ABSTRACT

KUNZE, ANDREA JORDAN. Students' Discipline-Specific Perceptions of Learning Practices: A Mixed-Methods Approach. (Under the direction of Dr. Teomara A. Rutherford).

Students' learning experiences help shape their perceptions of what effective learning practices are, and these perceptions affect the effort and approaches students engage in when in a learning environment. The type of learning environment students engage with may vary across disciplines, therefore students' perceptions may be domain-specific. Data for this study were students' discipline-specific perceptions of effective course structures and activities for chemistry and humanities and their general epistemic beliefs. Individual responses from students (N = 329) across three courses were grouped as either constructivist or instructivist learning approaches and then reported as a ratio of the two views. A step-wise regression was used to determine domain-specific differences in the students' responses, and the association between their epistemic beliefs and perceptions of learning. Results revealed disciplinary differences in students' perceptions of learning, as well as potential influential factors due to differences in each course's models of learning. Understanding students' perceptions of learning have implications for students' future enrollment in, effort invested in, and approaches to learning within different courses.

Students' Discipline-Specific Perceptions of Learning Practices: A Mixed-Methods Approach.

by
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BIOGRAPHY

Andrea Kunze earned her B.I.S. in Human Learning and Development from Georgia State University in 2016. She is currently a student in the department of Curriculum and Instruction pursuing her Master of Science in Educational Psychology.

Throughout her undergraduate studies, Andrea worked as a research assistant for multiple departments. During her time in the Educational Psychology department, she worked on projects about how students learn science within collaborative and informal learning settings and presented her work at local conferences. Additionally, her time in the Neuropsychology department furthered her interest in individual differences in cognition using fMRI. These early research experiences sparked her interest to continue researching students' learning and cognition by pursuing a master's degree in Educational Psychology.

Since beginning her graduate studies, Andrea has continued an interdisciplinary approach to her research by actively participating in research within the Educational Psychology and Psychology departments and working on projects that involve collaborators in Computer Science and Chemistry. Her work thus far has been accepted to both national-level conferences such as the American Psychological Association (2016, 2017), National Association for Research in Science Teaching (2018), and American Educational Research Association (2018), as well as international-level conferences such as International Congress of Applied Psychology (2018). In addition, she is also a first author on a paper currently under review.

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CHAPTER 1: INTRODUCTION

University students do not come to college with blank slates, but rather come with a combination of experiences with a variety of instructional practices that shape their perceptions of successful learning. Many of them may identify with a particular preference or belief about how they best process information (Willingham & Dobolyi, 2015). Although their views of learning do not reflect their actual capabilities or dictate which approaches are best for learning performance (Alghasham, 2012; Cuevas, 2015), these beliefs about learning are important because students' perceptions of learning environments are related to their approaches to learning and how they engage with their environment (Bandura, 1989; Ramsden, 1992). The approaches to learning students choose to engage in are important, because deep learning approaches, such as thinking critically about material and making connections to prior knowledge, are associated with better learning outcomes than more surface approaches, such as memorization (Felder & Brent, 2005). Both surface and deep learning approaches are often associated with different types learning environments (Entwistle & Tait, 1990). Deeper learning approaches are most consistent with constructivist learning environments (Freeman et al., 2014; Von Glasersfeld, 1996); however, in higher education, instructivist learning approaches, which promote surface learning approaches, continue to dominate courses (Eagen et al., 2014). Within this study, a mixed-method approach is taken to explore students' perceptions of effective learning activities and course structures across three courses in two domains. These perceptions are matched with constructivist and instructivist learning approaches and are related to a potential undergirding factor, students' beliefs about the nature of knowledge.

1.1.Theoretical Framework

I frame my study within Bandura's (1989) Social Cognitive Theory (SCT), where students' personal factors, such as their beliefs and perceptions, have a reciprocal and dynamic relationship with how they engage with learning environments and approach learning (Biggs, 1993, 1999; Myer, 1998). In addition, a self-regulated learning framework is used to explain the dynamic relationship between students perceptions of effective strategies and practices, and the learning environment. Because students play an active role in their learning, their perceptions and experiences are also brought to the classroom, where they interact with their teacher and peers' beliefs during the learning process, indirectly shaping the learning environment. In line with SCT, Experiential Learning Theory (ELT) states, "learning is best facilitated by a process that draws out the students' beliefs and ideas" (Kolb & Kolb, 2005, p.194). This idea of drawing on students' beliefs about learning is consistent with constructivist views of learning, where knowledge is a socially constructed process that accounts for students' prior knowledge and learning experiences (Vygotsky, 1978). Consistently, these theories of learning suggest that students' epistemologies, beliefs, learning environments, and approaches to learning are a complex and bi-directional system; however, studies showing contradicting relationships between perceptions, environment, and approaches, suggest they are still not fully understood (Baeten, Kyndt, Struyven, & Dochy, 2010; McParland, Noble, & Livingston, 2004; Tetik, Gurpinar, & Bat, 2009).

1.2. Personal Factors—Student beliefs of Learning & Knowledge

1.2.1. Perceptions of Learning. Within Bandura's (1989) Social Cognitive Theory, students' beliefs about learning and knowledge are considered personal factors that contribute to a learning context. A common misconception about individuals are that they have a set learning style, or strategy, that is most effective for processing information. Additionally, there are underlying assumptions about learning styles; they are generalizable and consistent across different subjects, and are a reflection of an individual's cognitive abilities; however, scientific literature notes the lack of support for those assumptions (Massa & Mayer, 2006; Pashler, McDaniel, Rohrer, Bjork, 2008). To move further away from learning styles as part of a student's personal learning factors, it is encouraged to view students' perceptions of learning as *learning preferences* (Dunn, Beaudry, & Klavas, 1989; Willingham, Huges, & Dobolyi, 2015). Learning preferences can be broadly defined as one's predisposition for perceiving and processing information in a particular way or combination of ways; they are the learner's perspective, or beliefs, of what strategies are most effective for their learning (Sarasin, 1998).

In Higher Education courses where students have more autonomy and control over their approaches to learning, accounting for their perceptions of effective learning strategies can provide insight into who the learner is, how they approach learning, and the learning environment itself. A recent study has shown that course structures that account for individual learning preferences have been shown to increase student-perceived autonomy, which contributes to deeper conceptual learning (Jang, Reeve, & Halusic, 2016). Increasing student autonomy is crucial in developing deeper conceptual understandings in the more adult audience found in Higher Education courses; however, to achieve an autonomy-supportive environment, students' perspectives must be taken into account (Ryan & Deci, 2000). This is not to say that courses should be completely structured to fit students' desires as often touted by advocates of learning styles. Instructors and educators should still know best which methods are most effective for communicating a concept. Instead, learner preferences can be one piece of information that aid instructors in understanding the individual factors that students bring to the classroom and construct the learning environment with.

This relationship between student beliefs and actions is also expressed in motivation literature, and has found to be associated with approaches to challenges, and actions taken to achieve their learning goals (Dweck, 1986; Dweck & Leggett, 1988); however, this relationship between beliefs and action is not unidirectional. Students' perceptions of their learning environment, including beliefs about assessment, are also associated with their approaches to learning and perceptions of the courses goal structure (Lizzio, Wilson, & Simons, 2002; Parpala, Lindblom-Ylänne, Komulainen, Litmanen, & Hirsto, 2010). In particular, students adapt their own learning strategies to align with their beliefs about effective strategies to meet assessment requirements (Biggs, 2003; Birenbaum, 2007; Hativa & Birenbaum, 2000). This means that students will adopt differing learning strategies to fit their beliefs and understandings of a courses structure and goal orientation, in order to be successful.

Outside of learning beliefs and motivation literature, there is support in the field of self-regulated learning (SRL) for the idea that such student beliefs can influence their performance and success. Boekaerts (1996) explained SRL as a model that includes an interaction between cognitive and motivational regulatory behaviors. This means students monitor and regulate their actions (or behaviors) and motivation (perceptions and beliefs) during learning, similar to that described in the SCT model. Other SRL models directly reflect the same triadic factors (Zimmerman, 1989). From a recent review of the six main SRL models (see Boekaerts & Corno, 2005; Efklides, 2011; Hadwin, Järvelä, & Miller, 2011; Pintrich, 2000; Winne & Hadwin, 1998; Zimmerman, 2000), there is consensus across them that SRL is a cyclical process between student perceptions and goals, learning strategies, and self-reflection and adaptation to the learning environment (Panandero, 2017).

1.2.2. Epistemic Beliefs. In addition to the importance of learning perceptions and beliefs, domain-general beliefs about the nature of knowledge and learning, or epistemic beliefs, are additional personal factors that contribute to academic achievement (Hofer, 2000; Muis & Franco, 2009; Phan, 2008). Students' epistemic beliefs are a reflection of a collection of independent beliefs about the nature of knowledge, and the nature of learning (Olafson, Schraw, & Vander Veldt, 2010). These beliefs are considered on a spectrum of naïve to sophisticated perceptions of the process of learning (Quick learning), ability to learn (Innate ability), source (Omniscient Authority), organization (Simple Knowledge), and certainty of knowledge (Certain Knowledge) (Schommer, 1990) (See Figure 1). The concept of knowing and learning as a continuum from simple to complex is not new (see Kuhn, 1991; Perry, 1970); however, more contemporary models view epistemology as multi-dimensional rather than unidimensional (e.g., Schommer, 1990).

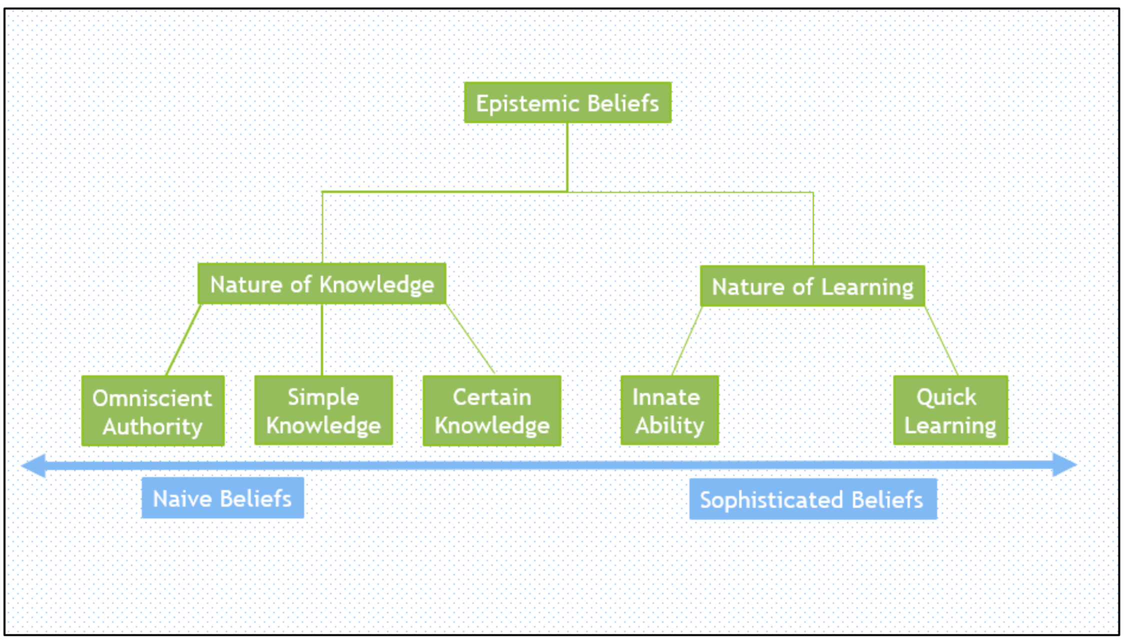

Figure 1. A model for understanding epistemic beliefs

Accounting for epistemological beliefs provide insight into an individual's understanding of the nature of knowledge, including how to acquire and construct new knowledge. Studies that have conducted cluster-analyses on epistemic beliefs have revealed a higher achieving and motivated profile for students with more sophisticated beliefs, meaning students understanding of learning and knowledge contribute to their drive and performance in the classroom (Buehl & Alexander, 2005; Chen, 2012). Other studies have found that sophisticated beliefs are associated with greater use of self-regulatory strategies and deeper learning approaches (Greene, Muis, & Pieschl, 2010; Hofer & Pintrich, 1997; Schreiber & Shinn, 2003; Vermetten, Vermunt, & Lodewijks, 1999). For example, Schommer (1990) found epistemic beliefs were related to how students connected new information to prior knowledge and how they monitored their comprehension of material. This means that the methods students use for creating new knowledge are related to their epistemic cognition.

1.3. Behavior & Approaches—Epistemic Practices

Schommer's earlier work suggests that students' epistemologies can be seen in the actions they take to learn. In line with this, Phan (2008) found that students' learning approaches mediate students' epistemic beliefs association to their learning outcomes, further supporting the bi-directional relationship in SCT between students' personal beliefs and learning approaches. Learning approaches can be explained as surface-level or deep. Surface learning strategies are based on rote memorization, and actions often seen with this type of learning are flash cards, mnemonics, and reading textbooks (Eagen et al., 2014). These more shallow strategies have shown to be associated with more naïve epistemic beliefs (Ravindran, Greene, DeBacker, 2005), further supporting the concept that students' beliefs plays a role in their approaches to learning. In contrast, deep learning strategies, such as connecting prior knowledge and critical thinking, are associated with more sophisticated epistemic beliefs (Schreiber & Shinn, 2003). Other deep learning strategies, such as those seen in self-regulated learners, are also seen in students with more sophisticated beliefs (Greene, Muis, Pieschl, 2010). This means that the actions students engage in when trying to learn new material are underpinning their beliefs about the nature of knowledge and learning, supporting the concept of epistemic practices.

1.3.1. Communities of Practice. When considering epistemic practices within a learning environment or students, we need to be consider potential disciplinary differences in how knowledge is communicated to students in the classroom, or what the practice of their learning environment is. According to Biglan (1973), academic disciplines can be categorized as Pure (e.g., biology) or Applied (e.g., engineering) domains, nested as either a life (e.g., psychology) or non-life subjects (e.g., chemistry). Within these different domains, often there is a collective understanding or perspective of how to process and seek information, problem solve, and communicate the knowledge (Eitenne Wegner, 2004). There is evidence that students tend to study in disciplines that align with their views of learning and learner characteristics (Entwistle & Tait, 1990; Malaney, 1986). This suggests different disciplines may require different skills and attract different students, and provides the impetus to further explore how these differences may manifest in student preferences for different instruction.

Students' perceptions of courses differ by disciplinary field, particularly between soft and hard fields of study (Nelson Laird, Shoup, Kuh, & Schwarz, 2008; Ramsden & Entwsitle, 1981). Chemistry is considered a hard, Pure non-life science academic subject (Biglan, 1973). To be chemically literate, students need an understanding of key chemical ideas, what chemists do, essential skills, and chemistry environments (Bennett & Holman, 2002). Humanities and Social Sciences are academic disciplines categorized as a soft, Pure life science (Biglan, 1973). Compared to the hard sciences, such as chemistry and physics, the experts and professionals within the social sciences do not drastically differ in their procedures for seeking new information or knowledge

(Ellis, Cox, & Hall, 1993); however, studies support the concept that approaches to problem solving and critical thinking are domain-specific (e.g., Chi, Feltovich, & Glaser, 1981; Glaser & Chi, 1988). This suggests that across fields there are some similarities in CoP, but variation can still be found.

1.4. Learning Environment—Epistemic Orientation & Climate

In addition to the relationship between epistemic beliefs and learning practices, epistemic beliefs are also associated, or even embedded in, learning environments. There is growing evidence that epistemologies are represented in a learning environment through course materials and structure, and has an influence on students' own beliefs (Bendixen & Rule, 2004; Feucht, 2008; Haerle & Bendixen, 2008; Muis & Duffy, 2013). For example, Muis and Duffy (2013) showed that students' epistemological beliefs shifted when within a constructivist learning environment, and this shift, or epistemic change, was associated with an increase in critical thinking and academic performance. Bendixen and Rule (2004) also found students' epistemic beliefs to be influenced by the beliefs and actions of their teachers and peers. Both studies support the concept of epistemic orientations, or individual's epistemological alignments based on learning practices and structures at hand, as adaptive processes that are contextually-driven.

A classroom's epistemic orientation is present in the structure and types of assessment and activities it provides the learners. Historically, higher education learning environments have been oriented towards a teacher-centered model of learning (Laurillard, 2002). This instructivist-based approach to learning assumes an authoritative and passive reception of information through memorization and recall, predominately given in the form of lecture, and leaves little room for discussion and real-world application (Archee, 2012; Porcaro, 2011). These kinds of environments promote the teacher as the knowledgeable authoritative figure, which suggest a more naïve epistemological orientation. Contrary to this, the theory of constructivism emerged as a learning theory supporting more student-centered approaches based upon the notion that knowledge is socially constructed and builds on prior knowledge and experiences (Vygotsky, 1978). The orientation of a course is a reflection of the teachers understanding of the material, and their epistemological beliefs. A study by Chan & Elliot (2002) revealed that teachers' epistemic beliefs affect their understanding of course material, and the strategies and practices they provide to their students. Furthermore, other studies found teaching and learning structures are related to students' beliefs about learning and approaches to learning (Gow and Kember, 1993; Kember & Gow, 1994; Kember, Leung, & McNaught, 2008). A study by Entwistle and Tait (1990) found students with preferences for deep learning approaches preferred active learning structures, in contrast with students with preferences for surface approaches who preferred rote learning structures. This does not mean students who prefer surface learning benefit best from that approach, but that their perceptions may influence student motivation for and perception of the course, which in turn has implications for effort and engagement (Cano, 2007; Floyd, Harrington, & Santiago, 2009). This indicates that in a learning environment the orientation of the learning structure, and the teacher and students' epistemic beliefs, contribute to the epistemic climate of an environment. For this study, I particularly look at the orientation of instructivist and constructivist courses.

1.4.1. Instructivism. Instructivism is also known as traditional learning, and historically has dominated K-16 classrooms. Most undergraduate courses consist of instructivist methods of learning, such as lecture, tutorials, and examinations (Laurillard, 2002). These traditional style classrooms are teacher-centered and typically memorization-driven (Porcaro, 2011). The role of teachers in instructivist classrooms is to facilitate and transfer knowledge to students as directly and effectively as possible (Bednar, Cunningham, Duffy, & Perry, 1991), which assumes a view of knowledge as controlled and certain (Fetherston, 2001). Common activities found in these types of classrooms are reliant on textbooks, repetition, individual work, and summative assessments. A course reflecting this type of structure limits student autonomy and interaction by relegating the student to a passive role in their learning (Jonassen, 1991). There have been multiple national calls to increase student-centered strategies in the classroom (e.g., NRC, 1999, 2003; NSF, 1996), because these more interactive learning approaches have shown to positively change students' perceptions and success in fields with high attrition, such as STEM (Freeman et al., 2014; Singer, Nielson, & Schweingruber, 2012). Despite this, more than 60% of chemistry courses are still presenting information in a instructivist style, and the majority of all STEM courses consist of more than 100 students making a less instructivist approach complicated (Stains et al., 2018).

1.4.2. Constructivism. Contrary to Instructivism, constructivist theories of learning reflect the idea that people construct their own meaning of knowledge from their interactions with the world, including collaborative interactions (Hartle, Baviskar, & Smith, 2012; Piaget, 1976; Vygotsky, 1978). Contrary to instructivist classes, students in a constructivist class play an active role in the construction of their learning (Garrett, 2008). Common activities that reflect this view of learning include hands-on authentic practice, creation, argumentation, and perspective taking (Choi & Lee, 2009; Papert, 1993). More authentic learning environments, such as those found in constructivist classrooms, focus on depth of knowledge over memorization and regurgitation, and emphasize construction of knowledge based on prior experiences (Cox-Petersen & Olson, 2000). A meta-analysis conducted by Freeman et al. (2014) revealed undergraduate STEM courses that implement active learning approaches out perform traditional courses, and are more likely to retain students (Freeman et al., 2014). In addition to supporting academic performance, constructivist pedagogies also promote investigation and interpretation of information, because of the collaborative and student-driven nature of those environments (Ertmer & Newby, 1993; Tom, 2015). Constructivist environments, because of the interactive nature, reflects a more sophisticated epistemic orientation, which could be beneficial for students across all disciplines.

1.5. Purpose of the Study

There have been multiple studies that have shown students' beliefs about learning, and choice in strategy affect their academic performance (Alghasham, 2012). We also know that these beliefs and perceptions about learning affect how students interact in the classroom and differ across domains. What is still not fully understood is how these beliefs play a role in the "big picture," or epistemic climate, as they have a reciprocal relationship to the environment and actions. Considering epistemologies are present in students' learning beliefs, practices, and environments (Greene et al., 2010; Kember et al., 2008), I used a SCT and self-regulated learning framework to explain how some of these factors interplay with each other. I compared how students perceive effective learning structures and strategies across two disciplines that heavily differ in nature, and how these perceptions differ by their epistemic beliefs. Namely, I ask 1) What do students perceive as effective chemistry and humanities course structures and practices? and 2) Do these perceptions differ across course subject? Lastly, I ask 3) How do these perceptions associate with student views on the nature of knowledge? By answering these questions, I strive to shed some light on the role of epistemic cognition in a learning climate.

CHAPTER 2: METHODOLOGY

2.1. Research Design

I used a mixed-methods approach with quantitative methods embedded within a qualitatively-driven research design to address my research questions. Data collection was limited to a single phase via an online survey. The qualitative data sources came from two places: the individual course syllabi for all three courses, and two open-ended questions within the 18-question questionnaire.

2.2. Procedures

Data were collected in the fall of 2017. To recruit participants, a PowerPoint outlining the purpose, compensation, requirements, and format of the study was presented to four sections of an Introduction to Humanities and Social Sciences (HSS) course for major-declared students taught by a single instructor, a single section of a Preparatory Chemistry course taught by one instructor (Chemistry 1), and a single section of an Introduction to Chemistry course taught by another instructor (Chemistry 2). Students were provided extra credit for the course in which they were enrolled as compensation for their time. Two surveys were created; the surveys were largely the same, but the chemistry survey asked how students perceived chemistry, and the HSS survey asked how students perceived humanities and social sciences. Each course's instructor provided their course syllabus.

After initial recruitment, participants were sent an email containing a unique link to the survey. Students were given two weeks to complete the survey after receiving the initial email, with reminder emails sent twice over the two weeks to those who had yet to complete the survey. Each student's link directed them to a page with information regarding the study and informed consent. After reading this page, students were given the option to agree with the terms and proceed to the survey. By initiating the survey, students provided consent to participate and permission for the research team to access to their private academic records. Once the deadline for the survey passed, the unique survey identifiers were sent to the Office of Institutional Researching and Planning (OIRP) to match student academic records to de-identified responses.

2.3. Participants

A total of 879 surveys were initially completed from 1376 surveys sent out; however, 217 (25%) of the completed surveys were duplicate responses leaving a total of 662 unique responses for a total response rate of 48%. In these cases, the first survey responses were preserved. From the 662 surveys, an additional 142 students were excluded for being in courses outside those examined in this study. Of the 520, an additional 31 surveys were excluded for being incomplete, and 160 for missing academic records.

Participants for this study were 329 undergraduate students at a large southern university. To be eligible to take the survey, participants had to be at least 18 years of age and enrolled in one of the participating courses during the fall 2017 semester: Chemistry 1, Chemistry 2, or the HSS course. Table 1 below lists the demographics of the participants separately by course. Because a large number of students were excluded from the sample for their demographic data not being matched with their survey answers by OIRP, I conducted independent *t*tests to determine if the excluded students differed significantly on constructivist and instructivist preferences from those in the included group. All differences were non-statistically significant, with all p's > 0.33.

Table 1
Descriptive Student Characteristics by Course

	Chemistry 1 #(%)	Chemistry 2 #(%)	HSS #(%)
Gender			
Female	63 (56%)	61 (46%)	58 (68%)
Male	49 (44%)	71 (54%)	27 (32%)
Race			
White	79 (71%)	96 (73%)	66 (78%)
Latinx	3 (3%)	7 (5%)	2 (2%)
Black	14 (12%)	7 (5%)	6 (7%)
Asian	11 (10%)	16 (12%)	9 (11%)
Other	5 (4%)	6 (5%)	2 (2%)
Year			
Freshman	96 (86%)	108 (82%)	76 (89%)
Sophomore	11 (10%)	23 (17%)	8 (9%)
Junior	5 (4%)	0 (0%)	1 (1%)
Senior	0 (0%)	1 (1%)	0 (0%)
	M (SD)	**M (SD)**	**M (SD)**
HS GPA	3.49 (.86)	3.54 (.92)	3.63 (.46)

Note. The total number of students is N = 329; Chem 1 (N= 112), Chem 2 (N = 132), & HSS (N= 85). Number in parentheses represents the percentage of students within the course. Other, under Race, represents students who were either unspecified, multiracial, or not one of the races listed. HS GPA = High school GPA.

2.3.1. Chemistry. Of 588 chemistry students, 396 completed the survey. An additional 151 participants were eliminated for missing academic records, and lastly an additional student was eliminated for being a graduate student. The final number of chemistry participants used for analyses were 244, divided 112 for Chemistry 1, and 132 for Chemistry 2.

2.3.2. HSS. 300 students were recruited from four sections of the HSS course. A total of 144 students completed the survey for a 48% response rate across all HSS course sections. Of these 144 students, an additional 59 students were eliminated from analyses for missing academic records. The final number of participants used for analyses from the HSS course was 85.

2.4. Measures

2.4.1. Open-ended Questions. The development of the researcher-created open-ended questionnaire was based on previous pilot-testing that used a sample of introductory chemistry students from a university on the west coast (Kunze & Rutherford, 2017, August). The questionnaire consisted of three open-ended questions, but for the purpose of this study we focus on the first two:

1. How are good [chemistry/humanities & social sciences] courses structured?

2. What are activities that help you learn about [chemistry/humanities & social sciences]?

2.4.2. Epistemic Belief Inventory. The Epistemic Belief Inventory (EBI) developed by Schraw, Bendixen, & Dunkle (2002) was used in this study to assess students' general views of knowledge. Building off of the Schommer-Aikens model (2002), the measures span five dimensions of epistemology: Quick Learning (learning speed), Certain Knowledge (knowledge ambiguity), Simple Knowledge (knowledge structure), Innate Ability (learning control), and Omniscient Authority (source of knowledge). Each dimension consisted of three, five-point Likert-scale questions, for a total of 15 questions (See Appendix A).

2.5. Analysis

2.5.1. Phase 1: Qualitative

2.5.1.1. Open-ended. The open-ended course structure and course activities questions were analyzed using a grounded theory approach (Strauss & Corbin, 1990, 1998). Because of the limited prior research on differences in students' perceptions of domain-specific classroom practices, and desire to probe these differences through open-ended questions, I used a grounded theory approach to avoid assumed categories and promote insight through full data immersion (Hsieh & Shannon, 2005). The course structure and course activities questions were coded separately to ensure robustness of the codes. For each students' response, an initial sentence-by-sentence open-coding scheme was used, allowing each student to have multiple codes per response. An axial coding process was then used to group the open codes based on common characteristics. These common characteristics revealed themes differing in active versus passive learning preferences aligning with Vygotsky's (1978) Social Development Theory. Lastly using this framework, a selective coding process was used to relate both the course structure and course activities themes to either instructivist (Harrington & Standen, 1999) or constructivist (Jonassen, 1991) models of learning.

2.5.2. Phase 2: Quantitative

2.5.2.1. Open-ended Transformation. To integrate the qualitative and quantitative analyses, the codes that were created during the axial coding phase of the qualitative analyses were transformed; each axial code was coded as either 0 (not present) or 1 (present) for each student response. It is worth noting that students who responded in more detail to the questions tended to have more codes present. Once transformed, the percentage of students reporting each theme was calculated (see Table 2a and 2b). A second coder, an undergraduate researcher who coded the prior pilot-study themes, was used to ensure interrater reliability and quality of the codes created. Cohen's Kappa statistic was calculated to determine consistency among raters (See Appendix B for details). The interrater agreement between the two coders was greater than 80% for all course structure themes, and greater than 86% for all activities themes. For codes with discrepancies between coders, a final decision was made by the lead researcher. These 0/1 axial codes were then totaled within each selective code (constructivist/instructivist). A ratio score was calculated representing each student's ration of constructivist views to instructivist views of learning.

2.5.2.2. Epistemic Beliefs. The five dimensions in the EBI consisted of three questions each. The score (1-5) for each of the three questions was averaged to determine each students' degree of naivety (or sophistication) for each dimension. The Cronbach alphas for each subscale are as follows: certain knowledge ($\alpha = .50$), innate ability ($\alpha = .71$), omniscient authority ($\alpha = .61$), quick learning ($\alpha = .65$), and simple knowledge ($\alpha = .69$). These alphas are consistent with those obtained in other studies using these measures (e.g., DeBacker, Crowson, Beesley, Thoma, & Hestevold, 2008; Ravindran, Greene, & DeBacker, 2005).

CHAPTER 3: RESULTS

3.1. Student Perceptions of Courses Structures and Activities

To answer my first research question, *What do students perceive as effective chemistry and humanities course structures and practices?*, students' open-ended responses revealed codes that aligned with constructivist and instructivist approaches to instruction. First, an initial number open codes from the course structure question for the three courses were found: HSS (N= 93), Chem 1 (N = 102), Chem 2 (N =1 83). Examples of different codes across the three courses include, "Stories of other's experiences," "Step-by-step instructions," and "Efficient lecture." The open codes for the activities question were then determined: HSS (N = 56), Chem 1 (N = 62), Chem 2 (N = 96). Examples of open-codes from the activities question include "Mnemonics," "Outlines of important material," and "Interviewing experts in different fields."

Axial coding was then used across both questions to synthesize the open-codes that were characteristically the same, but only differ in phrasing. An example of chemistry student responses that differ in phrasing, but are still elementally the same are, "Homework" and "Practice problems," as both express the desire for repetition and practice of learned material. Another example includes HSS students who desired courses that "Promote student participation" and were "Interactive," because both expressed students' desire for interaction and active engagement with the course and others. The number of themes synthesized across course structure were: HSS (N = 16), Chem 1 (N = 17), and Chem 2 (N = 18). Theme numbers for activities were: HSS (N = 17), Chem 1 (N = 11), and Chem 2 (N = 15).

A second round of axial coding was then used to combine any common codes across the three courses for course structure (N = 20) and activities (N = 17). To ensure the quality of the grouping, I then recoded 10% of the total sample to determine if the codes hold up across all courses. Examples of common themes for all three courses included the use of "lectures," "discussion," and "hands-on application"; however, some themes remained exclusive to only one or two courses (e.g., guest speakers and practice problems). Below are examples of comments that are representative of the three courses.

"I think good humanities and social sciences courses are structured around a free learning environment. In other words, I think it necessarily needs to be an interactive class. There needs to be active discussion between professor and students. This allows students to learn through their own processes, and the professor simply guides them to this learning, rather than just telling them what to learn."
[HSS, student 1]

"Quality HSS classes have a loose structure that allows for individual passions and interest to seep through the structure. It allows for creativity and expression through the material. It does not have a heavy reliance on reading a textbook or pure lecture form. It involves activities and projects that have real-life applications." [HSS, student 2]

"Good chemistry courses have a lecture with notes that are easy to follow as well as practice example problems done by the teacher in class. They also have enough resources for those that need help, and always have extra problems to do outside of class for practice."
[Chem 1, student 1]

"Good chemistry courses are structured by having lectures with PowerPoints to follow and a teacher who thoroughly explains the content. Then having homework assignments and books to read that instill those same lessons a second time so you can remember it better and practice."
[Chem 1, student 2]

"I think good chemistry courses are structured in a way that every student can learn all the material they need to know for tests by attending lectures. I think a textbook should only be used as supplementary material, and should not be the first source a student relies on to learn chemistry."
[Chem 2, student 1]

"The teacher should provide explicit instruction on material that is or is not required to know for the course. The teacher should provide plentiful examples of practice problems similar to exam/quizzes inside and out of the lecture period." [Chem 2, student 2]

A selective coding process using student-centered/constructivist and teacher-centered/ instructivist frameworks was then used to further group the axial codes. In Table 2a and 2b, both classes of chemistry students reported a larger portion of instructivist preferences for their course structures and learning activities as compared to humanities students. In particular, repetitious activities, such as practice problems, were almost exclusively noted by the chemistry students, as discussion activities were by the HSS students. This differences in the HSS responses compared to chemistry responses may suggest domain-specific perceptions of learning. Worth noting, is the 21% of HSS students that reported a preference for direct instruction in their course structure, and 15% of HSS prefer lecture for learning activities. Despite this high percent, the open-ended responses from these students revealed they desire this type of instruction in conjunction, or balance, with other more constructivist aspects. This raises question as to whether there are statistically significant differences in students' perceptions of instructivist and constructivist learning environments by discipline, or if they have more in common than it appears:

"They are constructed with a balance of lecture and discussion. Lecture, so that the teacher can teach the topic and discussion, as to open different students' attitudes towards the topic." [HSS, Student 3]

"Good humanities and social science courses are structured with meaningful lectures and some type of engagement with the information presented." [HSS, Student 4]

"Humanities and Social Sciences courses are good when they are structured with a combination of lecture and hands on learning or learning by observation." [HSS, Student 5]

Table 2a

Portion of Student Perceptions of Learning for Course Structure Themes

Course Structure	Theme	Chem 1 (%)	Chem 2 (%)	HSS (%)	Sample Quote
Instructivist	Self-Assessment Activities	8%	16%	0%	"Practice tests"
	Practice Activities	28%	37%	6%	"Develop the skills they will need in their major, such as writing"
	Examples/Walk-throughs	32%	16%	0%	"Examples with step-by-step instruction."
	Direct/ Simplified Instruction	43%	53%	21%	"Teacher stands up and teaches on a topic for a large period of time."
	Review Activities	13%	15%	0%	"Reviewing content"
	Organized/ Structured	12%	14%	8%	"Rigid guidelines"
Constructivist	Hands-on/Application	6%	10%	12%	"Hands-on experimentation/learning activities."
	Interactive/ Discussions	14%	12%	45%	"Class discussion because I like engaging with my classmates."
	Responsive to Student Need	11%	18%	7%	"Structured toward the student."
	Expand Perspective/ Open Enviro.	2%	0%	24%	"Open different students' attitudes."
	Cumulative/Connecting Material	3%	12%	0%	"Explains the interrelation of concepts."
	Promotes 21st Century Skills	0%	0%	11%	"Comprehension, and analytic skills."
Other	Affective	4%	5%	8%	"Strong student/teacher relationship."
	Teachers	8%	5%	7%	"It depends heavily on the style of the professor."
	Supplemental Resources	5%	21%	5%	"A useful textbook or other resources."
	Guest Speakers	0%	0%	2%	"Keynote Speakers."
	Other/Vague	13%	6%	12%	"Structured well."

Note. HSS students (*N* = 85), Chem 1 students (*N* = 112), and Chem 2 students (*N* = 132).

Table 2b

Portion of Student Perceptions of Learning for Activities Themes

Activities	Theme	Chem 1 (%)	Chem 2 (%)	HSS (%)	Sample Quote
Instructivist	Memorization/Review	23%	20%	5%	"Flashcards."
	Lecture	5%	12%	15%	"The professor explains the subject."
	Self-Assessment	5%	2%	2%	"Allow the students to test their knowledge."
	Examples/Guided Practice	24%	32%	5%	"Have hints to point me in the right direction."
	Practice Problems	62%	62%	0%	"Practice problems! Practice problems! Practice problems!"
Constructivist	Discussion	1%	0%	27%	"Class discussion of concepts."
	Interactive/Group Activities	4%	18%	16%	"Lots of group work to allow students to learn from their peers."
	Hands-on/Application	17%	18%	19%	"Doing it first-hand."
	Writing Activities	6%	6%	8%	"[Writing] a paper on scholarly articles."
	Perspective Taking	0%	0%	7%	"Learning about the various different opinions students have on the topic."
	Relate to Prior Knowledge	0%	1%	0%	"Connect a concept to something I've experienced or am familiar with."
Other	Reading Activities	5%	14%	16%	"Reading articles or the textbook."
	Community Activities	0%	0%	38%	"Events hosted by the various Humanities departments, or guest speakers."
	Multimedia Resources	15%	11%	14%	"Watching crash course videos."
	Affective	1%	0%	5%	"class more engaging and fun"
	Additional Aid	7%	14%	0%	"Chem Tutoring Center."
	Other/Vague	0%	0%	5%	"I don't know."

Note. HSS students (*N* = 85), Chem 1 students (*N* = 112), and Chem 2 students (*N* = 132).

3.2. Domain-specific Differences in Perceptions

To answer research question two, *Do these perceptions differ across course subject?*, I first visually explored the percentage of students reporting each number of constructivist and instructivist preferences reported by course (See Figure 2). Figure 1 displays six histograms of the students' responses by course and model of learning. Visually, most HSS students reported little to no instructivist responses, and chemistry students reported a wider range of instructivist responses. This relationship appears inverse for constructivist responses, with a large percentage of HSS students' reporting at least one theme and the chemistry student responses clustering more at the left.

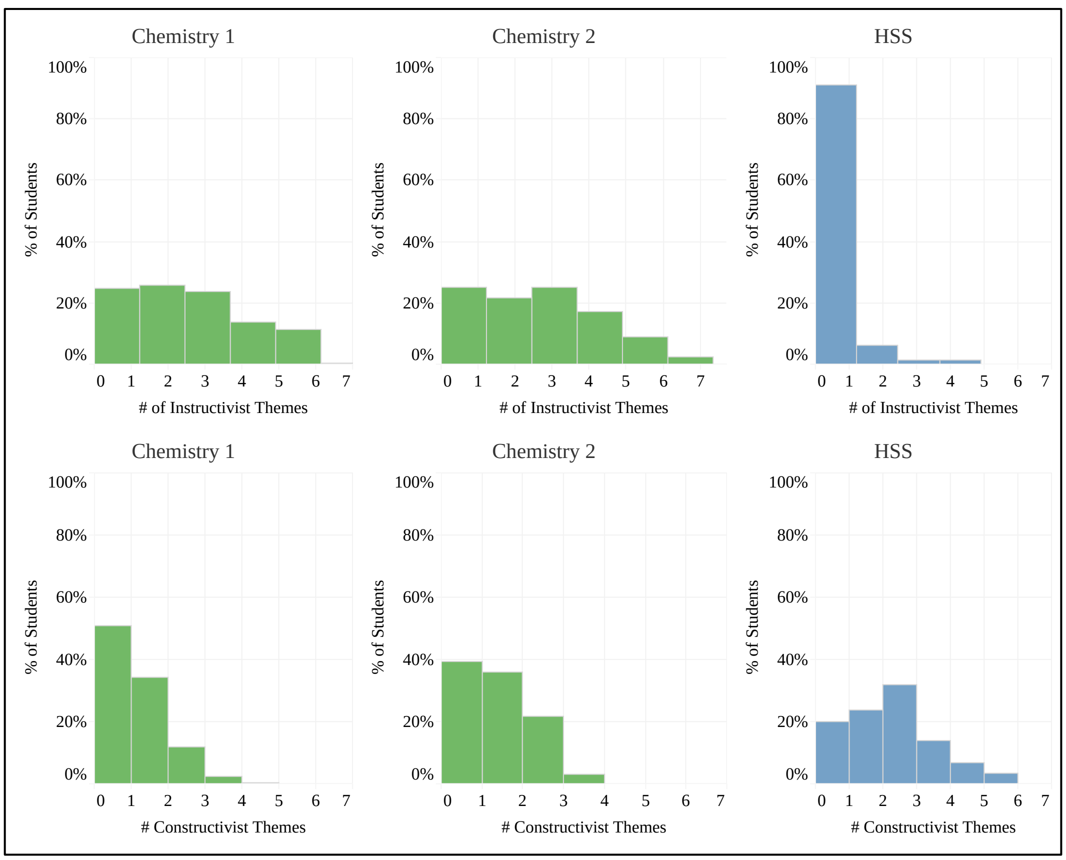

Figure 2. Visual Comparisons of Student Responses by View of Learning and Course
This figure represents the spread of instructivist and constructivist responses and the percentage of students by course. Chemistry courses are displayed in green, and the humanities course is displayed in blue.

As these distributions do not take the number of responses given by students into account (see Table 3), the ratio of constructivist to instructivist themes was calculated for each student to represent their views of learning. A oneway ANOVA with posthoc mean comparisons was conducted to reveal any statistically significant differences in the courses. Analyses revealed all three courses differed statistically significantly in the average number of constructivist preferences reported, compared to instructivist preferences differing only in the HSS students. I then regressed this ratio on the subject of study (chemistry or HSS), controlling for gender, race, and high school GPA. The results of the multiple regression explained 28% of the variance in students' views of learning (R2 = .284, F(4,324) = 32.06, $p < .001$). Looking individually at the predictors, course subject was the only variable that statistically significantly predicted students views of learning ($\beta = -.526$, $p < .001$) (See Table 4). In this case, students within the chemistry courses had a constructivist to instructivist ratio over half a standard deviation lower than those in the HSS course, indicating their views were substantially more aligned with instructivist approaches.

Table 3
Descriptive Statistics for Students' Views of Learning

	Instructivist		Constructivist	
Course	M	SD	M	SD
Chemistry 1	2.49	1.44[c]	0.64[b,c]	0.76
Chemistry 2	2.65	1.48[c]	0.96[a,c]	0.89
HSS	0.48	0.67[a,b]	1.76[a,b]	1.34

Note. HSS students (*N* = 85), Chem 1 students (*N* = 112), and Chem 2 students (*N* = 132). M =mean, SD = standard deviation.
Statistically significant differences in the means for each construct by course was calculated at the $p < .05$, [a] = different from Chemistry 1, [b] = different from Chemistry 2, [c] = different from HSS.

Table 4
Multiple Regression of Construct: Instruct Preferences by Course Subject

	b	β	SE
Chemistry	-111.721	-0.526*	10.151
Female	0.975	0.005	8.934
White	11.638	0.055	10.002
HS GPA	-0.416	-0.004	5.528
Constant	111.761		23.476
R2	.284		

Note. HSS students (*N* = 85), Chem 1 students (*N* = 112), and Chem 2 students (*N* = 132).
* *p* < .001. Dependent variable scale is such that larger numbers equal more constructivist. Reference group for this model is nonwhite, male, HSS students.

3.3. Learning Perceptions & Epistemic Beliefs

To answer the last research question, *How do these perceptions associate with student views on the nature of knowledge?,* I first visually explored differences in the students' epistemic beliefs by course (See Appendix C). I then tested for the skew and kurtosis of each of the dimensions (See Table 5). All variables were within the acceptable ranges for skewness (+/- 1) and kurtosis (normal distribution is 3), suggesting a normal distribution across students' epistemic beliefs (Ho & Yu, 2014).

Table 5
Descriptive Statistics of Epistemic Beliefs Subscales

Epistemic Belief	M (SD)	Skew	Kurtosis
Innate Ability	2.43 (.83)	0.34	2.85
Omniscient Authority	2.93 (.71)	0.06	2.83
Quick Learning	1.66 (.52)	0.52	3.39
Simple Knowledge	2.40 (.70)	-0.12	2.59
Certain Knowledge	2.55 (.66)	0.27	3.05

Note. N = 329. The Cronbach alphas for each dimension was also calculated: Simple knowledge (.67), Quick learning (.70), Omniscient Authority (.63), Innate Ability (.71), and Certain knowledge (.52).

I then explored mean differences in students' epistemic beliefs by course (See Table 6). Five oneway ANOVAs revealed that omniscient authority (R2 = .044, F(2,326) = 7.46, *p* < .001), quick learning (R2 = .024, F(2,326) = 3.99, *p* = .019), and simple knowledge (R2 = .056, F(2,326)

= 9.74, $p < .001$) beliefs statistically significantly differed by course. Pairwise post-hoc means comparisons were conducted to compare which courses differed at the $p < .05$ level and are represented in Table 6. Chemistry 1 students' views of omniscient authority were statistically significantly higher than both Chemistry 2 ($t(3) = -3.45$, $p = .002$), and HSS students ($t(3) = -3.40$, $p = .002$), meaning Chemistry 1 students had more naïve views about the source of knowledge, or who relays information (i.e., experts or teachers). These students are more likely to believe learning is a not a co-constructed process, and rely on the instructor for information and learning (Schommer, 1990).

Table 6
Descriptive Statistics for Epistemic Beliefs Dimensions by Course

	Epistemic Beliefs	M	SD	Min	Max
Chemistry 1	Certain Knowledge	2.63	0.69	1.00	4.33
	Innate Ability	2.40	0.84	1.00	5.00
	Omniscient Authority[b,c]	3.13	0.73	1.33	5.00
	Quick Learning[b]	1.77	0.56	1.00	4.00
	Simple Knowledge[b,c]	2.62	0.64	1.00	4.00
Chemistry 2	Certain Knowledge	2.46	0.66	1.00	4.67
	Innate Ability	2.51	0.83	1.00	5.00
	Omniscient Authority[a]	2.83	0.70	1.00	4.33
	Quick Learning[a]	1.60	0.50	1.00	3.00
	Simple Knowledge[a]	2.29	0.70	1.00	4.00
Humanities & Social Sciences	Certain Knowledge	2.46	0.66	1.00	4.67
	Innate Ability	2.51	0.83	1.00	5.00
	Omniscient Authority[a]	2.83	0.70	1.00	4.33
	Quick Learning	1.60	0.50	1.00	3.00
	Simple Knowledge[a]	2.29	0.70	1.00	4.00

Note. HSS students (N = 85), Chem 1 students (N = 112), and Chem 2 students (N = 132). Lower scores for epistemic beliefs are associated with a more sophisticated view of knowledge. Statistically significant differences in the means for each dimension by course was calculated at the $p < .05$, [a] = different from Chemistry 1, [b] = different from Chemistry 2, [c] = different from humanities.

Pairwise correlations were calculated between students' epistemic beliefs and course subject, instructor, and the constructivist to instructivist preferences ratio (See Table 7). The course subject chemistry was weakly but statistically significantly associated with simplicity of knowledge. Worth noting, each of the three courses had differing associations with the five dimensions of the epistemic beliefs. Students within the chemistry 1 course showed a statistically significant negative association to omniscient authority, quick learning, and simple knowledge. Simple knowledge was the only dimension all three courses had a statistically significant association.

Table 7

Pairwise-Correlations of Course Perceptions and Epistemic Beliefs

	1.	2.	3.	4.	5.	6.	7.	8.	9.
1. Chem 1	-								
2. Chem 2	-0.59[c]	-							
3. HSS	-0.42[c]	-0.48[c]	-						
4. Chemistry	0.42[c]	0.48[c]	-1.00[c]	-					
5. Construct: Instruct	-0.22[c]	-0.26[c]	0.53[c]	-0.53[c]	-				
6. Certain Knowledge	0.10	-0.10	0.01	-0.01	-0.02	-			
7. Innate Ability	-0.03	0.07	-0.05	0.05	-0.13[a]	0.28[c]	-		
8. Omniscient Authority	0.21[c]	-0.11	-0.11	0.11	-0.05	0.18[b]	0.01	-	
9. Quick Learning	0.15[b]	-0.11	-0.05	0.06	-0.06	0.19[c]	0.27[c]	0.10	-
10. Simple Knowledge	0.24[c]	-0.12[a]	-0.12[a]	0.12[a]	-0.06	0.18[b]	0.10	0.37[c]	0.37[c]

Note. N= 329. Chemistry represents domain-specificity. Construct:Instruct is the ratio of students' reported views of learning.

[a] $p < .05$; [b] $p < .01$; [c] $p < .001$.

Building off of the multiple regression in Table 4, I then used a step-wise regression predicting students' ratio of constructivist to instructivist preferences by the five dimensions of epistemic beliefs (See Table 8). The variables that displayed a statistically significant association to learning preferences in the first regression were retained and used in the first step of this regression to answer my second research question. The second step included each of the epistemic beliefs subscales. The results of the regressions revealed course subject as more predictive of students' views of learning than any dimension of epistemic beliefs. In the second model, including the epistemic beliefs accounted for an additional 0.9% of the variance explaining students views of learning, ($\Delta R2 = .011$, $F(5,322) = 1.00$, $p = .419$). Of the five dimensions, belief in innate ability was the only one that statistically significantly predicted students' perceptions of learning, ($\beta = -.103$, $p = .041$). The results from these analyses revealed students' epistemic beliefs explain a small percentage of the variance in their views of learning after accounting for course of study.

Table 8
Step-wise Regression of Students' Views of Learning on their Epistemic Beliefs

	Step 1			Step 2		
Variable	**b**	**SE**	**β**	**b**	**SE**	**β**
Chemistry	-112.536	9.966	-0.529[c]	-111.757	10.079	-0.526[c]
Simple Knowledge				1.199	7.283	0.009
Quick Learning				-1.466	9.414	-0.008
Innate Ability				-11.558	5.634	-0.103[a]
Omniscient Authority				1.019	6.730	0.008
Certain Knowledge				0.426	7.071	0.003
Constant	119.953	8.583		143.018	26.963	
R2	0.281			0.292		

Note. N = 329. Variables found nonsignificant variables in the first model were left out of the second part of the analyses. Lower scores for epistemic beliefs are associated with a more sophisticated view of knowledge.
[a] $p < .05$; [b] $p < .01$; [c] $p < .001$.

3.4. Emerging Results: Course Climate

In addition to domain-specific differences, including two chemistry courses allowed me to examine within domain differences in students' responses that may be due to effects of the instructor. Also, according to the results from Question 1, Chemistry 1 students had a more naïve view of omniscient authority and simplicity of knowledge than both Chemistry 2 and HSS students. The differences found in the students' epistemic beliefs across all three courses aligns with research showing students beliefs can vary by the learning environment. Additionally, the emergence of themes that did not fit the instructivist or constructivist model of learning, as seen in Table 2, sparked an exploration of differences in the course climate.

3.4.1. Phase 3: Qualitative Analysis. Each instructor from the three courses provided their course syllabus, which included the order, assessments, and expectations for the semester. The syllabus for each course was qualitatively analyzed to understand which model of learning the courses were adopting by using a conventional content analysis approach for factors that shape the format and structure of a course (Rosengren, 1981). For the purpose of this study, I focused on the structure, activities, and grading practices of the courses.

All three courses presented elements that were similar and different; however, the three course models appeared to fall on a spectrum ranging from a teacher-centered approach to a student- and community-centered approach to teaching (See Table 9). The Chemistry 1 course presented the material in the form of lecture, and the activities to aid the learning revolved around a textbook and repetition, which is consistent with traditional, or teacher-centered practices (Porcaro, 2011). The Chemistry 2 course consisted of some of the same elements as Chemistry 1 (e.g., lecture), but this course also included hands-on activities reflecting that that of a student-centered classroom (Choi & Lee, 2009). Lastly, the HSS course included community-centered elements revolving around interaction and discussion with the professor and other students (e.g., class discussion), and community members (e.g., guest speakers). This course differed the most from both Chemistry courses by bridging both classroom structures, instructivist and constructivist models of learning, with a community-centered model of learning (Epstein, 2002).

Table 9

Undergraduate Courses Model of Learning by Learning Factors

Course Factors		Chemistry 1	Chemistry 2	Hum. & Soc. Sci.
Structure	Lecture	√	√	√
	Lab	X	√	X
	Seminar	X	X	√
Activities	Readings	√	√	√
	Practice Problems	√	√	X
	Guest Speakers	X	X	√
	Hands-on Activities	X	√	√
	Class Discussions	X	X	√
Grading	Exams	75%	75%	X
	Quizzes	15%	15%	X
	Homework	10%	10%	X
	Writing *Reflection*	X	X	70%
	Analysis	X	X	16%
	Group work	X	X	14%
Model of Learning		**Teacher-centered**	**Student & Teacher-centered**	**Student & Community-centered**
		Instructivist ←	→	**Constructivist**

Note. Each course provided the syllabus, or semester outline, that contained course structure, activities, and grading assessments. These three factors were noted, and the table above reflects the differences found across the three courses. X = Not present, √ = present.

3.4.1.1. Results. In addition to the courses' structure differences, the students' open-ended responses evoked some of the structures and activities listed within the course syllabus. Examples of students' direct reflection of the courses syllabus include additional aid, homework, and guest speakers (See Table 10). In particular, 38% of the students in the HSS course listed "community activities" as an effective learning approach, which did not fit into either instructivist or constructivist models of learning. These findings are in line with a longitudinal study conducted by Zeeger (2001) that found students' approaches to learning are changeable and dynamic as a result of the academic experiences, or exposures in a learning environement. This study also supports the idea that a student's learning environment is associated with their beliefs and behaviors.

Table 10

Student Responses Reflective of Syllabus Structures

	Syllabus	Student Response
Chem 1	"Graded homework will be administered online through Sapling"	"Sapling homework."
	"Example problems"	"Going over example problems that are similar to what we will see in homework."
Chem 2	"Problem Session"	"…chemistry recitation (problem session)."
	"Supplemental Instruction"	I used supplemental instruction."
HSS	"Talks given by outside speakers"	"Hearing guest professors talk about not only their area of study, but [the department] as a whole has been useful."
	"Vocational Enrichment Events"	"Going to sponsored events from the department."

Note. N = 329. 38% of students in HSS reported community events.

The Chemistry 1 course's syllabus expressed no constructivist structures, in contrast to those of Chemistry 2 and HSS, which both included differing degrees of constructivist elements (See Table 9). These differences are particularly interesting, because 92% of students within all three of these courses were first semester Freshman, meaning the courses in this study were among their first exposures to undergraduate learning environments and their chosen discipline. Because of the emerging model of learning spectrum for the three courses, I went back to look at the percentage of students reporting one or more instructivist or constructivist themes for both the course structure and activities questions. Unlike the ratio, the percentage allowed me to see what portion of the Chemistry 1 students identified no vs. any constructivist features.

Students who noted at least one instructivist theme in their open-ended responses were those in HSS (39%), Chem 1 (94%), and Chem 2 (95%). Students who noted at least one constructivist theme were those in HSS (80%), Chem 1 (47%), and Chem 2 (64%). Two oneway ANOVA's were conducted to reveal any statistically significant differences within the three courses for any instructivist preferences reported, $F(2, 326) = 94.64$, $p < .001$, and any constructivist preferences reported, $F(2, 326) = 11.76$, $p < .001$. Posthoc Tukey mean comparisons revealed that both Chem 1 ($t(3) = -12.00$, $p < .001$) and Chem 2 ($t(3) = -12.62$, $p < .001$), differed significantly statistically from HSS in the portion of students reporting any instructivist learning preferences. This means there were no differences in the portion of students that reported instructivist learning preferences between Chemistry courses, but more students in both Chemistry courses reported at least one instructivist theme as compared to the students in the HSS course. For constructivist preferences, the posthoc tests revealed all three courses differed statistically significantly from each other in the portion of students who reported any constructivist themes (See Table 11). These are similar findings to the analyses conducted in Table 3. These results support the aligned view of student preferences and environments, reflecting the SCT model of interaction between person and environment.

Table 11
Results from Constructivist Themes— Tukey PostHoc Test

Course	*M*	*SD*
Chemistry 1	$0.47^{b,c}$	0.50
Chemistry 2	$0.64^{a,c}$	0.48
HSS	$0.80^{a,b}$	0.40

Note. N = 329.
Statistically significant differences in the means for each dimension by course was calculated at the $p < .05$, ^{a} = different from Chemistry 1, ^{b} = different from Chemistry 2, ^{c} = different from humanities.

CHAPTER 4: DISCUSSION

With this study, I aimed to answer three questions: (1) What do students perceive as effective chemistry and humanities course structures and practices? (2) Do these perceptions differ across course subject? and (3) How do these perceptions associate with student views on the nature of knowledge?

4.1. Research Question 1: Student Perceptions as Models of Learning

The first goal of this study was to expand on prior work related to students' perceptions of learning. First, the use of qualitative open-ended questions allowed for students to freely choose what activities and structures came to mind when thinking about effective learning approaches, which can allow for more flexibility and authenticity than is true of closed-response questions used by many studies (e.g., PALS, 1985; PISA, 2012). The approach in the study allowed for richer responses from students and did not make any a priori assumptions about the types of activities students may prefer, experiential differences in the students, or differences across disciplines.

This qualitatively-driven approach revealed that students' learning preferences largely fell into categories that aligned with instructivist or constructivist models of learning. Interestingly, across the three courses, students had a wide variety of types of structures and activities they noted would help them to learn a subject, but the HSS students reported more constructivst views, as opposed to the chemistry students' mostly instructivist preferences. Many of these instructivist/constructivist distinctions were consistent with surface and deep approaches to learning, previously found to be related with different types of learning environments (Entwistle & Tait, 1990; Freeman et al., 2014). The proportional difference in the student responses across the three courses suggested there to be potential discipline-specific differences in how the learning environments were structured, included students' perceptions of learning, or both.

4.2. Research Question 2: Discipline-specific Perceptions

The findings from the first research question enabled me to further explore the apparent discipline-specific perceptions, and the extent to which course subject might affect students' preferences. Prior research has shown that knowledge and learning is domain specific (Glaser & Chi, 1988), therefore we might expect students' perceptions of learning in each domain to also reflect these differences. Findings from the analyses revealed that students within chemistry perceived chemistry learning to be most effective in a traditional setting with direct instruction and memorization-based techniques. Students learning humanities and social sciences perceived that domain to be one that is most effectively learned using interactive discussion and participation from students, teachers, and community-members. Although the students were not asked to directly compare the subjects, the stark differences between the fields lends some support for differences across soft and hard science fields as found in studies such as Nelson Laird, Shoup, Kuh, and Schwarz (2008).

4.3. Research Question 3: Student Perceptions and Epistemic Beliefs

Considering how students' personal factors, such as their epistemic beliefs, are associated with their approaches to learning (Greene et al., 2010; Phan, 2008;), I also explored how students' epistemic beliefs related to their constructivist to instructivist learning preferences ratio. The results showed that students' belief in innate ability was the only dimension of epistemology that predicted students' preferences for learning. This means that students who believe that knowledge is innate, or that people are just naturally smart, are more likely to have instructivist learning preferences. This is important, because students that believe ability is fixed are less likely to persist when facing challenges (Dweck, Walton, & Cohen, 2014), which may explain why students with more naïve beliefs about the nature of learning and knowledge prefer simple/direct instructivist approaches over deeper constructivist learning approaches. In addition to these findings, the statistically significant differences found across all courses, rather than just domain, sparked the need to further explore individual differences in the courses climate rather than the communities of practice.

4.4. Emerging Results: Students Perceptions and Course Climate

To address the differences across all three courses the qualitative analyses revealed student perceptions of effective learning environments may be a reflection of practices and orientations of the course itself. These results also showed that across disciplines and courses there are similarities and differences in how instructors communicate information, and how students seek information. The overlap in the three courses suggest classrooms or learning environments may have models of learning that are dynamic and changing rather than constant, as suggested by many students desiring a balance of instructivist and constructivist activities. Also, the results showing students within chemistry 1 versus chemistry 2 and HSS have more naive beliefs across multiple dimensions of the epistemic beliefs measure suggest that, in addition to a differences in models of learning, the classroom may be oriented in a less sophisticated way.

In addition to both of models of learning, there has been a recent push in education for a school learning community, where schools, families, and community partnerships come together to increase student learning and experiences while meeting the school goals (Epstein & Salinas, 2004). Epstein's Framework of Six Types of Involvement (2002) with school-community partnerships addresses different types of school-community collaborative involvement practices, such as school program events, and community activities. These characteristics that describe this type of skill to practice are similar to some of themes found within the HSS students’ responses that did not fit the traditional instructivist or constructivist learning models themes, such as, “Guest

Speakers" or "Community Events." Although this school-community learning is a framework and not a model of learning in the same as instructivist and constructivist practices are, it reflects an expansion on constructivist views of learning by providing opportunities for apprenticeship and co-construction of knowledge with field experts (Porcaro, 2011). These emerging findings support the concept of views of learning as falling on a spectrum; however, further exploration is needed as to how students and teachers epistemic beliefs play a role in the learning environments epistemic climate.

4.5. Limitations

My study was limited in three main ways. First, the open-ended nature of the survey questions allowed students to choose to list as many, or as few, activities and structures they perceived effective. This means some responses may have been inflated due to students responding in more detail, allowing for greater deviation in students' constructivist:instructivist ratio. The second limitation of this study is the loss in sample size due to a number of students' academic records not being matched by the university OIRP. Even though I tested for statistically significant differences among students open-ended responses who were excluded versus included, the change in the sample number could have made a difference for the other measures such as epistemic beliefs. Lastly, the lower–than-desired alphas on three of the five epistemic beliefs subscales could have contributed to the results, namely the failure to find links between other dimensions of epistemic beliefs and learning preferences. Furthermore, there could have been a suppressing effect between the five dimensions. Because there were statistically significant differences between all three courses on certain dimensions, it is possible assessing the domain-specific differences (i.e., chemistry or not) resulted in some of the differences in the epistemic beliefs dimensions to become suppressed. Even if low-alphas are consistent with other studies (e.g., DeBacker et al., 2008; Ravindran et al., 2005), it could be limiting the conclusions that can be drawn.

4.6. Implications

By further exploring students' perceptions of effective learning across courses and disciplines, instructors and researchers can better understand how students' personal factors and beliefs engage with learning environments. For example, in this study, those with innate views of learning also preferred more instructivist methods of instruction, such as lectures and practice problems. Future researchers can use longitudinal or experimental research to test the directionality of these relations—with the push to move students toward a growth mindset (e.g., Snipes & Loan, 2017) it may be important to know which instructional practices hinder or foster such transformations. For university instructors who wish to foster more sophisticated beliefs, this study provides some evidence that these beliefs are associated with constructivist course practices, even within subjects, like chemistry, that may be dominated by instructivist practices and students with more instructivist preferences.

4.7. Conclusion

Within this study, my goal was to explore student preferences and beliefs within the context of their courses as guided by SCT and SRL models. In meeting this goal, a number of contributions are presented: First, a qualitative approach to data collection through open-ended responses allowed for more unique responses than closed-ended surveys that are more often used. Second, this approach allowed for a broader understanding of the reciprocal relationships between students' beliefs and perceptions, their approaches to learning, and their learning environments. Third, the results support emerging literature on the role of epistemic beliefs throughout practices and environments, and how the interplay of students learning beliefs and the actual learning environment create an epistemic climate. This is important in beginning to understand how students, and instructors, epistemologies are presented in their actions and beliefs, and how those factors cultivate an environment that can be supportive (or not) of more sophisticated views of learning and knowledge. Lastly, this study built upon previous research by revealing an emerging model of learning linking instructivist, constructivist, and community-based practices with students' perceptions of effective learning. The finding of emerging model in higher education courses is important, as it suggests there may be a shift occurring in how instructors are communicating information to students across some disciplines. Future studies should consider taking into account the instructors epistemic beliefs, as well as the students, and consider a longitudinal study to assess how these beliefs and of learning shift over time. In addition, exploring what actions students actual participate in to learn the subject, rather than just their perceptions of what practices are effective, would to useful in trying to understand differences in student approaches and beliefs.

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APPENDICES

Appendix A

Epistemic Belief Inventory (Schraw, Bendixen, & Dunkle, 2002)

Original Item Number	Subscale	Question	Likert-scale
7	Certain Knowledge	Parents should teach their children all there is to know about life.	1 = Strongly disagree...5 = Strongly agree
23	Certain Knowledge	What is true today will be true tomorrow.	1 = Strongly disagree...5 = Strongly agree
No number	Certain Knowledge	The moral rules I live by apply to everyone.	1 = Strongly disagree...5 = Strongly agree
8	Innate Ability	Really smart students don't have to work as hard to do well in school.	1 = Strongly disagree...5 = Strongly agree
14	Innate Ability	How well you do in school depends on how smart you are.	1 = Strongly disagree...5 = Strongly agree
24	Innate Ability	Smart people are born that way.	1 = Strongly disagree...5 = Strongly agree
19	Omniscient Authority	Children should be allowed to question their parents' authority.	1 = Strongly disagree...5 = Strongly agree
25	Omniscient Authority	When someone in authority tells me what to do, I usually do it.	1 = Strongly disagree...5 = Strongly agree
26	Omniscient Authority	People shouldn't question authority.	1 = Strongly disagree...5 = Strongly agree
15	Quick Learning	If you don't learn something quickly, you won't ever learn it.	1 = Strongly disagree...5 = Strongly agree
20	Quick Learning	If you don't understand a chapter the first time through, going back over it won't help.	1 = Strongly disagree...5 = Strongly agree
27	Quick Learning	Working on a problem with no quick solution is a waste of time.	1 = Strongly disagree...5 = Strongly agree
1	Simple Knowledge	Most things worth knowing are easy to understand.	1 = Strongly disagree...5 = Strongly agree
10	Simple Knowledge	Too many theories just complicate things.	1 = Strongly disagree...5 = Strongly agree
12	Simple Knowledge	Instructors should focus on facts instead of theories.	1 = Strongly disagree...5 = Strongly agree

Appendix B

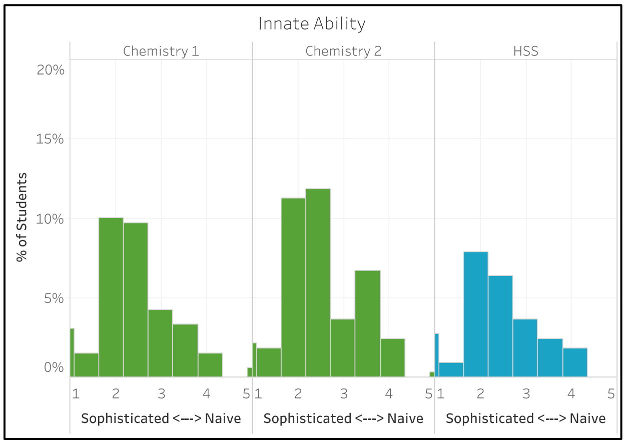
Cohen's Kappa Statistic for Inter-rater Reliability: Course Structure Themes

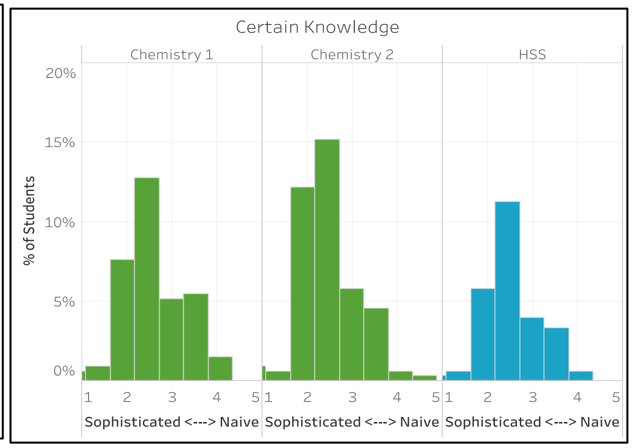
	Agreement	Kappa	*P*	SE
Self-Assessment Act.	94%	0.40	<.001	0.05
Practice Activities	89%	0.61	<.001	0.05
Examples/Walkthroughs	93%	0.79	<.001	0.05
Direct/Simplified Instruction	80%	0.59	<.001	0.05
Review Activities	93%	0.51	<.001	0.05
Organized/Structured	92%	0.51	<.001	0.05
Hands-on/Application	95%	0.72	<.001	0.05
Interactive/Discussions	95%	0.87	<.001	0.05
Responsive to Student Need	93%	0.41	<.001	0.05
Expand Perspective/Open Enviro.	94%	0.56	<.001	0.05
Cumulative/Connecting Material	96%	0.31	<.001	0.05
Promotes 21st Century Skills	95%	0.24	<.001	0.04
Affective	92%	0.13	0.006	0.05
Teachers	90%	0.53	<.001	0.05
Guest Speakers	100%	1.00	<.001	0.05
Other	88%	0.54	<.001	0.05

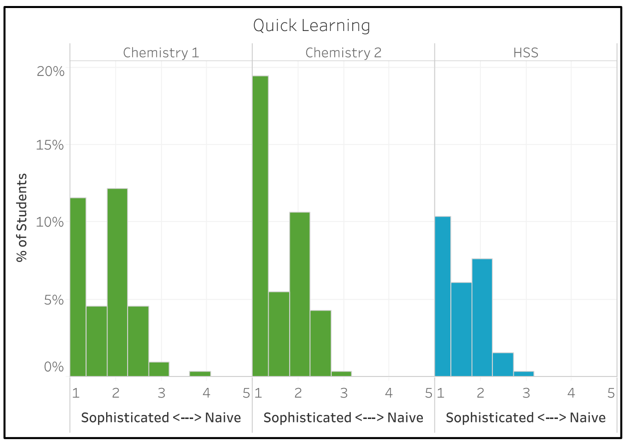
Cohen's Kappa Statistic for Inter-rater Reliability: Activities Themes

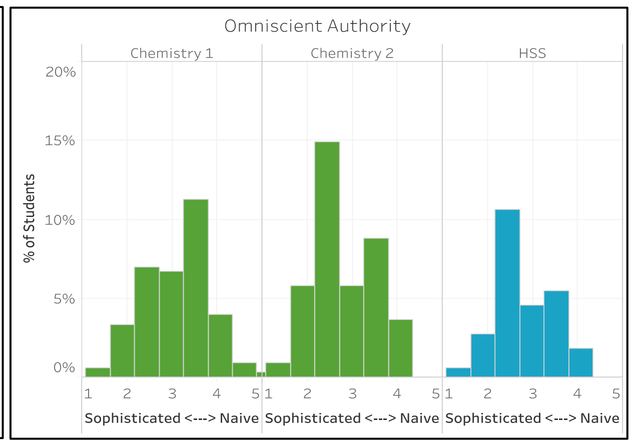
	Agreement	Kappa	*P*	SE
Memorization/Review	91%	0.63	<.001	0.05
Lecture	96%	0.77	<.001	0.05
Self-Assessment	98%	0.72	<.001	0.05
Examples/Guided Practice	94%	0.74	<.001	0.05
Practice Problems	93%	0.86	<.001	0.05
Discussion	95%	0.77	<.001	0.05
Interactive/Group Activities	93%	0.63	<.001	0.05
Hands-on/Application	93%	0.74	<.001	0.05
Writing Activities	96%	0.30	<.001	0.05
Perspective Taking	98%	0.42	<.001	0.05
Relate to Prior Knowledge	97%	0.81	<.001	0.05
Reading Activities	96%	0.81	<.001	0.05
Multimedia Resources	91%	0.71	<.001	0.05
Affective	98%	0.30	<.001	0.04
Other	86%	0.14	<.001	0.03

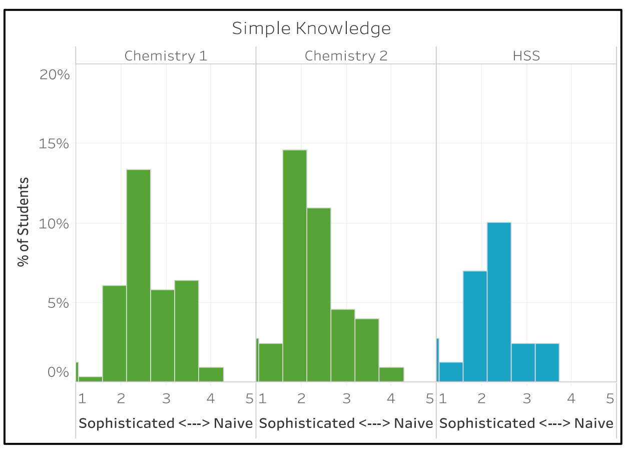
Appendix C


Innate Ability
Chemistry 1
Chemistry 2
HSS
% of Students
20%
15%
10%
5%
0%
1 2 3 4 5
Sophisticated <---> Naive
Sophisticated <---> Naive
Sophisticated <---> Naive


Certain Knowledge
Chemistry 1
Chemistry 2
HSS
% of Students
20%
15%
10%
5%
0%
1 2 3 4 5
Sophisticated <---> Naive
Sophisticated <---> Naive
Sophisticated <---> Naive


Quick Learning
Chemistry 1
Chemistry 2
HSS
% of Students
20%
15%
10%
5%
0%
1 2 3 4 5
Sophisticated <---> Naive
Sophisticated <---> Naive
Sophisticated <---> Naive


Omniscient Authority
Chemistry 1
Chemistry 2
HSS
% of Students
20%
15%
10%
5%
0%
1 2 3 4 5
Sophisticated <---> Naive
Sophisticated <---> Naive
Sophisticated <---> Naive


Simple Knowledge
Chemistry 1
Chemistry 2
HSS
% of Students
20%
15%
10%
5%
0%
1 2 3 4 5
Sophisticated <---> Naive
Sophisticated <---> Naive
Sophisticated <---> Naive