to our spaces because we ask them to show up to our spaces and just say yes to whatever we see. And then when I'm asking them instead to do some deep thinking and do some deep reflecting on how they learn. Because they don't just get to say, I want to do this, or I want to do that. [In my class,] They reflect, they say I want to do this because blank, this is the way it supports my learning, this is why I want to do that. And that has been hard for them, but also in the end really fulfilling for them. I want them to be human in my classroom. The number of times I hear from my students, 'this is the first time I feel like I'm not a number.' That's wild. Why do we make them feel like numbers?

Acknowledging that the educational system often emphasizes adherence to established learning schemes and knowledge structure, faculty participants instead aim to encourage students to reflect on the meanings of learning to themselves.

Within a similar perspective of student autonomy, another faculty has implemented a course policy that allows students to request a one-time extension on an assignment deadline without providing an explanation, recognizing that unforeseen circumstances can arise in students' lives. This participant illustrated the related part of course design, saying "that was a really enjoyable experience to find ways to teach in a new modality to align policies and practices with course goals and do it in a way that provided enough flexibility to students but also didn't make my life unmanageable." Faculty participants want students to experience that learning is not an unpleasant activity that requires sacrificing other aspects of life.

Establish A Solid Foundation for Next Steps

Lastly, participants emphasized establishing a solid foundation of disciplinary knowledge for continued studies in college or potential future research endeavors. A participant described

that there is a general agreement on core ideas of undergraduate science within disciplinary societies, saying, “I think the big ideas are almost codified that everybody would be expected to teach. I think most people would kind of pick those things off anyway.” Yet, faculty members have the autonomy to decide which content to delve into and how to teach it in their classes. Participants are mindful of selecting skills and knowledge to impart that will serve as robust foundation for advanced courses, not only in the same discipline, but across chemistry, biology, and physics. For example, a chemistry faculty feels responsible to teach the core concepts of chemistry thoroughly, as students often take chemistry before taking biology courses in SRC.

Additionally, participants consider students’ interests in specific majors and career paths when making curricular decisions. As approximately eighty percent of SRC students opt for biology majors with the aim of pursuing health-related fields, participants in other disciplines employ different strategies to engage students in their course designs and accommodate their teaching styles. For instance, a chemistry faculty member explains how the current chemistry course will be beneficial in advanced courses like organic chemistry or physical chemistry, ultimately leading to higher scores on the Medical College Admission Test. Also, a physics faculty member tends to incorporate biological examples into class activities and homework. Meanwhile, a biology faculty member noted that plant-related content is suppressed to cover human-related biology more, as the majority of SRC students are interested in health-related studies and careers.

Sources of Faculty’s Passion in Teaching

The third theme involved in the interplay between faculty beliefs about course design and their curricular decisions is the faculty’s passion for teaching. Aligning with faculty interests in teaching-focused jobs, participants are internally motivated to continuously develop their

courses. Despite teaching the same courses for decades, one faculty said, “it's a new group of students each year, so it's a new group of personalities. It's a new mix of cultural and ethnic backgrounds each and every year. So, it never gets stale for me. It never gets old.” Another participant reflected that although it is possible to maintain a moderate level of active learning and make little changes over years, they want to keep developing their courses. This faculty explained, “it's something that I do. I want to provide students with a very positive experience. I want them to learn, feel empowered, like all those kinds of things. And I think that's what drives the curricular piece.” In addition, many participants noted that they actively consult with their colleagues, educational research, and professional development opportunities out of their personal endeavors to be a better teacher.

It appears that mostly internal drives motivate participants to invest in course design. As developing teaching skills is natural desire to them, participants compared their motivations to invest in course design with “making dinner” or looking after “baby.” Some participants also stated simply, “it is fun”, or “teaching is my passion.” I organized the internal drives into four categories: autonomy in course design, urge for creativity, student development, and integrity as an educator.

Autonomy in Course Design

Several participants shared their teaching experiences in doctoral education to describe how they appreciate and leverage faculty autonomy currently in course design. Although they liked the teaching assistant role, they also acknowledged its limitations because the development of teaching skills necessary for a teaching assistant role is not an important part of training within experimental science research groups for doctoral students. Additionally, the scope of their responsibilities and time constraints hindered the ability to experiment with different teaching

schemes or make adjustments to course content when they were teaching assistants. Consequently, the value of a teaching assistantship was limited to having opportunities to experience a course already designed instead of engaging in course design activities.

Reflecting on this unmet desire for course design involvement, participants highlighted the freedom in exploring creative course design within the specific context of SRC. One participant said, “what's cool now at [faculty] level is to feel more fully in control of course design… I don't feel obligated to follow some type of traditional course design that would be expected to prepare them in a very specific way.” Similarly, another participant commented about how gratifying it was, with a sense of responsibility, to be able to design a learning space in ways that aligns with one’s values once becoming the instructor of record. The participant shared that despite a deep interest in making students want to be in class rather than merely improving their performance, teaching assistants faced limitations in practicing these ideas. Therefore, this faculty participant enjoyed the current autonomy to create a ‘joyful and liberating’ classroom environment.

Urge for Creativity

Some participants emphasized the importance of autonomy in course design, as it satisfies their desire to express their creativity. For instance, one faculty member described the merit of a faculty job as follows: “it's not just executing something that someone else made. Being able to have the ideas feeds me, it gets me excited, it makes me want to come and test things out and try things.” Another faculty also described one of the fulfilling course design experiences as “design my own lessons instead of relying on the book… That was a moment.” Related to their urge for creativity, participants expressed that their job would become mundane if they made few changes while teaching college science for decades, especially when problem-

solving in college-level science lacks intellectual stimulation for faculty. They reflected that pondering over what kind of scientists society needs, what are the goals and pathways for undergraduate science education, and how to engage students with those goals in their classes is a fun way to satiate their need for creativity. In the same vein, one participant shared a dissatisfying teaching experience when heavily relying on an inherited syllabus for a class to teach for the first time. Although that approach felt safe and natural initially, the faculty reflected that the experience served as a reminder to take ownership of deciding what and how to teach a course to have a satisfying semester.

Participants' desire to be creative in course design was intricately linked with their desire to satisfy their intellectual curiosity and fulfill their beliefs. Various faculty members reflected on the enjoyment and satisfaction derived from thinking about how to foster conceptual change in students or posing 'what if' questions envisioning student development. For instance, one participant said that, "it is my own intellectual curiosity and desire to tweak stuff, which is lovely." Another participant also shared that, "[course design is] intellectually stimulating to think of it as a problem to solve how can we get them to do what I want them to be able to do." They make notes to themselves about what did and did not go well and how the goals were met while reflecting on the consequence if they change something, add some activities, or frame desired outcomes differently for the next semester. A faculty devoted in the discipline-based education research noted that, "the science is really cool, but then, you could be a scientist about student learning." Participants indicated that changing something in course preparation based on the lesson they learned from the previous semester leads to a better teaching experience in general.

In addition, a comment was made about the small class size at SRC. As a class size of more than five hundred students is common in many science undergraduate programs at research universities, particularly in introductory level classes, a faculty shared that the prospect of adapting to such a large class can be daunting. Another participant shared that the size of classes in SRC, which is typically smaller than research universities, allows faculty to expand their breadth of freethinking in course design, saying, “with 50 students, you could do whatever you want.”

Student Development

In addition to personal endeavors, participants are driven to dedicate themselves to course design for student development. Course design activity and student development are inherently inseparable aspects for these participants because faculty shape elements of a course following their educational visions. It appears that comprehension of scientific concepts and the enhancement of learning attitudes contribute to participant satisfaction with student learning.

First, participants had satisfying course design experiences when they observed student development in personalized a topic for their classes, hoping students would critically engage in disciplinary concepts, thinking, and practices. Participants gave examples of how they personalized their lesson by employing such topics as weather pattern, local ecosystem, greenhouse gas effect, movement of eugenics, or respiratory system, while meeting the scientific concepts that a disciplinary group agreed to cover. Faculty found it fulfilling to witness students take ownership of their learning by investigating phenomena prepared by faculty and developing their own experiments over the semester. This sense of fulfillment gets reinforced over time with repeated positive experiences.

Observing student development in learning behavior and attitude as intended in course design is another point that faculty satisfied through their course design activities. For example, one participant recounted a positive experience of modifying a course design to encourage students to continuously engage with core principles introduced at the beginning of the semester. This faculty observed students consistently revisiting these core principles, leading to the development of a comprehensive understanding. This outcome was highly gratifying for the faculty member.

Furthermore, other participants shared successful experiences with implementing alternative assessment styles that grant students autonomy in evaluating their own learning. They highlighted that, besides improved learning of science, the change in students' attitudes toward learning because of the assessment change was exciting. More specifically, one faculty instituted a policy allowing students to retake tests multiple times and redo lab reports without penalty, but with co-reflection with the faculty regarding their learning from the previous test and plan for next one. The participant expressed excitement about how this new grading structure brought a positive learning environment into the course, saying, "it was so successful. The attitudinal change in students was just amazing. They are just not stressed about learning, but they're still learning… it just completely simplifies life because everything is not for points anymore"

Course design activities appear to be deeply relational, as the ultimate aim of course design for faculty participants is to have students perceive the value and trust the directions faculty established. A participant described her approach to course design, saying, "[it] makes me think of what aspirations and intentions do I have for students and for myself in terms of the experiences and the knowledge I want us to be able to leave with or to have constructed together." Afterwards, positive student feedback confirms the course was successful. Whether

through course evaluations, casual conversations about how students liked the course, or anecdotes of student excitement on discovering their learning in daily life, feedback enhanced the overall sense of fulfillment in course design work. Also, one participant noted that communication with students about the rationale behind the structure of an assignment or lesson was important to receive positive responses, saying, “they really appreciate the hard work you put in, particularly if you articulate it to them.” Thus, autonomy in course design is crucial for self-satisfaction, yet positive student feedback serves as potent affirmation or validation for the direction of their work.

Integrity as an Educator

Taken together, enjoyment coming from autonomy in course design, urge for creativity, and student development add up to the personal sense of integrity as an educator for faculty in this study. Participants expressed that teaching is their passion, driving them to continuously strive for competency in teaching and research that informs their teaching. Especially senior faculty members emphasized their commitment to ongoing teaching development despite their confidence in teaching, acknowledging the significant advancement in their disciplinary educational research, student learning styles, and educational technology over recent decades. They noted that they want to stay current in the field and develop new ways to share information with students as a faculty member who bears teaching as a main responsibility.

Moreover, making changes to course design each semester is an enjoyable challenge that participants set for themselves to be a better educator, which fosters a better self-image. Within the relatively high faculty autonomy in course design at SRC, participants tend to bring in alternative teaching methods as long as they align with their educational values. This process contributes to an elevated self-image, fueled by improved student learning outcomes resulting

from updated course designs. Faculty discussed that increased student learning in areas that they revised, whether through group or individual course re-design, was particularly rewarding and fulfilling. One participant articulated the sentiment, saying, “they can do that they didn't use to do before I changed it, and that’s super satisfying personally.” This personal satisfaction intertwines with faculty professional development and student development, which in turn nurtures a sense of fulfillment. Thus, faculty’s professional growth and fulfillment, alongside student development, appear interconnected and mutually reinforcing.

Evolution of Curricular Beliefs and Decisions

The fourth theme is the evolution of curricular beliefs and decisions. Recognizing that course design is a dynamic process that unfolds throughout one’s career, faculty participants highlight the developmental aspects of their beliefs about course design and their curricular decisions. Through interactions with colleagues, engagement in professional development opportunities, or self-directed learning, faculty beliefs about various facets and parts of course design have evolved as well as their curricular decisions along with their teaching experiences. Participants described course design as “ongoing process”, “a trial and error”, “iterative improvement”, or “continual each time, never ending”. For example, one participant reflected on course design experiences, saying:

> I'm ever changing my course. I don't think I've ever taught exactly the same course. I'd say the first time you try a really big new thing, a big change, not just a tweak or a small thing, but structural change. I want to do it 3 or 4 times at least. Because like context is different, space is different, people are different. You gotta give it some room to breathe before you reflect on it.

Another participant also discussed why there cannot be a completed or finished course design, saying, “you don't know how students really respond to how the sequencing of the ideas are laid out. It can vary from semester to semester. Some students feel like it's going well, that some students don't.”

Some participants also remarked on developmental aspects by sharing memorable episodes in their early years of teaching. One participant illustrated the chaos of the first semester as a faculty member, noting that the task of aligning course materials and activities with curricular goals gradually became an almost involuntary process after more than ten years of teaching experiences. This faculty recounted that, “I remember like mid-semester I pulled a colleague aside and was like, I don't know what I'm doing tomorrow. I know I've got stuff like curriculum to work from, but I don't know what's coming tomorrow.” Additionally, another faculty spoke of a lesson from their early experience that remains effective in current course design. This participant said, “one thing that surprised me when I first started teaching is that unless you assign points to an area, students do not care. It's not enough to say, ‘here's something cool to do’… Assignments points are indication of value.” In the following, I further analyze how faculty’s curricular decisions have evolved by internal and external motives.

Evolution of Internal Motives

With the high level of autonomy that SRC faculty possess in their teaching, their internal drives to craft creative courses and improve themselves as better teachers largely inform their curricular decisions. Many participants noted that they initially grapple with how to effectively convey content knowledge. Subsequently, faculty step back and prioritize course goals while navigating moving pieces of course design. Over time, faculty members gain confidence to

adhere to their beliefs about course design and do not get easily swayed by challenges encountered during their new attempts in course design.

Following What Others Do

Participants indicated that their early understanding of course design was bounded to content selection and content delivery. Particularly during the initial stages of their careers, when faculty members often feel they are in "survival mode," they relied on an inherited syllabus and a common list of topics to cover in a course, as well as imitated how others approached teaching. For instance, a faculty said, "I was just following suit. I was kinda like doing what people had done in the past, the gigantic lecture approach." Similarly, another faculty discussed that the initial understanding was limited to lecture preparation, thinking, "I have to teach these topics and I'm gonna go in the order of a textbook." Another faculty also commented, "at the very beginning, it was really topic-based and about what are some interesting ways we can have them learn that topic."

Along with the limited understanding of course design at the beginning of their careers, however, one participant described how a new faculty can be swamped by the responsibility of course design in the early stage of a career. Consequently, they often find themselves relying on sources that they can imitate or emulate:

> So, when you are new it's always overwhelming no matter what. It's just always a lot to learn a new course about the approach that you have, the depth that this unit has, the norms of that in terms of what sort of student exceptions you approve, what are honors options like. There's just a lot there.

Another faculty also reflected on how teaching goes during early years but added that faculty naturally tend to gravitate towards creating their courses. This participant said, "I was really

adopting a curriculum that another professor had developed, so I was essentially teaching his course. Over time I personalized that and made it much more course that I had developed the structuring content for."

Prioritizing Course Goals

Most participants indicated that the significant difference and development they achieved in their teaching, compared to the early years, was the establishment of clear course goals. A faculty said:

> Now it's more driven by learning goals than it was at the beginning. The beginning was more driven by a topic list that I inherited but didn't necessarily understand. And now it's a deeper sense of the broad picture of what we're trying to do and how the pieces come together.

Another faculty also remarked on the shift in the perception of course design, saying, "I was just thinking like, oh, it's not just the content. It's what you want them to do with the content." This faculty articulated that having a set of course goals not only assists in designing class activities, assignments, and assessment styles, but also provides faculty confidence in selecting specific content areas, especially when the list of topics that students are expected to learn in a college can seem infinitely long. SRC faculty participants highlight that setting course goals serves as both a starting point and a reference point throughout the course design process.

Specifically, *backward design* is mentioned frequently in explaining a general approach for designing their courses. For example, a participant elaborated the design process:

> I think all aspects of backwards design popped in my head. So, what are the goals for this course? What are the activities that are intended to help students work towards those

> goals? What are the assessments that we have and how well do they help us understand the degree to which students are getting to those course goals as well?

In alignment with this idea, other faculty members provided similar processes. One faculty said, "what do you want them to be able to do when they leave your course. You start there. It's called backwards design. You design your course materials to effectively allow the students to meet those learning goals." Another participant noted that, "probably, 2006 or 2007 people started to talk about backward design. And I started to really think about it from the goal and objective part first. And then see what I could plug in to make each class segment." Echoing this approach another faculty said, "the core thing that I have forefront in my mind is the idea of backward design: what I want students to learn, and then having identified those learning objectives, how am I going to assess and evaluate those things." Continuing this thread, the faculty illustrated how faculty design class activities, assessment and faculty-student interaction styles centered on course goals as follows:

> I think of what goals or outcomes are really for students. What kind of things would you like students to be able to do or have experienced at the end of your course. It's sort of a backward design process, then to think about what kinds of experiences would lead to those outcomes, and then setting up like what are the goals or the parameters around the course to begin with.

Unexpected Challenges

In the process of course design, faculty encounter unexpected challenges inevitably. The unexpected challenges primarily stem from student characteristics, which may be difficult to take immediate measures in the upcoming semester, and from instructional matters, in which faculty are willing to continuously refine their course designs for subsequent semesters. Although the

unexpected challenges could potentially leave faculty members feeling dissatisfied or frustrated during a semester, participants indicated that the challenges influence the future instructional plans.

For example, a participant shared a frustrating experience with student behavior in a flipped classroom approach. This method aims for students to engage with lectures and course materials before class and use class time for higher-level of thinking and interactive activities. However, the provided materials, intended as the background information for class discussions, led students to misunderstand that they have less to do in class. This participant expressed frustration, saying, “they will just stay working on the in-class assignment and plugging away. I've even had situations now where students will have conversations with each other at their tables at almost full volume while I'm trying to lecture.” This faculty member is particularly frustrated by the low-level of student engagement. Despite the frustration, the faculty is thinking about potential solutions to create meaningful student engagement in class, such as minimizing repetition between pre-class and lecture slides or varying the group size for in-class activities.

In alignment with this perspective, another faculty commented that however well-designed a course may be, student bandwidth is a critical factor. Even if a faculty creates a checklist to help students track their progress in the course, students ultimately need to find a way to incorporate it into their workflow of the semester. This faculty discussed challenges beyond the faculty’s control, saying, “just because we think it would be so great for personal reflection, or this other option like midterm corrections, with all these like great facets to them, if it's just too much, then it's not actually supportive of students.” Thus, faculty sometimes need to either halt the plan, if possible, or stick to the plan despite the challenges, as the course design cannot be easily overhauled during a semester.

Nevertheless, the challenges appear to have a marginal impact on faculty's course goals. Participants indicated that they are willing to retry their plans or make changes in the upcoming semesters especially when they perceive the challenges as being related to instructional processes, which are in their control. For example, a participant shared a dissatisfying course design experience, saying, "that was frustrating because it never quite worked the way I wanted it to," this faculty also embraced such challenge as a normal teaching experience, describing course design work as, "It's never like—Okay, this course is ready, Pick it up off the shelf, That's it, It is ready to go. It's always changing something, right?" Another faculty also shared a frustrating experience, saying, "It was just a disaster because students really didn't even go on the program, didn't understand where to go. It was a mess." But then this participant also shared an updated plan, "I made some adjustments, and I'm trying next semester. I talked to somebody about where my challenges were. He was just telling me just to reword things or take certain things out. We're gonna try it again next year."

Taken together, faculty beliefs about course design, particularly regarding course goals, remain steadfast regardless of whether the challenges they face are easily addressed or not. Although it can be frustrating for faculty when students do not follow their course design as intended, their perspectives on their course goals do not waver. For example, one faculty shared a tough experience with an assessment plan that eventually became stable after years of refinement. This assessment was initially perceived as radical for both faculty colleagues and students, as it allows each student to decide how their learning will be assessed throughout a semester. Despite colleagues' concern over a heavy workload for keeping track of multiple routes that each student would choose or students' capabilities to set learning paths, the faculty achieved fulfilling results that students took responsibility in their learning. The faculty reflected

that it wass perceived as radical “because we've been trained to think about [education] like, this is the one right way of doing things.” However, this faculty emphasized, “t's so wild. That is so hard, but that's the space that I want to live in, right?” Despite the challenges, faculty beliefs persist.

Unexpected Benefits of External Stimuli

Although course design is typically the domain of individual faculty members, curricular decisions may be influenced by external factors. Faculty participants shared that although faculty may have had a low certainty in the direction that external factors suggest, they have sometimes provided opportunities to expand faculty perspectives on course design. For example, faculty members within the same discipline group spoke of class activities implemented as makeshift measures during the pandemic turned out to be effective, and even transferrable to in-person settings. A faculty said:

> The pandemic was actually an opportunity to try lots of new things. They didn't all work. But some work better than we thought. We started that due to the necessity of online learning when COVID hit. But students enjoyed it. They collaborated well. They were able to do more challenging problems… it was so awesome. We've kept it.

Besides such emergency situations, faculty commented on external motives to experiment with new course designs which eventually brought unexpected benefits.

Disciplinary Society

Conversations in disciplinary societies are mentioned as sources that captured participants’ attention and led them to adopt different perspectives on their disciplinary knowledge and teaching. A faculty shared an experience where a casual exploration of teaching materials published by a disciplinary society served as a turning point, saying, “[A series of

books] were really designed to be able to teach [different courses], hit all the topics and so I wanted to explore that, and it really just sort of opened my eyes to shifting how we often think about labs." This faculty specifically recounted how the conceptualization of lecture and lab has developed due to those materials, saying, "[lab course] certainly was just re-demonstrating—yeah, science hasn't changed. And it moved a bit more towards the inquiry, and that's changed even more so now. That helps sort of lay some of those foundations"

Another faculty also spoke about the influence of conversations within disciplinary education circles, which led science educators to delve into how to emphasize scientific reasoning:

> while I would enjoy [mathematical calculation], I no longer think it's more closely aligned with my actual course goals because of this conversation that's been happening with [science] education researchers about [scientific] core ideas and science practices. It's helped me to think perhaps that's not key to actually what I want to do in my course, and this made me to spend more time on molecular level reasoning … That's been an important point of conversation that's influenced my curricular design and teaching approach in the last few years.

Traditionally, mathematical reasoning has been intricately woven into science education, but those discussions inspired a shift in focus.

Additionally, one more faculty noted that reports from disciplinary societies served as a catalyst for transforming conceptualization of student thinking in the classroom. The entities and report mentioned as representative examples are National Science Foundation, American Association for the Advancement of Science, and Next Generation Science Standards for K-12 education. This faculty illustrated the excitement of discovering the right resources for

understanding what students want to do with their learning in class, saying “all those things, when you think—Wow these people have articulated what I've been trying to say, jumping off of things.”

College Environment

The college environment was also discussed as an opportunity to broaden the teaching scope of faculty participants. One faculty member reflected on a situation where the college wanted to add new content that this faculty was not familiar with. This faculty described how things unfolded in an unexpectedly positive way over time despite the initial doubt. The faculty said:

> I tried it, but it didn't crystallize for me how helpful it would be for students until I had taught it once. And then at the beginning of the next semester I was able to be like, okay, so it's like an example everywhere. And then at the end of the second semester, I was like, oh, it's not just structure property function what it is telling them. … Over the 3 semesters, come to a really good understanding of how the big idea should be implemented from the beginning to the end. Even this semester I learned ‘I'm going to make a slide next time instead of just asking them to talk to each other.

Additionally, participants spoke of their colleagues as a driving force for their teaching development. For example, a faculty shared, “Sometimes one of my colleagues tries something new and I don't buy in right away,” and then added “we encourage each other. You know, the way science is. You gotta have evidence that your thing worked, right? So, I get shown evidence, and I get convinced.” As faculty members have diverse interests in course designs and introduce them to each other, the scope of an individual faculty’s course design ideas is broadened.

In essence, although I distinguished the evolution of internal motives and external stimuli for clarity in the presentation, faculty beliefs and their curricular decisions evolve over time based on their individual experiences within their work environment. Participants stated that course designs evolve over time. A faculty, for example, said, “The joking conversation is—it takes 3 times to know what a course is. The third time is actually what you want it to be because you found the problems, a way to solve them or to try them differently.” First semesters to implement a new course design, let alone in one’s career, are described as “survival mode” or “extremely bumpy.” One participant noted that every first semester of a new design would be satisfying if a faculty group can have a positive answer to this reflection question: “Did we get to the end of the semester without things going completely wonky?” This faculty then added that as the course design is refined over semesters, “I no longer just wanna get through. I wanna to be really good. I want to improve upon these areas that maybe didn't work quite as well the first time.” Alongside faculty’s desire to excel at teaching, all internal and external motives have contributed to the evolution of faculty’s beliefs and curricular decisions.

Institutional Settings that Influence Course Design

In addition to discussing organizational context, passion and motivation for course design, and the evolution of their curricular decisions, SRC faculty participants shared insights on institutional settings that currently support faculty in embodying their vision of course design. Key influences included the harmonious balance between research and teaching responsibilities, and financial support for undergraduate learning assistants and summer work. Participants also identified areas for improvement to better facilitate course design. These included aligning teaching appraisal processes between the college and university levels and advocating for systemic recognition of the intangible aspects of teaching that are difficult to measure.

Harmonious Responsibilities of Research and Teaching

Participants with both research and teaching responsibilities noted that their disciplinary educational research interests and course design work have a mutually reinforcing effect. For example, a faculty researching informal learning and public engagement in science mentioned that this research area inspires their course design, emphasizing that learning occurs effectively when creatively embedded. This faculty said, “I see so much that I can get transferred into formal classroom spaces because it really can do make powerful experiences for people if you can combine that with other formal classroom pedagogy that you can really create powerful learning experiences.” Moreover, another faculty participant expressed satisfaction that the research and teaching responsibilities are well aligned, noting that it is common for faculty to “not get to reflect [on teaching] as much as maybe you would want to as a researcher.” Aligned with the research interests, this faculty has created an upper-division research course that invites students to research on science learning among college students. The faculty shared that, “I'm always thinking about students’ learning and what can be better for students’ learning and what's a good goal for students’ learning. So my teaching and research dovetail very nicely together.”

Additionally, another participant researching learning assessments emphasized that the research and teaching responsibilities “definitely heavily influence each other, particularly my assessment project.” This faculty shared a collaborative research project topic, stating, “we try to understand how students use their cultural resources as a way to engage with the [scientific] ideas. Do they feel more of an ability to do [science] based on these assessments?” and commented that the knowledge, experiences and ideas are naturally transmitted between research and teaching realms.

Financial Support for Undergraduate Learning Assistance (ULA) and Summer Work

SRC faculty participants emphasized that the ULA support is a distinct feature of the college and a valuable resource for course design. One faculty commented, “I think the ULA is disproportionately higher in [SRC] per student compared to the regular [science] department.” Additionally, the roles of undergraduate learning assistants range from experiment preparation to peer support and pretesting experiments with faculty. Specifically related to course design, one faculty member noted, “you can test out things on them. Usually, the mistakes they make are the mistakes students will make in class, so you can identify early the sort of things problem likely to occur.” Another faculty mentioned that ULA support is beneficial for designing assignments in a way that promotes desirable student learning and added:

> The students design their own experiments in lab to test their conceptual understanding. That's hard for them, and they need someone to stand next to them and say, ‘Okay, explain it to me.’ But it doesn't just have to be me. The ULA is around doing that too.

Related to the positive effect for peer support for student learning, another faculty commented, “[ULA] are more accessible for students” and added that a high number of ULAs means that they are available for students “for a variety of times compared to the [regular science] department.”

Additionally, summer funding for course design or revision is mentioned as a helpful resource for a group of faculty members to work together. A participant said, “we could work on it over the summer because you don't have much time to complete new design in the form during the semester.” Another faculty also shared, “for example, last summer we obtained funding from the college to do a major revision of the course that I teach. And that was very helpful in helping us, you know, have some time to actually redesign the course.”

Regarding financial support, one faculty specifically highlighted the importance of resource allocation being at the discretion of faculty. This faculty member articulated that when resource allocation becomes an "enormous political negotiation" requiring argumentation and approval, it impedes experimentation with different methods of training students and collaborations among faculty members. The faculty further discussed:

> I have to know that I'm allowed to decide what's best for my students by my department. I have to know that if I want to change something, that I can reallocate my resources how I'd like. For example, I have these resources of ULA hours. I get to decide how they're used. They could be used for student review sessions or prep lab supplies, or you know there's a list of things that ULAs could help for with. I get to decide how they're allocated.

Difference in Teaching Appraisals Between the College and University

SRC faculty participants shared mixed responses regarding teaching appraisals for annual reviews and promotion due to inconsistency between the college and university. First, along with presented comments about a high-level of autonomy and collaboration in course design, faculty members expressed positive sentiments about teaching appraisals at the college level. For instance, one faculty member stated,

> What I love about working at [SRC] is you try things and if they don't work that's okay. You reflect on them and you think about what parts of this could have done differently… institutional support in being able to make decisions and being able to admit that decision didn't work out and say I want to do something different. That's really important.

Another faculty also elaborated that annual review materials encourage SRC faculty to experiment in course design, stating, "we submit one of the sections on 'what did you try new

this year? Did it work, why? Did it not work, why? If it didn't, how could you speak the technique?' so it could work better in the future."

Furthermore, several faculty members spoke favorably of the college's decision in the past to place a much smaller value on student evaluations in teaching appraisals due to their bias and harshness. A faculty noted that, "especially negative course evaluations are no longer really playing a role in our annual evaluation unless we want to bring them in sometimes to highlight, 'this is something that I am aware of now and should try to correct.'" Another faculty specifically attributed faculty's reduced concern over student evaluations to a dean who was supportive of experimentation in teaching, saying, "[Dean] was always accepting that you can make errors. Like you can try something, and it can fail miserably. That's not a problem as long as you're learning from it. So, the annual review process was supportive in that way," and added, "it was never a fear of my student evaluations went to crap because I tried something new."

However, in contrast to the positive sentiment about the college's method of teaching appraisals, some faculty commented on student evaluations and how the university use of those assessments would disrupt their visions for course design. One faculty explained, "[SRC] have moved away from using that exclusively, but you get rated. It does influence that. It does influence how much you get increase each year, right? Remember, promotions are through the university. The promotions are not done in [SRC]." Another faculty remarked on a university's way of teaching appraisals on promotion dossier:

> A lot of lip service is paid around campus to the idea that student evaluations of faculty and classes can be full of bias, gender bias, racial bias other things and that's of, you know, 'we don't wanna be judging faculty just on that.' However, in all of my evaluations, the entire time I've been here, student evaluation comments are always

> brought up. And you can have students giving you pretty like strong negative Yelp review style comments, especially when they're concerned about their grade… I have had [administrators] talk to me like, 'hey, you have a lot of good student evaluations, but you also some people complaining about this', as opposed to being like 'what do you do in the course'.

This frustration stems from the fact that, although the unique submission requirement of teaching materials and the preparation process for a dossier make the faculty position at SRC distinctive, those efforts are not adequately valued in the broader university's evaluation process, which places "a lot more focus on student opinion in the end."

Furthermore, a comment about a lower student evaluation on labs than lectures was made. While one credit is assigned for labs, the hours required for lab work is more than three hours. A faculty explained that "the number of credits assigned for labs tend to be misaligned with the amount of effort they need to put in. And then that comes into [student evaluation] as well." Especially, faculty members in chemistry and physics noted that, given that the majority of SRC students pursue biology studies, students' low levels of patience and interest appear as unfavorable comments on student evaluations. A physics faculty said, "there are very few physics majors. Physics is like a service course essentially for these other people." Similarly, chemistry faculty stated, "a lot of my students don't want to be doing chemistry. They want to be in medicine, and they are required to do chemistry. They'd much rather do biology, so a lot of the interest is not in there."

Seeking Systemic Recognition for the Unmeasurable

Although time is generally a limited resource, faculty members noted that its availability influences the level of interaction between faculty and students and sets a self-imposed

expectation for one's course design. For example, a faculty noted that course design can always be improved, whether a semester went well or not, and added that "but I have to have the time and the bandwidth to be able to do those improvements." Additionally, another faculty recounted a semester where projects substituted timed tests, resulting in an exciting learning experience for students. This faculty, however, hesitates to repeat the approach due to the time and effort associated with it, stating, "I just went back to exams even though I loved it." More is elaborated:

> Gosh, it'd be cool to have like a project-based course instead of what we have now, but I think that's maybe like an obvious failure. I design this so I would have to put so much time in as an instructor, 4 times the amount of time in, and I'm not gonna be able to do it no matter how induced I am about it. So, then it'll just cause student stress and delay in getting their responses back. So, I think [time] is something I'm like always attentive to now and thinking of course design.

Graduate teaching assistant support was recognized for tasks such as grading, conducting recitation sessions, and holding office hours, with one faculty member stating, "the only reason we're able to move away from automated multiple-choice grading is TA support." There was still a general view that more institutional support for faculty to effectively allocate more time for course design was needed.

Echoing the need for recognizing time needed for course design, one faculty articulated the difficulty of enacting one's educational value of working in truthful relationships within an institutional reward system. As discussed earlier, although SRC faculty members appreciated the college's work environment that encourages teaching experimentations, a participant discussed that, "at the end of the day we live in institutions where the reward comes from the scale of your research…Reappointment and policy say, 'show me your work with the scale, right?'" This

faculty shared that sometimes the lack of evaluation criteria in a reward system shifts one's attention from creating "deep personal meaningful connections with smaller groups of students" to research work which will be systematically recognized. This faculty also reflected that, "there is always that tension of, 'am I doing it at the expense of building that trusting relationship with my students?' but I do like all those hours that you spend in your office just talking to students building them up."

Furthermore, the desire for relational work is not limited to the faculty-student relationship but extends to interactions between colleagues as well. A faculty elaborated:

> Something that I perhaps wish we had more of is just time and space to do some thinking with each other, thinking in community, to do co-designing. Time and space where you always weren't focused on fixing the next problem or fixing problems at all, but rather just engaging in deep thinking, in deep unlearning. That's what I wish we had more.

Although a mentoring program exists, a faculty noted that an institution should support it for the sake of deep relational work rather than solely for institutional reasons.

In aggregate, faculty discussed the importance of institutional settings that enable them to implement and improve envisioned course designs. Many participants, active in disciplinary educational research, mentioned that harmonious teaching and research responsibilities create a combined positive effect on both. Financial support for ULA and course design projects was also noted as a valuable resource that promotes interactive course design among faculty groups and students. However, faculty members emphasized that university-level teaching appraisals must be aligned with college-level support for course design, and they expressed a desire for institutional settings to better respect the fluid and relational nature of course design.

In this chapter, I analyzed faculty participants' recounts from five perspectives to lay out the dynamic of science faculty beliefs about course design and their curricular decisions. I organized these perspectives into five themes: how faculty perceive the organizational context; what faculty want their students to learn in their courses; what makes faculty keep going; how faculty's curricular decisions have evolved; and what institutional settings influence course design. In the analysis, I discovered that across the themes, faculty viewed course design work as intellectually stimulating and emphasized the importance of faculty autonomy in course design. In the next chapter, I will discuss these two concepts in relation to the research question—how science faculty beliefs about course design interplay with their curricular decisions at a Science-focused Residential College (SRC) resides at research university—, as well as implications for institutional practice.

CHAPTER 5: DISCUSSION

Teaching is inherently a self-directed, private endeavor where teachers navigate ill-structured problems in complex class settings (Kagan, 1992; Nespor, 1987). In navigating uncertainties, teacher beliefs guide their decisions, creating a relatively predictable and safe classroom environment (Nespor, 1987). This study on faculty members in a Science-focused Residential College (SRC) at a research university reveals that they find course design to be intellectually stimulating, driving the interplay between faculty beliefs about course design and their curricular decisions. This finding aligns with Kagan's (1992) study, which suggests that teaching is an intellectual activity as teachers navigate uncertainties independently while maintaining control. For faculty members in this study, the uncertainties involved in various components of course design—such as setting course goals, selecting content, sequencing, teaching, assessing learning, and revising—are intellectually stimulating challenges due to their autonomy. Furthermore, this study highlights that for faculty to find course design work intellectually stimulating, higher education institutions must build trust with faculty by providing a high level of autonomy in course design. This trust should be reflected in a coherent administrative process encompassing hiring, support for professional development in teaching, annual reviews, and promotions.

This study on the interplay between faculty beliefs about course design and their curricular decisions illuminates relatively understudied topics, including faculty perspectives and teaching-focused institutions. While considerable political effort has emphasized increasing the number of students majoring in STEM fields, and scholarly attention has focused on STEM education at research universities, comparatively little is known about science faculty perspectives in course design or education in teaching-focused institutions.

For example, political focus on science and engineering education is centered on streamlining STEM from formal education to the national workforce. Of the $3 billion allocated annually to STEM education by US federal agencies, only 15% is used for educational research at all education levels combined, and funds allocated to postsecondary education are primarily distributed as financial aid for students (Congressional Research Service, 2018). That is, undergraduate curriculum studies have a limited presence in both policy and educational research, yet pedagogy in higher education is frequently criticized for the perceived lack of ability among college graduates. In this societal environment, higher education institutions often place the responsibility on faculty members to employ *innovative* teaching methods or *best practices* that may or may not align with their own beliefs about course design.

With the growing recognition of the importance of STEM education reform for cultivating socially responsible scientists and engineers with cultural humility (de la Garza, 2019; Zouda, 2018), STEM undergraduate education has garnered significant political and scholarly attention in recent decades. Consequently, a growing body of research has emerged, emphasizing the need to move away from traditional classrooms and adopt more effective teaching methods, often overlooking the fundamental meaning of teaching as a core responsibility of professors and how the system can encourage them to creatively express their educational beliefs in their courses.

However, the national funding structures and entrenched incentive systems in higher education have impeded substantive changes in both national direction and institutional practices (Weaver et al., 2016). For instance, the practice of buying out teaching loads with research funding encourages faculty to focus on disciplinary research while penalizing efforts in course development and research on teaching and learning. As a result, motivating STEM faculty to

invest time and effort in teaching in ways that adhere to their beliefs that is not systematically measured remains challenging, despite the availability of teaching resources (Weaver et al., 2016).

This issue is particularly evident in large research universities, where government investments and industrial networks are concentrated, dominating the discourse on STEM education reform (Owen-Smith, 2021; Sharma & Hudson, 2021). Meanwhile, other types of institutions, such as teaching-focused colleges like SRC, are often excluded from national and scholarly discussions, despite their primary emphasis on undergraduate education rather than research. This study sought to center faculty perspectives from such institutions in conversations about the potential of undergraduate curricula. As the findings suggest, science faculty at SRC approach course design differently from their counterparts at research-focused institutions (Weaver, 2018), who may lack the necessary resources or institutional encouragement to invest in course design.

In this chapter, I discuss two key points that are grounded in the findings. First, I address the aspects of course design that faculty find intellectually stimulating, as well as the institutional characteristics that facilitate this. Second, I highlight the importance of institutional trust in enabling faculty to engage effectively in course design. These points underpin the five themes identified in the findings, which collectively address the research question of how science faculty beliefs about course design interplay with their curricular decisions in a SRC. The five themes are: perceived organizational context, faculty's goal for student learning, sources of faculty's passion in teaching, evolution of curricular decisions, institutional settings that influence course design.

Course Design as Intellectually Stimulating

Faculty members are entrusted with the responsibility of deciding what disciplinary knowledge students should learn and creating courses that provide meaningful educational experiences (Gonzales et al., 2023). This pivotal role positions faculty as those shaping the foundational archetypes of future intellects. Recognizing this privilege inherent in this responsibility, faculty autonomy in course design becomes closely intertwined with their beliefs about the purpose of college education for students and society. Notably, faculty in this study appear to enjoy course design as part of their responsibility and privilege, driven by the intellectually stimulating aspects of the process.

Firstly, faculty in this study view course design as an intellectually stimulating endeavor that involves carefully considering the knowledge and attitudes students need to develop in college to be well-prepared for the next chapter of their lives. They aim to foster critical thinking skills and a lifelong learning attitude in their students, reflecting a belief held by the faculty. To support this essential student development, faculty members recognize the importance of their professional authority and autonomy in identifying core scientific ideas. They aspire to leverage these ideas to help students build a solid knowledge framework that they can build upon throughout their lives.

Additionally, faculty in this study find it intellectually stimulating to help students unlearn negative learning mindsets and translate their vision of science learning as positive and enjoyable into a semester-long course experience. This approach is particularly relevant given the criticism that STEM education often glorifies a competitive culture in learning, driven by national concerns about maintaining global competitiveness (Zouda, 2018). In this context, institutionalized education frequently reinforces the notion that learning is unpleasant and

requires sacrifice. Faculty in this study recognize that students are influenced by their previous educational experiences, and they strive to counter this perception by creating enjoyable and engaging learning experiences in their courses. These efforts reflect the faculty's beliefs about course design, and their sense of responsibility for students and integrity as educators in a society.

Moreover, the faculty autonomy to act on their beliefs about course design, implement their visions, and experiment with diverse teaching methods drives faculty in this study to continuously seek better or alternative approaches to course design throughout their careers. They also engage with disciplinary societies to understand how their fields and educational goals are evolving. This combination of interest in teaching and learning with intellectual curiosity about instructional issues enhances participants' passion for teaching.

The significance of this study lies in highlighting that the faculty's desire to be creative plays an essential role in introducing variety in the courses. Faculty members endeavor to make the best use of their autonomy for student learning, making course design decisions based on their beliefs about curriculum. For example, participants customize various aspects of their course design and refine their goals to align with the broader educational objectives of the overall college experience of students. Also, faculty members in teaching-focused positions strive to avoid making their jobs mundane and dissatisfying by not teaching college science in the same way for decades, especially given the relatively fixed content set for undergraduate natural science education.

However, there are three institutional characteristics specific to SRC that enable faculty members to find course design an intellectually stimulating activity. First, a collaborative work environment within and across disciplines inspires their course design. Specifically,

interdisciplinary collaboration with faculty in the humanities and social sciences is highly valued. as differing norms in aspects of course design—such as fostering in-class discussions or creating assignments—naturally introduce productive challenges. Having offices in the same building and on the same floor with faculty in humanities and social sciences fosters this collaborative environment, expanding their imagination in strategies to foster discussion, design assignments, or plan assessments. Whether or not conversations with faculty in different fields lead to course development or curricular decisions, faculty find exchanging ideas intellectually stimulating.

Next, tenure-track faculty appreciate that disciplinary educational research is encouraged, in contrast to its lesser value as a measure of research performance for their counterparts in research universities. Their work in disciplinary educational research and course design mutually reinforces and inspires each other, making both endeavors more concrete and refined. The interconnected teaching and research responsibilities fulfill faculty's desire to scholarly investigate diverse aspects of course design, such as student characteristics, learning environments or educational tools.

Lastly, financial support for undergraduate learning assistants enables faculty to naturally integrate peer support into course design, highlighting their belief in the significance of both peer interactions and the student-faculty relationship in the learning process. With the assistance of student peers, faculty can foster a collaborative learning environment where students feel more comfortable seeking help and engaging with course material. This support also allows faculty to experiment with diverse communication methods to enhance student understanding and foster interactive learning experiences.

On the whole, while faculty members in this study initially pursued the teaching-focused roles with an interest in teaching, they continue to seek ways to keep their work intellectually stimulating. Through a continuous process of trial and error, faculty personalize their course designs based on their beliefs about curriculum and student learning, accumulating know-how that can adapt to both expected and unexpected factors. Faculty autonomy in course design is crucial for fostering creativity in courses and fulfillment in their professional roles. Just as freedom of thought allows individuals to explore new possibilities and generate original ideas, faculty members in this study emphasized the need for a supportive work environment and institutional safeguards to adopt and experiment with approaches their courses. This suggests that reducing faculty's freedom to navigate diverse teaching methods critically undermines their professional fulfillment and disrespects their autonomy. Identifying each component of a course and aligning it with both their and institution's educational goals and their beliefs about curricula while satisfying their intellectual curiosity are significant sources of their passion for teaching and sense of fulfillment for their profession.

The Need for Institutional Trust in Faculty

SRC faculty participants highlighted their high level of autonomy in course design, noting that this autonomy was both a key reason for choosing to join the institution and a vital factor enabling them to continuously refine their courses in alignment with their evolving educational beliefs. While they enjoy their autonomy in course design and a teaching-centered work environment of the college, they also express a desire for stronger institutional support to safeguard their curricular decisions based on their beliefs about course design. This need is particularly critical for non-tenured faculty, who rely heavily on institutional backing for career development and are often central to fulfilling the institution's teaching mission. During

promotion reviews, they are especially vulnerable to reputational and financial risks associated with negative student feedback, which may arise when they experiment with new pedagogical strategies inspired by their educational beliefs and intellectual curiosity. Unfortunately, this finding is consistent with existing literature, which shows that student evaluations are often overemphasized in assessing course quality compared to faculty perspectives and multiple forms of evidence (Uttl, et al., 2017). This reflects academia's ongoing failure to recognize that student evaluations are an outdated primary method for evaluating teaching quality despite the prominence of the scholarship of teaching and learning among faculty in this study, including those who actively conduct or consult with educational research (Carpenter et al., 2020; Stroebe, 2020; Uttl, et al., 2017).

Historically, when teaching was considered as a one-sided practice led by the instructor, student evaluation was nearly the only available source of teaching feedback regardless of their credibility or a quality (Hutchings, 2010). However, during the 1990s, a paradigm shift in educational research redefined students from passive recipients of knowledge to active agents in their own learning (Fanghanel, 2013). As understanding students' perspectives and roles in learning gained importance, research on teaching and learning expanded, offering evidence-based validation for teaching practices and pedagogical inquiry (Fanghanel, 2013).

A substantial body of research indicates that student learning and highly rated courses, or students' self-perceptions of teaching effectiveness, are not particularly related, and thus relying on these ratings for faculty hiring and promotion decisions may inadvertently encourage poor teaching practices (Carpenter et al., 2020; Stroebe, 2020; Uttl, et al., 2017). Therefore, it is less reasonable that faculty members are reviewed mainly on student evaluations in promotion dossiers rather than on scholarly reasonings behind their course designs, especially when faculty

in teaching-focused positions are required to regularly document course goals and how activities and assessments are aligned with those for promotion. Faculty having experienced being undervalued for their scholarly efforts in course design at a university-level provide insight into the institutional realities at play.

Another area highlighted in this study is the lack of institutional acknowledgment for relational work in teaching which was an important belief of the participants of this study. Numerous studies demonstrate that social relationships between faculty and students significantly impact students' confidence in tackling complex problems, cognitive development, and academic achievement (Booth & Woollacott, 2017; Detweiler, 2021; Gregory, 2010). Faculty in this study noted that this issue reflects a broader challenge in academia rather than a specific shortcoming of their own institution. Relational work—often time-consuming—such as mentoring students or engaging in discussions with colleagues that do not immediately result in curricular changes is rarely recognized in tenure and promotion reviews. These findings underscore the need for institutional recognition of the invaluable role faculty play in fostering student learning.

Taken together, this study highlights that faculty in teaching-focused positions value the opportunity to exercise their originality through course design. While their efforts are culturally recognized and appreciated at the college level, institutional practices—particularly those related to promotion and salary negotiations—often fail to acknowledge the significant time, energy, and intellectual engagement required for course design. When scholarly contributions to course design are undervalued and student evaluations dominate teaching assessments, a disconnect arises between evaluation practices and the creation of a supportive teaching environment, potentially diminishing faculty morale.

To effectively foster diverse, experimental course designs, institutions should build trust with faculty by implementing cohesive practices that encourage experimental teaching approaches. These practices should span hiring, professional development, departmental culture, annual reviews, and promotions (Demir & Criswell, 2023; Dennin et al., 2017). Rather than attempting to quantify qualities that are inherently immeasurable, institutions could better respect and support faculty beliefs about course design and their curricular decisions. For instance, promotion dossier reviews could involve reviewers well-versed in the scholarship of teaching and learning, ensuring that teaching excellence is both recognized and rewarded.

Faculty members bring varied interests, expertise, and educational beliefs to their teaching, such as presenting subject matter effectively, fostering positive learning environments, and guiding students in reflecting on their learning. This study highlighted faculty's passion for course design, revealing a shared preference among participants for not reusing the same course design repeatedly. Instead, they sought collaboration with colleagues across disciplinary boundaries to refine and innovate their courses. Supporting individual instructors' unique approaches and priorities is, therefore, key for institutions to have diverse course designs.

Implications

STEM undergraduate education reform is often treated as a critical societal issue, with colleges and universities prioritizing it in their rhetoric. However, it is an open secret that tenured faculty dedicating significant time to teaching is unrealistic and impractical under the prevailing higher education reward system, which favors research productivity (Dennin et al., 2017; Weaver et al., 2016). Although institutions have established centers for teaching and learning to promote evidence-based teaching through a top-down approach, the faculty beliefs about course

design—held by those who serve as the primary agents of institutional curriculum reform—are often overlooked.

This study highlights course design as an intellectually stimulating activity for faculty and a reflection of their creative endeavor, reaffirming that faculty members are the primary agents in course design. By focusing on the beliefs about course design of SRC science faculty, the findings shed light on key insights into faculty perspectives on course design and the institutional supports needed for faculty to design their courses effectively beyond this given context. In the following sections, I discuss implications for leadership in higher education institutions, as well as theoretical implications for studies on educators' beliefs.

Building on the insights from this study, it is crucial for institutions to brand teaching responsibility as an intellectually stimulating and meaningful activity for their faculty members. Although measures and steps must be tailored to each institutional setting, the fundamental idea should be that faculty autonomy in course design is non-negotiable for fostering creative and diverse course designs. Maintaining the popular academic culture that frames teaching responsibility as procedural content delivery by a replaceable workforce with doctoral degrees will not yield original course designs from faculty.

Based on participants in this study, faculty members who join teaching-focused positions likely find teaching rewarding and have had a clear sense of teaching interests since their doctoral years, even without systematic support for teaching development. Such faculty are likely scholarly and personally invested in understanding the reasons behind student learning success or failure and discovering effective ways to engage students in the learning process. Therefore, the autonomy and flexibility that allow faculty to integrate dynamic elements of course design and resolve complex issues according to their educational beliefs and priorities are

essential for their sense of self as educators. If an institution does not meet these desires, these faculty members may leave for institutions with better support for their educational beliefs and professional development opportunities. Given the changing academic labor market nationally at all postsecondary universities, institutions need to retain teaching-focused faculty members who are dedicated to course design if they want effective curricula reform and greater student success in the classroom.

Acknowledging Time as a Critical Resource for Resolving Educational Curiosity

This study made clear that colleges and universities need to respect faculty autonomy to pursue creative endeavors and provide community support that aligns with their educational beliefs in order for teaching-focused faculty to engage in informed curricular decisions. Faculty in this study expressed the need for a community to effectively address their curiosity through both formal and informal interactions. They value opportunities to meet thinking partners, reflect on teaching assumptions, learn different course design approaches, and unlearn outdated methods. Sustainable communities help members reconceptualize teaching, share diverse research questions and designs, and inspire each other.

Although it is not uncommon for institutions to have learning communities and mentoring programs for exchanging ideas and reflecting on teaching, time constraints often compel faculty to prioritize research over deeper reflection on teaching. These formal and informal communities have not fully served as networks that promote and support course design as intellectually stimulating work, nor are they viewed as inclusive spaces for all faculty interested in improving their course designs. Instead, these communities are often seen as exclusive groups disconnected from disciplinary research (Weaver et al., 2016). Institutions

should respect faculty's professional aspirations and trust that they will use their time wisely for meaningful professional and relational conversations aimed at enhancing their course designs.

Aligning Evaluation with Course Design Autonomy

Consistent with institutional support for faculty autonomy in course design, faculty evaluation should align with the expected time and scholarly effort dedicated to course design. Beyond having criteria to submit teaching documents for teaching-focused faculty members, faculty need to know that the rationales for their new attempts in course design or teaching materials are thoroughly reviewed in the promotion review or contract renewal process. In other words, when faculty are uncertain about the dossier reviewers' familiarity with educational and pedagogical materials, they may doubt whether their teaching effectiveness will be fairly assessed. Such doubts can discourage faculty from dedicating the time and scholarly effort needed for creative course design, hindering their ability to align with their beliefs about the student learning process and desired learning outcomes. To address this, the review process needs to provide constructive feedback and intellectual engagement regarding course design and teaching responsibilities. This approach can help faculty find greater meaning in their work and strengthen their commitment to the institution's educational mission.

Additionally, based on participants experience in this study, support from the dean or department chair in a college is critical. These academic leaders are more accessible in the process of curricular decisions and can actively advocate for efforts dedicated to course design on behalf of their faculty members in the review process. Faculty members are entitled to and accustomed to working according to their intellectual interests and beliefs about course design with autonomy. To attract faculty members dedicated to creative curriculum development,

institutions need leadership that perceives course design as intellectually stimulating, important to student learning, and time well spent.

Theoretical Contribution to Educators' Belief Studies

Research on educators' beliefs, primarily those of K-12 teachers, has focused on understanding why teachers adopt certain teaching approaches for student success (e.g., Pajares, 1992; Skott, 2010). This body of literature is based on the premise that teacher beliefs significantly influence overall teaching methods. However, it faces challenges from the underexplored notion that human beliefs are unstable and capricious (Österholm, 2010a; Pajares, 1992). Consequently, scholarly communities have prioritized what to teach and how to instill better educational values over examining the impact of teacher beliefs.

Despite these challenges, studies on teacher beliefs have emphasize the importance of respecting the diverse educational perspectives and values of individual educators, as well as the role that teacher beliefs play in defining and performing curricular decisions. Scholars have primarily worked to establish foundational assumptions, creating a stronger academic basis (e.g., Kagan, 1992; Nespor, 1987; Österholm, 2010a; Pajares, 1992; Skott, 2010). This study contributes by reinforcing three main assumptions of teacher beliefs and demonstrated their applicability to faculty in higher education.

Existing literature posits that belief is a stable cognitive strategy that helps individuals judiciously perceive their surroundings and take meaningful actions. In this study, faculty beliefs about course design, including their goals for themselves and for student learning, were found to remain solid and consistent throughout their careers. These beliefs continued to guide their professional practices, even during challenging institutional incidents or unfavorable student reactions. Next, this study aligns with the assumption that beliefs exist in clusters, as faculty's

explanations of course design are grounded in their professional commitment to teaching responsibilities rather than other areas of life. Lastly, the results of the analysis highlight that a causal relationship cannot be established between faculty beliefs and their curricular decisions. Instead, faculty beliefs and curricular decisions evolve individually and mutually, shaped through social interactions with students and influenced by institutional settings and support. This finding contributes to the teacher beliefs literature by highlighting the complex interplay between faculty beliefs and their curricular decisions.

Future Research

Future research can pay more attention to faculty in teaching-focused institutions for their insights into course design. As demonstrated in this study, faculty in such positions view course design as an intellectually stimulating process, reflecting their commitment to student learning and critical thinking. This work demands significant time, creativity, vigilance, and resilience, underscoring the depth of effort required to align professional values with teaching practices. Building on these findings, future research on higher education administration, faculty learning communities, and national reform guidelines for undergraduate education could explore how to create academic environments where faculty beliefs can freely interplay with curricular decisions, shifting away from "best practices" models.

In addition, it is crucial to note that the level of autonomy observed at SRC is both notable and exceptional, particularly in an era where faculty autonomy over college curricula is increasingly undermined by administrative oversight, accountability pressures, and political demands. These findings should be situated within the broader context of higher education. SRC provides a unique setting to explore how faculty exercise autonomy in course design, underscoring the need to advocate for stronger institutional support to safeguard faculty

autonomy as a means of ensuring quality undergraduate education. Conducting research on faculty beliefs in other teaching-focused institutions would further deepen our understanding of how faculty interests in teaching develop and are sustained throughout their careers, what influences their curricular decisions, and which institutional settings faculty find supportive for creating their courses.

Conclusion

In conclusion, this study reveals how faculty beliefs about course design interplay with their curricular decisions, fostering intellectual stimulation in their teaching-focused roles within the academy. These beliefs require significant effort, including self-reflection, collaboration with colleagues, literature review, and relational work with students. For these beliefs to be effectively reflected in undergraduate curricula, institutional support needs to recognize and value these efforts, address faculty's educational curiosity, and provide meaningful student learning experiences, while also ensuring that evaluation processes align with course design autonomy. While these steps may not be common across all colleges and universities, the participants in this study from SRC demonstrated that it is possible to engage in discipline-based research that informs teaching while making curricular decisions grounded in their beliefs about course design. Their enthusiasm for their faculty careers and dedication to teaching and learning underscores the importance of examining faculty beliefs about curriculum and how these beliefs interplay with their curricular decisions in undergraduate science courses.

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APPENDIX A: INTERVIEW PROTOCOL

1. How long is your teaching experience?
2. What made you get into a teaching-focused college?
3. To what extent do you design your courses at your current institution?
4. What comes to your mind when you think of course design?
5. How has your understanding of course design and teaching has developed through your experiences?
6. How does your organizational culture influence the way you design and teach your course?
7. How does your discipline influence the way you design and teach your course?
8. What supports are critical for you to make decisions on course design or navigate uncertainty about course planning or teaching?
9. Tell me about an experience in course design that fulfilled your beliefs about course planning, teaching, or revising.
10. Tell me about an experience that frustrated or dissatisfied your beliefs about course planning, teaching, or revising.
11. What makes you invest your time and energy in course design?
12. Is there anything else about the topic that I haven't asked you that you would like to discuss, or anything that would be important for looking at faculty perspectives in course design?

APPENDIX B: RESEARCH PARTICIPANT INFORMATION AND CONSENT FORM

The purpose of this form is to provide you with an explanation of the research and obtain your consent for participation in this research study. I want to ensure that you are fully informed about the potential risks and benefits associated with your involvement in the study. It is important to note that your participation is entirely voluntary. Please take the time to review this information carefully before making your decision, and feel free to contact the researcher with any questions or concerns you may have.

1. EXPLANATION OF THE RESEARCH and WHAT YOU WILL DO:

- You are being asked to participate in a research study intended to understand how faculty beliefs about course design interact with their curricular decisions. Although the value of higher education lies in the diverse academic viewpoints held by faculty members, literature and policy discussions regarding undergraduate curriculum have not typically taken faculty perspectives, but the student learning outcomes or economic value associated with degrees. Science fields are representative fields where garner national and public attention due to their widely perceived potential to drive both national and individual economic growth. From this study, I hope to learn faculty perspectives of course design.
- If you agree to participate in this study, you will be asked to participate in one interview that will last between 45 to 60 minutes. The interview will take on a specified date and time that works most conveniently to your schedule, either in-person or virtual of participants' choice. The interview will be recorded and transcribed.

2. POTENTIAL BENEFITS AND RISKS:

- You will compensate from your participation in this study. In addition, your participation in this study may contribute to the understanding of faculty perspectives of course design and hopefully add weight to the faculty voices in curriculum development.
- Your participation in this study is not expected to cause you any foreseeable physical, legal, social, economic risks. Your answers are not expected to harm you in any way.

3. PRIVACY AND CONFIDENTIALITY:

- The recordings and transcriptions will not be stored or analyzed on a public computer. Data will be stored and analyzed on a personal computer and password protected. Backups will be stored in a personal Dropbox and iCloud which will also be password protected. You will be asked to assign the pseudonym to protect your anonymity and to review how your voices are presented in the study. Only the pseudonyms will be used for data analyses. Data generated through the study will be treated as confidential. Only the researcher and principal investigator will have access to the data.

4. COSTS AND COMPENSATION FOR BEING IN THE STUDY:

- Participating in this study incurs no costs beyond your time and energy.
- Upon completing participation, participants will receive a $15 gift card for participating in this study.

5. YOUR RIGHTS TO PARTICIPATE, SAY NO, OR WITHDRAW:

- Participation in this research is voluntary. You may change your mind at any time and withdraw.
- You have the right to say no. You may choose not to answer specific questions or to stop participating at any time.
- At any time of the interview, you may ask the interviewer to stop the recording to keep particular details off the record.

6. CONTACT INFORMATION FOR QUESTION AND CONCERNS:

- This study has been approved by the Michigan State Institutional Review Board. If you have concerns or questions about this study, such as scientific issues, how to do any part of it, or to report an injury, please contact the researcher, Yukyung Bae (baeyukyu@msu.edu).
- If you have questions or concerns about your role and rights as a research participant, would like to obtain information or offer input, or would like to register a complaint about this study, you may contact, anonymously if you wish, the Michigan State University's Human Research Protection Program at 517-355-2180, Fax 517-432-4503, or e-mail irb@msu.edu or regular mail at 4000 Collins Rd, Suite 136, Lansing, MI 48910. The IRB reference study is 00010185.

APPENDIX C: RECRUITMENT E-MAIL

Dear _____,

My name is Yukyung Bae, and I am currently a PhD candidate in the Higher, Adult, and Lifelong Education program at Michigan State University. I am seeking faculty participants with any appointment type for a research study regarding faculty beliefs of course design at a science-focused residential college. You are receiving this message because you are a science faculty member at a science-focused residential college.

I would like to invite you to participate in my study that examines how faculty beliefs about course design interact with their curricular decisions (course planning, teaching, and revising). This study is to explore faculty perspectives on curriculum development, diverging from the dominant literature on curriculum that focus on student learning outcomes. If you are interested in talking about your experiences in course design, I hope that you consider participating in this project.

The extent of your participation would include one interview and perhaps a follow-up contact for elaboration on a previous response or clarification of my understanding of your responses. The interview will take between 45 to 60 minutes either in-person or virtual of your choice. The interview will be recorded with your consent.

If you are interested in participating in this study, please click here to access more information about the project and to schedule a meeting for the interview. If you have questions about the study or your participation, I am happy to talk further about this project. Please feel free to contact me at [email]. Thank you so much for your consideration.

Sincerely,
Yukyung Bae