Examining and Supporting Domain Identification and Student Interest in First Year College Students

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ABSTRACT

Students entering college with a pre-selected major have often developed some beliefs and knowledge related to their major. Domain identification (DI) and interest are two constructs that could be particularly useful to researchers and practitioners examining the first year experiences of college students within their prospective major. This dissertation examines how first year college students and their professors perceive DI and interest in a prospective science major within the context of courses designed to introduce students to their major.

This dissertation uses a manuscript format to examine DI and interest through theoretical analysis and the lived experiences of first year college students and their professors. The theoretical manuscript (Chapter 3) compares the theory and research supporting Osborne and Jones' model of DI as well as Hidi and Renninger's (2006) and Krapp's (1999, 2002) models of interest development. The two empirical manuscripts (Chapters 4 and 5) qualitatively explore perceptions of first year college students and their professors by focusing on the following areas: (a) first year college students' perception of their DI and interest in their prospective major, (b) professor's perceptions and support for their first year students' DI and interest in a prospective science major, and (c) the similarities and differences between these perceptions.

Taken as a whole, the findings of these manuscripts highlight the theoretical and practical distinctions between the two constructs. Although the models are similar in framing DI and interest as value-based concepts that develop through experience, they each possess a distinct theoretical framing and definition for value. This distinction between the value components of DI and interest is emphasized in the students' descriptions of their current major's relevance to their future goals and aspirations. Themes emerging from both of the qualitative studies are generally consistent with Osborne and Jones' (2011) model of DI; however, the findings of these studies did not fully align with Hidi and Renninger's (2006) model of interest. The comparison of student and faculty perceptions provided support for some methods the professors used to encourage the development of DI and interest in their students.

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Attributions

Portions of Manuscript 1 (Chapter 3) are based on the book chapter, “Fostering students’ identification with mathematics and science using principles from the MUSIC Model of Academic Motivation” (Jones, Ruff, & Osborne, in press) which will be published in the forthcoming book *Interest, the Self, and K-16 Mathematics and Science Learning* (Renninger & Nieswandt, in press). Drs. Brett Jones (Virginia Tech) and Jason Osborne (University of Louisville) provided intellectual contribution to the development of the discussion included in Manuscript 1.

Dr. Brett Jones is named as the second author on Manuscript 3. He aided in the structuring of the discussion and conclusions sections and in editing the manuscript.

Table of Contents

Acknowledgements iii
Attributions iv
Table of Contents v
List of Tables ix
List of Figures x
Chapter 1: Introduction 1
Rationale 2
Domain Identification 2
Interest 4
Intersections between domain identification and interest 5
Incorporating the perceptions of professors 6
Research Questions 6
Outline of Dissertation 7
Significance of the Research Project 8
Assumptions and Limitations 8
Reflexivity 8
Volunteer Bias 9
Chapter 2: Review of Literature 10
Domain Identification 10
Operational Definitions of Identification 12
Valuing and self-esteem 12
Valuing and belonging 12
My Analysis of the Operational Definitions 13
Models of Academic Identification 14
Domain identification 14
Identification with academics 17
Participation/Identification model 25
Identification with school 27
My Analysis of the Models of Academic Identification 30
Impetus for model development 30
Value 31
Academic performance 33
Sense of belonging 34
Extent to which identification is filtered through the individual's perceptions 35
Academic Identification in a First Year Context 37
Student Interest 39
Four-Phase Model of Interest Development 40
Phase 1: Triggered situational interest 42
Phase 2: Maintained situational interest 42
Phase 3: Emerging individual interest 44
Phase 4: Well-developed individual interest 45
Person-Object Theory of Interest 46
Interest development within the POI 47

Analysis of Models of Interest Development 48
Prior experiences....49
Knowledge component 49
Value....50
Development of interest and transition between phases....50
Chapter 3: Intersections and overlaps: A theoretical examination of domain identification and student interest (Manuscript 1) 53
Abstract....54
Domain Identification....56
Antecedents of Domain Identification....57
Consequences of Domain Identification....58
Alternative Models of Identification....59
Academic identification....59
Identification with school 60
Comparison of Models of Identification....60
Value....61
Academic performance 61
Sense of belonging....61
Focus of identification 62
Relating Alternative Models of Identification With Interest....62
Interest....63
Four-Phase Model of Interest Development....64
Person-Object Theory of Interest....66
Analysis of Models of Interest Development 68
Prior experiences....69
Knowledge component 69
Value....70
Development of interest and transition between phases....70
Intersections Between Domain Identification and Student Interest....72
Similarities Between Domain Identification and Interest....72
Value-based concepts....72
Awareness....73
Differences Between Domain Identification and Interest....73
Construct components.....73
Focus of interest....74
Definition of value....74
Points of Overlap and Divergence....75
High domain identification and low individual interest 75
Low domain identification and high individual interest....76
Conclusions and Future Research....77
References....79
Chapter 4: Development of Domain Identification and Interest in First Year Science Majors (Manuscript 2)....86
Abstract....87
Theoretical Background....89
Domain Identification....89

Interest....92
Research Question....94
Method....95
Research Design....95
Working Definitions....95
Participants....96
First Year Experience Courses....96
Data Collection....97
Data Analysis....99
Findings....100
Self-Definition in Flux....100
Feeling Competent....102
"I have always been good at…"....103
Getting Better....103
"The person that people go to"....104
Feeling less competent....105
Expressing Interest Through Enjoyment....107
My favorite class....108
Enjoyable experiences....109
Social experiences....110
Keeping Things Relevant....112
Important to me now....112
Relevance within the major....113
Planning for careers....114
When relevance trumps interest....115
Discussion....116
Domain Identification....116
Interest....119
Where Domain Identification and Interest Diverge....121
Relevance, selective valuing, and stored value....121
Separating individual interest from academic majors....122
Conclusion and Implications....124
Theoretical Considerations....124
Practical Considerations....126
Future Studies and Limitations....127
References....128
Chapter 5: Supporting Student Interest and Domain Identification in Science Majors: Faculty Perceptions of First Year College Students' Domain Identification and Interest Development (Manuscript 3)....134
Abstract....135
Theoretical Framework....137
Interest....137
Domain identification....139
Antecedents of domain identification....140
Consequences of domain identification....141

Influence of Social Support in the Development of Interest and Domain Identification 142
Research Questions 143
Method 143
Research Design 143
Working Definitions 144
Participants 144
Course Descriptions 145
Data Collection and Analysis 145
Findings 146
Building on Prior Experiences and Significant Others 147
Biochemistry student profile 147
Physics student profile 148
Thinking Like a Scientist 149
Encouraging big picture understanding 150
Early experiences in domain thinking 151
Biochemistry 151
Physics 152
Making Connections With Research and Researchers 154
Informal mentoring 154
Access to research opportunities 155
Summary 156
Discussion 158
Interest 158
Professors' beliefs 158
Supporting interest through course design 159
Differences from theory and other interest research 160
Domain Identification 161
Professors' beliefs 161
Supporting identification through course design 162
Comparing Faculty Perceptions with Student Beliefs 164
Relevance to future goals 164
Understanding the relevance of coursework 165
Implications and Conclusions 166
References 168
Chapter 6: Summary, Conclusions, and Future Research 174
Summary 174
Conclusion 176
Future Research 178
References 181
Appendix A: Interview Guides 193
Appendix B: Selective Valuing Examples 200
Appendix C: Code Mapping Tables 201

List of Tables

Table 1: Comparison of Key Aspects of the Four Models of Academic Identification 32

Table 2: Comparison of Key Aspects of the Four Models of Academic Identification 63

Table 3: Comparison of Key Aspects of the Two Models of Interest Development.....69

Table 4: Student Participant demographics 96

Table 5: Changes in Student's Science Major Prior to First Interview 101

Table 6: Beliefs Associated with Theme of Building on Prior Experiences and Significant Others 157

Table 7: Instructional Strategies Associated with Themes of Thinking Like a Scientist and Making Connections 157

List of Figures

Figure 1. Model of academic identification adapted from the text of Steele (1997).....16

Figure 2: Osborne and Jones' (2011) model of domain identification.....22

Figure 3: Participation/Identification Model adapted from Finn (1989).....25

Figure 4: Model of identification with school adapted from the text of Voelkl (1997).....28

Figure 5. Antecedents and Consequences of Domain Identification (adapted from Osborne & Jones, 2011) 57

Figure 6. Model of a student's physics identification (adapted from Osborne & Jones, 2011)....91

Chapter 1

Introduction

When students arrive for their first year of college, they bring with them prior educational experiences that shape their perceptions of the academic experiences they encounter at a collegiate level and inform their initial choices in college (Astin, 1993; Thompson, 2007; Tinto, 1993). Students who enter college with a pre-selected major have chosen their major based on a variety of academic and social experiences outside of the college context. They have already developed some beliefs, knowledge, interests, and values related to their major. They likely can see themselves fitting into the major and have probably started to make it part of their identity. In examining the first year experiences of college students within their prospective major, domain identification and interest are two motivation constructs that could be particularly useful to researchers and practitioners.

Domain identification describes "the extent to which an individual defines the self through a role or performance in a particular domain" (Osborne & Jones, 2011, p. 132), whereas interest encompasses both an individual's affective and cognitive engagement with a domain, as well as the individual's predisposition to re-engage with the domain (Renninger, 2010). In an educational context, a domain can be defined generally, such as "academics", or more specifically as a school subject (e.g., math or science) or academic discipline (e.g., engineering or biochemistry). Domain identification and interest are constructs that develop from an individual's educational and social experiences and influence later academic outcomes (Harackiewicz, Durik, Barron, Linnenbrink-Garcia, & Tauer, 2008, Osborne & Jones, 2011; Renninger, 2010). Additionally, both of these constructs focus attention on the impact of the

value that an individual holds for a domain on later academic, social, and emotional outcomes (Renninger, 2010; Renninger & Hidi, 2011; Walker, Greene, & Mansell, 2006).

The initial courses that undergraduate students take in their prospective major provide them with an opportunity to increase their domain knowledge and the value they hold for the domain. Ideally, these courses provide students with an opportunity to envision themselves within the domain of their major. Through their initial courses, students have academic and social experiences that may reinforce, negate, or cause them to re-evaluate their prior experiences and perceptions (Harackiewicz et al., 2008). In each of these cases, students' interest in and identification with the major may further develop or weaken.

Rationale

Although domain identification and interest have been examined within a college population, I designed my dissertation to explore these two constructs within the context of the transition of first year students into their prospective major. Particularly, my purpose was to examine how first year college students and their professors make meaning of interest in and identification with the prospective major within the context of courses designed to introduce students to their prospective majors. Understanding factors that influence students' interest in and identification with the major are especially important in some majors, such as those in science, because there is currently a lack of graduates in those fields. A better understanding of why students choose to stay or leave the major during their first year is critical to retaining students in these majors.

Domain Identification

Existing research on domain identification examines different areas of domain identification such as academic identification, math identification, or engineering identification

(Jones, Paretti, Hein, & Knott, 2010; Osborne, 1997b; Osborne & Walker, 2006; Schnittka, Brandt, Jones, & Evans, 2012). Although theoretical models provide a description of how the development of domain identification should occur, further research is needed to understand how students develop different domain identifications (Osborne & Jones, 2011; Voelkl, 1997). My research study focused on students who are entering college with a pre-selected major and participating in an introductory course related to their major, as these students had potentially begun to develop some level of identification with their major.

Researchers have tended to use quantitative, self-report questionnaires and large-scale datasets to develop an understanding of domain identification in relation to other motivation and performance constructs (Osborne 1997a, 1997b; Voelkl, 1996, 1997). These studies tend to use one of a small set of measures of domain identification. However, two of the more widely used measures of domain identification (Osborne, 1997b; Voelkl, 1996) are based on different operational definitions of identification (identification with academics, Osborne, 1997b; and identification with school, Voelkl, 1996). The authors of both of these measures report the need for improved measurement of the construct, as do Osborne and Jones (2011) in their review of domain identification. In addition, the language used in these measures, though derived from the operational definitions and theoretical models of identification, is similar to the language in items of several related constructs such as academic self concept, importance, interest, and attainment value (Wigfield & Cambria, 2010). Examining how students talk about their identification with the prospective majors could provide a basis for revisions to current measures or the development of new measures of domain identification rooted in both theory and the experiences and perceptions of individuals.

Interest

Much of the research on interest as a motivation construct has focused on the types of activities that trigger or "catch" interest and students' responses to triggered interest (Alexander, Kulikowich, & Schulze, 1994; Hoffman, 2002; Lipstein & Renninger, 2007; Mitchell, 1993). More recent research has focused on the development of interest, particularly how individuals move through the situational and individual interest phases of the Four Phase Model of interest proposed by Hidi and Renninger (2006) and the methods by which others (e.g., parents, teachers, peers, mentors) can influence or support this development (Barron, 2006; Kunter, Baumert, & Köller, 2007; Pugh, Linnenbrink-Garcia, Koskey, Stewart, & Manzey, 2010; Renninger, 2010; Renninger & Hidi, 2011; Thoman, Sansone, Fraughton, & Pasupathi; 2012). Hidi and Renninger's (2006) model of interest integrated prior research on situational and individual interest with researchers examining two levels of situational interest (triggered and maintained) and two levels of individual interest (emerging and well developed).

The first year of college is a transition point for many students and provides a context for examining how interests develop or change within the student. Harackiewicz et al. (2008) reported that that interest development in introductory courses was related to both academic performance and later course choice of college students who participated in an introductory psychology course. They used self-report measures and quantitative analysis of situational and individual interest in their study. Rather than using quantitative measures to examine the relationships between interest and other concepts, my dissertation research includes qualitative studies that explore the nuances of how students experience, reflect upon, and describe their interest in their prospective major.

Intersections Between Domain Identification and Interest

Domain identification and interest are similar constructs that share many dimensions. Domain identification and interest both develop through the experiences (academic or otherwise) of individuals within a specific domain (Renninger, 2009). Both constructs include, at least in part, the value an individual holds for a domain. As value-based constructs, domain identification and interest are different from motivation constructs based on self-belief. Belief constructs such as self-efficacy and academic self-concept are based on individuals' perceptions of their level of skill (Dennison, Zarrett, & Eccles, 2007; Pintrich, 2003; Wigfield & Cambria, 2010). These perceptions are related to and can impact the value that individuals develop for a domain, but belief constructs do not describe the underlying value or importance of a domain to an individual. Finally, within both domain identification and interest, as individuals develop a greater value for the domain through experience they begin to self-identify as being part of the domain (Osborne & Jones, 2011; Renninger, 2010).

The two constructs have a high level of similarity, but they are theoretically different. Whereas value for the domain is the key component of domain identification[1] (Osborne, 1997b; Osborne & Jones, 2011), the interest construct incorporates affective and cognitive components as well as value. Interest is initially engaged through an emotional response to an activity and increases as an individual develops content knowledge within the domain. Positive affect and increasing domain knowledge then lead the individual to develop value for the domain (Linnenbrink-Garcia et al., 2010; Renninger, 2010). Thus, while the two constructs overlap, particularly when describing individual interest, they are theoretically different. However, the

[1] Voelkl (1997) also includes sense of belonging within a model of identification with school. See the literature review section of this document for a description of this alternative model of identification.

concepts have rarely been examined together to determine whether individuals, particularly in their lived experience, distinguish between interest and domain identification when reflecting on the level of value that they hold for their prospective major.

Incorporating the perceptions of professors

Researchers of both domain identification and interest have noted the influence of others (e.g., teachers, parents, peers, mentors) on the development of the constructs (Barron, 2006; Kunter et al., 2007; Osborne & Jones, 2011; Pugh et al., 2010; Renninger, 2010; Renninger & Hidi, 2011; Steele, 1997; Thoman et al., 2012). Prior studies within these two constructs have examined the impact of teaching strategies on interest (Kunter et al., 2007), the impact of instructors' domain interest on their students' level of interest (Long & Hoy, 2006), and the role of teachers from the perspectives of students (Jones, Osborne, Paretti, & Matusovich, 2012; Long & Hoy, 2006). However, research is needed to examine teachers' perceptions of their students' interest and domain identification. A better understanding of teacher perceptions and where these perceptions overlap students' self-perceptions of interest and identification is needed to provide a stronger basis to design interventions and improve instructional strategies to support development of interest and identification in the science domains.

Research Questions

I designed the present research to examine the motivation constructs of domain identification and interest through the individual perspectives of first year college students and their professors in the domain of science. The studies involved in my dissertation were framed by a set of research questions that guided the process of data collection and analysis:

- **RQ 1:** How do first year college students perceive their interest in and identification with their prospective science major?

- **RQ 2:** How do professors of first year students perceive their students' interest in and identification with their prospective science major?
- **RQ 3:** How do professors support first year students' interest in and identification with a prospective science major?
- **RQ 4:** How are the perceptions of students and faculty related to the prospective science major interest and identification similar and different?

Outline of Dissertation

This dissertation follows a manuscript format that is different from most traditional dissertations in that it includes three complete manuscripts. In Chapter 2, I present a literature review providing a background and theoretical framework for the three manuscripts that follow. Chapters 3, 4, and 5 include the three manuscripts: a theoretical manuscript and two empirical studies. Chapter 3 (Manuscript 1) closely examines the constructs of domain identification and student interest, elucidating the overlaps, intersections, and gaps between these two concepts. Chapter 4 (Manuscript 2) is a qualitative examination of first year college students' perceptions of their own identification with and interest in their prospective science majors. The participants of this study were first year college students who had chosen to major in the science domains of physics or biochemistry. Chapter 5 (Manuscript 3) is a qualitative examination of how the faculty within first year courses for biochemistry and physics majors perceive their students' development of identification with and interest in physics or biochemistry. This study also integrated the emergent themes from the faculty interviews with the themes emerging from the student interviews in Chapter 4 in order to compare the faculty perceptions of student interest and identification with their students' self-perceptions.

Significance of the Research Project

The studies I conducted provide a more nuanced view of the constructs of domain identification and student interest. The theoretical manuscript provides a close comparison of current models of the concepts. Examining domain identification and interest using a qualitative methodology provides a better understanding of how students and professors reflect upon and describe their identification with and interest in a domain. Understanding the perceptions of students also helps to clarify how these constructs develop within students. Finally, by focusing on the perceptions of students and professors, I have developed a better understanding of the intersection between domain identification and interest in the lived experiences of first year college students.

Practically, developing a better understanding of how students and professors perceive domain identification and interest provides researchers and practitioners with more information for developing interventions and instructional strategies to support the constructs. These studies also provide findings about the elements of first year introductory seminar courses that faculty and students perceived supportive of the development of interest in and identification with the domain of their prospective major.

Assumptions and Limitations

Reflexivity

During the data collection phase of this dissertation, I worked as a graduate assistant in the Office of First Year Experiences at Virginia Tech and helped to support *Pathways to Success* courses for both freshman and transfer students. In addition, I spent several years reading about and participating in studies related to domain identification. As a researcher, I sought to remain cognizant of my own biases and to remain open to the themes that emerged from the data.

Volunteer Bias

Student participants in the qualitative study volunteered to be interviewed. These students' experiences and perceptions should not be considered as representative of other students in the course.

Chapter 2

Review of Literature

The purpose of this literature review is to provide a background and theoretical framework for the manuscripts that follow in Chapters 3, 4, and 5. The review is divided into three sections. The first section describes the models and research associated with domain identification. The second section examines literature related to domain identification within a first year college context. The third section describes the models and literature related to the development of interest within an educational setting.

Domain Identification

The study of domain identification, or the valuing of a specific academic, vocational, or relational domain, can provide researchers examining college student development with a framework to examine how students develop an identity related to their major. The concept of domain identification provides researchers and practitioners with a narrowly focused perspective of identity development. For those interested in how experiences in college impact students from the first college courses through the choice of career, examining domain identification may provide more specific outcomes than examining an individual's holistic identity development.

Domain identification has emerged from an alternative conception of what comprises an individual's identity; in other words, how we answer the question "Who am I?" This model of identification is based on an alternative view of the self as compared to the psychosocial and cognitive development theories of identity development. In those global perspectives of identity development, the Self is viewed as a whole; whereas domain identification is rooted in the perception that an individual's Self is actually comprised of multiple selves (James, 1890). Psychosocial and cognitive development models are rooted in or in response to Erikson's (1968)

theory of development over the lifespan where models of domain identification developed from William James' view of the multiple selves.

In this section, I will closely examine the literature related to domain identification. I will first explore the two different perceptions of the concept (i.e., domain identification and identification with school) that have developed in the past two decades. I will examine the operational definitions, models, and outcomes related to identification in these different conceptualizations and reflect on the aspects of identification that overlap and differ between the two conceptualizations. Finally, I will connect domain identification to the context of first year student development by discussing how identification with academics domains may relate to current models of college impact.

Domain identification is a concept that has been used within two different lines of motivation research: the study of stereotype threat and engagement. When researchers are examining domain identification through the lens of stereotype threat theory, they tend to use the conceptualization put forward by Steele (1992, 1997) and Osborne (1995, 1997b). However, researchers who are examining domain identification through the lens of engagement (particularly emotional engagement) tend to use the conceptualization of identification with school put forward by Finn (1989) and Voelkl (1996, 1997). Researchers tend to use very similar terminology when referring to identification, such as identification with academics, identification with school, academic identification, or, more broadly, domain identification. Nonetheless, the two conceptions describe two different ways to perceive identification from the foundation level of the operational definition, through how the concept is modeled, and finally on where the emphasis is placed in the results of studies.

Operational Definitions of Identification

Valuing and self-esteem. Steele (1992) first connected domain identification to the study of academic motivation by placing academic identification as a central element of stereotype threat theory (Osborne, Keller, & Jones, 2007). Stereotype threat theory describes the depressed performance of individuals from stigmatized groups (groups associated with a negative stereotype) in high stakes performance contexts due to the anxiety of confirming a negative stereotype. In describing stereotype threat theory, Steele (1997) was clear to note that in order to be affected by stereotype threat, an individual must have a high identification with the domain. He defined academic identification as the extent to which an individual forms a relationship with the "domains of schooling," so that his or her self-esteem or self-regard depends in large part on their achievement in academic domains (Steele, 1997, p. 616).

Osborne and his colleagues (e.g., Osborne & Jones, 2011) further refined the definition of identification with academics as the *selective valuing* of a domain as important to the self-concept or self-esteem of an individual. This definition is based in the symbolic interactionist conception of self-esteem, in which the feedback an individual receives from the environment (in terms of academic performance, among other things) is filtered through the individual's perceptions of the outcomes and evaluation of the importance of the domain to their self-esteem (Osborne & Jones, 2011). Thus, individuals are impacted more by their performance (whether it is high or low) in a domain that they value greatly, rather than in a domain in which they place little value (Osborne, Walker, & Rausch, 2002).

Valuing and belonging. Finn (1989) and Voelkl (1996, 1997, 2012) have suggested a different definition of identification that is based with the study of the process of withdrawal from school. Finn (1989) first put forward the definition of identification with school as one part

of the Participation/Identification model describing how students are drawn to engage with or withdraw from school. Finn (1989) describes identification as how an individual perceives the congruence between the self and an object (e.g., institution, family, group). Students who are identified with school feel that they are "discernibly part of the school environment and that school constitutes an important part of their own experience" (Finn, 1989, p. 123), thus the student both feels a sense of belonging with the school and values his or her success in school-related experiences. Finn explicitly excludes self-esteem from this definition of identification, as he notes that self-esteem is an individual's judgment of worthiness of the individual's self. Valuing, in this definition of identification refers to the student finding worth in the goals and experiences related to the *institution* of school.

Voelkl's (1996, 1997) definition of identification with academics builds on Finn's definition by adding the element of pride. Voelkl (1997) expands the idea of belonging to include both a sense that one belongs in the school and a sense of pride for belonging in the school. Thus, the membership at the school becomes part of one's self-definition (Voelkl, 1997). Voelkl (1997) also expands the definition of valuing to incorporate both valuing of school as an institution and valuing of the school as a method of personal advancement.

My Analysis of the Operational Definitions

Examining the operational definitions of identification used by this set of researchers highlights several differences in their conceptualizations (see Table 1). Primarily, Finn (1989) and Voelkl (1996, 1997, 2012) include belonging as a component of identification, whereas Steele (1997) and Osborne (1997b) do not. Another key difference between the two conceptions is the connection between identification and self-esteem. For both Steele and Osborne, identification is linked to self-esteem, in that defining the self through the academic domain

serves to link academic achievement/performance to the individual's overall self-esteem. Whereas, Voelkl notes that identification with school shows that an individual has "incorporated it as a significant part of his or her self-concept" (1997, p. 296); Finn explicitly distances his conception of identification from research on self-esteem.

These differences are rooted in how the researchers focus the concept of identification. For both Steele and Osborne, identification describes the relationship between an individual and the "domains of schooling" (Steele, 1997, p. 616), whereas for Finn and Voelkl, identification describes the relationship between an individual and an institution of schooling. Thus, what an individual is identifying *with* is different in the two sets of definitions.

Models of Academic Identification

Regardless of how identification with academics is defined, two aspects are similar in all cases: domain identification is related to both prior academic experiences and future academic outcomes. Steele (1997), Osborne (2004), Osborne and Jones (2011), Finn (1989), and Voelkl (1996, 1997) have all offered explanations or models of how these relationships work that vary in level of complexity, in organization, and in related concepts. As with the operational definitions, Steele's and Osborne's explanations are closely related, as are Finn's and Voelkl's explanations. Also, the model put forward by Osborne can be seen as building on Steele's explanation of domain identification; similarly, Voelkl's model builds on that put forward by Finn.

Domain identification. Steele's (1992, 1997) focus in explaining the precursors and outcomes related to domain identification is to show how identification is impacted by negative stereotypes (see Figure 1). In this explanation, domain identification develops through an individual's perceptions, experiences, and evaluation of the environment (Steele, 1997). Steele

(1997) describes this process as a self-assessment, through which the individual tacitly considers his or her own skills and abilities within the given domain as well as the possibility of succeeding within the domain. Steele makes clear that individuals do not develop a relationship with a domain based purely on interests and prior successes. He proposes that an individual's self-assessment is highly influenced by the perceptions of peers, family, and teachers, who either purposefully or inadvertently encourage or discourage and individual's pursuit of certain academic domains or goals (Aronson & Steele, 2005). This may occur through the level of access a student is given to academic experiences and support, the level of acknowledgement of academic successes, and the climate of the academic setting (e.g., is the climate within the academic context warm and encouraging or chilly and discouraging; Aronson & Steele, 2005). An individual may be less likely to form or maintain domain identification if she or he does not feel a sense of belonging or that people similar to him or herself (e.g., in gender, race, ethnicity) have been successful.

Once formed, Steele (1997) proposed that domain identification should help students sustain their academic motivation through the ups and downs of academic experience. This level of stability has been observed in laboratory measures of domain identification during studies of stereotype threat where the domain identification of participants was not significantly decreased even in the context of a primed stereotype threat (Lesko & Corpus, 2006; Steele & Aronson, 1995; more recently mentioned in Osborne, Kellow, & Jones, 2007). However, domain identification can be impacted when students suffer a series of negative academic experiences. In order to protect the individual's overall self-esteem, he or she may begin to *devalue* the domain by claiming not to care about the domain or to *discount* performance by claiming that the

test/assessment was biased against them (Aronson & Steele, 2005; Schmader, Major, & Gramzow, 2001; Steele, 1997).

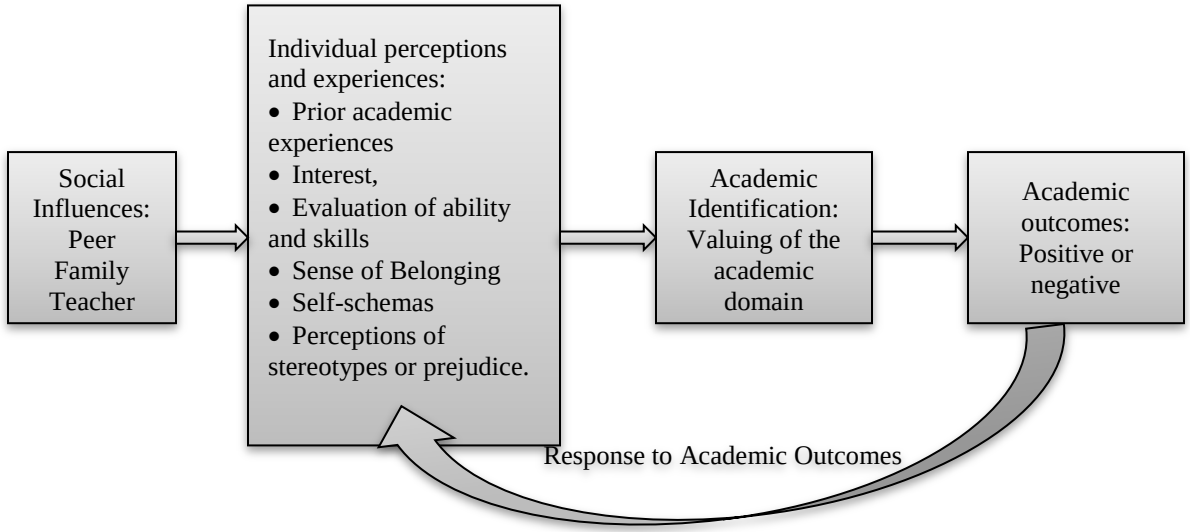

Figure 1. Model of academic identification adapted from the text of Steele (1997).

In a study of college students, Schmader, Major, and Gramzow (2001) found that, for European Americans and Latino students, devaluing was related to lower academic performance (as measured by GPA); however, for African American students, devaluing was related to perceptions of injustice. Steele posited that chronic devaluing a domain in response to negative outcomes or perceptions may lead the individual to dis-identify with the domain (Steele, 1992, 1997). By dis-identifying with a domain, the individual adjusts the level of value that he or she places in the domain so that negative outcomes or assessments have less impact on the individual's overall self-esteem. Stereotype threat becomes part of the model when an originally highly identified, stigmatized individual receives repeated academic outcomes that appear to

confirm the negative stereotype. As stereotypes emphasize both lack of ability and lack of belonging (Cohen & Steele, 2002), if a student begins to believe that they are confirming a stereotype this brings both their competence and their belonging in the domain into question (Aronson & Steele, 2005; Steele, 1997).

Even though domain identification is a fundamental component of stereotype threat theory, Steele has not proposed a testable model of domain identification. As a result, researchers examining the impact of stereotype threat on domain identification have used a variety of methods to describe and measure identification. These measures frequently ask students to respond to two statements (e.g., I am good at math, Math is important to me) or assume high identification by including only participants who have high SAT scores in the domain (math or verbal) or who are enrolled in vigorous courses in the domain (Aronson et al., 1999; Smith & White, 2001; Spencer, Steele, & Quinn, 1999; Steele & Aronson, 1995). Domain identification has rarely been examined as a dependent variable in stereotype threat studies. The level of domain identification is used primarily in stereotype threat studies to examine how students who are highly identified with a domain respond in high stereotype threat contexts (Keller, 2007; Smith & White, 2001).

Identification with academics. Osborne (1997a, 1997b) shifted a line of stereotype threat research to examine the relationship between domain identification and performance. Rather than experimental studies, Osborne and colleagues examined domain identification through large-scale datasets and longitudinal studies (Osborne, 1995; Osborne, 1997b; Osborne & Walker, 2001). The results of these studies highlight relationships that form the basis for the model of domain identification developed by Osborne and his colleagues (Osborne, 2004; Osborne & Jones, 2011). Through this model, Osborne and his colleagues show the relationships

between domain identification, social and motivational background factors, and academic and behavioral outcomes (see Figure 2).

Osborne (1997b) investigated differences in domain identification among different groups and different academic subjects using National Educational Longitudinal Study (NELS) data for 8th, 10th, and 12th grade students. In this study, domain identification was measured by the correlation between grade point average (GPA) and self-esteem as well as through academic achievement and self-esteem. The results showed that domain identification for most groups tended to decrease over the high school years in almost all academic areas. The correlations were different between different groups (male, female, White, Hispanic, and African American) and within the groups for different academic subjects (math, reading, history, and science). While the correlations between academic achievement and self-esteem decreased for most groups over time, the results for African American males stood out. The correlations between achievement and self-esteem were similar or higher to other groups at eighth-grade and 10th-grade, only science achievement was statistically in 12th-grade and the relationship was negative. Similarly, the relationships between grades and self-esteem were in line with other groups at 8th grade, but began dropping in 10th. By 12th-grade, the only statistically significant relationship was in science.

To examine the possible displacement of self-esteem (shifting identification away from academic domains to other areas) Osborne (1997b) also examined the changes in the correlation between self-esteem and popularity and self-esteem and athletic prowess (both self reported by the student) over the three grades. For African American males, both variables shifted from a non-significant correlation to a significant correlation leading Osborne (1997b) to suggest that this group of students may have been shifting the centrality of different domains, thus as

academic domains became less central to self-esteem, social or athletic domains may have become more central.

The results of this study highlight the relationship between domain identification and background factors related to group, and the possibility for change over time in identification. In addition, Osborne (1997b) showed some level of domain difference in identification in that students could identify with one subject more than another.

Osborne and Rausch (2001) extended the examination of domain identification using the NELS database to study a theorized outcome of academic dis-identification, which is the increased likelihood of withdrawing from school. Hypothesizing that withdrawal from school comes after academic dis-identification, they compared academic identification two years prior, for students who withdrew from school by 10^{th}- or 12^{th}-grade with that of students who remained in school. The results of this study highlight the connection between academic identification and both positive and negative academic outcomes (persisting or withdrawing from school).

Osborne and Rausch (2001) found substantial differences in academic domain identification (as measured by the correlation between GPA and self-esteem) between students who withdrew from school and those who remained. Students who withdrew from school had significantly lower identification with academics two years prior to withdrawing than students who remained in school. This result supports the assertion by both Steele (1997) that withdrawal from school is part of a longer process through which the student shifts away from valuing academics as a part of self-esteem. For students in nearly all gender and race/ethnicity groups, the relationship between GPA and self-esteem was not significant up to two years before they physically withdrew from school. When the groups were compared, students who persisted in school had significantly higher (with the exception of African American 12^{th}-grade males)

correlations and effect sizes for academic identification than their counterparts up to two years prior to withdrawal.

Using NELS dataset, Osborne (1997b) and Osborne and Rausch (2001) were able to test the concept of academic domain identification using large datasets and longitudinal data. However, this method is limited in several ways: (a) the large dataset provides researchers with the capability to examine differences between groups, but this method does not provide the ability to follow individual students; and (b) researchers cannot control the exact measures used or variables included in the large scale datasets, thus rather than use a measure of academic identification, the concept is measured indirectly through the correlation between the measure of self-esteem and self-reported GPA or academic achievement. Nonetheless, the results of these studies do provide insight into differences between groups begin to define some of the relationships in Osborne's model of academic identification.

Osborne (1997a) developed an instrument to specifically measure identification with academics/school. Unlike the studies using large databases, this instrument was designed to examine identification at the level of the individual student, to look at more specific outcomes related to identification with the academic domain, and to provide a tool that could potentially help community colleges to target students with low academic identification for interventions to improve academic outcomes. Entering students were given the School Perceptions Questionnaire and the Rosenberg Self-View Inventory (a measure of self-esteem). The students' GPAs were collected at the beginning of the study, at the end of the first semester, and two years later. Students' academic standing (withdrawn, academic probation, Dean's list) and graduation status were also collected after two years.

Identification with academics significantly predicted GPA after one semester and again after two years, even when controlling for sex, race, and self-esteem. In addition, students at different levels of academic standing had significantly different levels of identification with academics. A high level of identification with academics (as measured upon entering community college) was related to positive academic outcomes such as achieving Dean's List or Honor's standing; whereas a low level of academic identification was related to withdrawal, academic dismissal, or academic probation. The results of this study provide additional support for a relationship between academic identification and positive and negative academic outcomes.

The academic outcomes associated with domain identification were also examined through a longitudinal study of secondary students (Osborne & Rausch, 2001; Osborne & Walker, 2006; Osborne, Walker, & Rausch, 2002). The study followed students for two years after entering a diverse, inner city high school. Entering ninth graders were given a set of questionnaires measuring identification with academics, self-esteem, learning behaviors, and a set of cognitive and motivation constructs. School records were also examined at the end of each school year to gather GPA, days absent, and number of behavioral referrals (Osborne & Walker, 2006).

Osborne and his colleagues found that academic domain identification was related to a number of positive academic and behavioral outcomes. When the various measures were examined at the entry to ninth-grade, identification with academics in students was positively correlated with learning goals and performance goals, as well as with the intrinsic valuing of academics, perceived ability, self regulation, and both deep and shallow cognitive processing (Osborne & Rausch, 2001). When the entire group of students was examined, identification with academics, measured upon entering, was positively related to both ninth- and 10^{th}-grade GPA

and negatively related to ninth- and 10th-grade absenteeism and number of behavioral referrals. These results demonstrate a relationship between academic identification and other motivation constructs. In addition, the researchers showed that the relationship between academic identification and behavioral outcomes encompasses minor occurrences (behavior referrals) as well as the larger outcomes such as withdrawal from school.

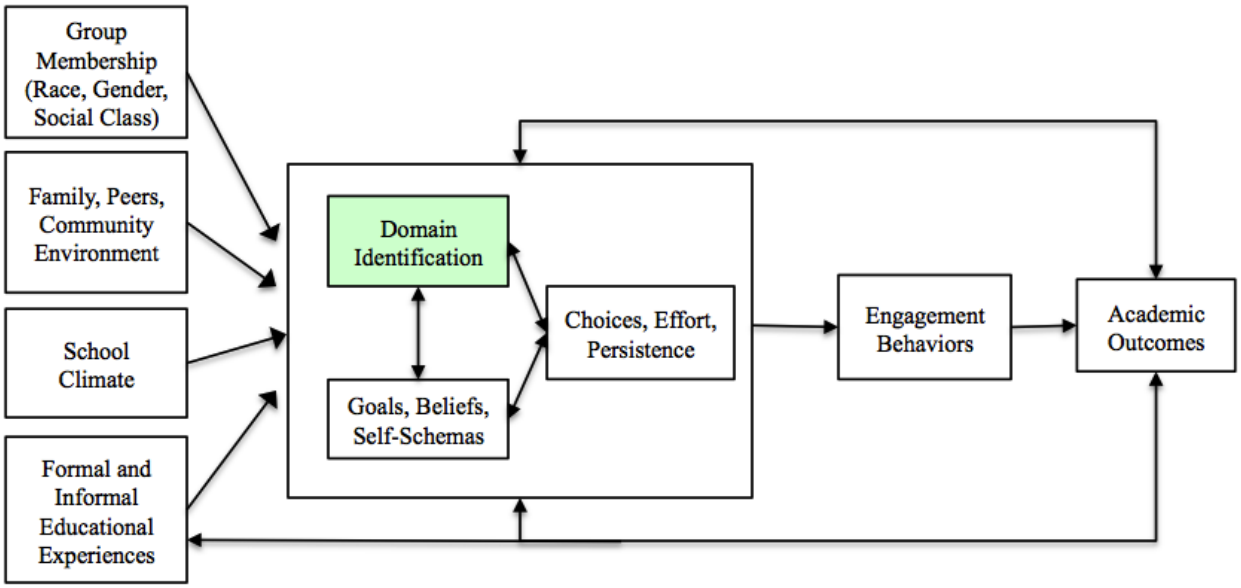

Figure 2: Model of domain identification adapted from Osborne and Jones (2011).

The model of domain identification put forward Osborne and his colleagues describes the process by which a set of social and academic background factors impact domain identification and related motivation constructs which, in turn, impact behavioral and academic outcomes. The background factors in this model of identification developed by Osborne and Jones (2011) are similar to the self-assessments described by Steele (1997). These factors include group membership (e.g., gender, race, ethnicity, class); family, peer, and community environment; school climate; and both formal and informal educational experiences (see Osborne & Jones, 2011 for more information). Through this set of precursors, Osborne's model of domain

identification is linked to other motivation constructs such as a student's feelings of interest, sense of control, belief that the domain is useful for both long and short term goals, and sense of belonging. These motivation constructs can be viewed as aspects of a student's prior educational experiences; their perception of school climate; and the input they receive from their family, peers, and community based on their group membership. As background factors the construct impact the student's development and maintenance of identification with an academic domain (Osborne & Jones, 2011).

This model of domain identification differs from Steele's description of identification in regards to the path from the precursors to the outcomes of identification. Steele and other stereotype researchers describe a fairly direct path linking a set of social and academic precursors to the development of domain identification and then linking level of domain identification to the risk of stereotype threat (Steele, 1997). Osborne and Jones (2011) have created a more complex model of identification which includes the relationship between the academic and social background factors and domain identification but goes farther to show the inter-relationship between identification; effort and persistence; and the goals, beliefs, and self-schemas that are related to academic success. These concepts working in concert are then related to academic engagement and outcomes. Osborne and Jones (2011) hypothesize that, in general, higher identification with academics is closely related to greater effort to succeed; persistence when faced with failure or frustration; and the goals, beliefs, and self-schemas that support academic success. Conversely, low domain identification is related to low effort in the domain; low persistence; and the lack of goals, beliefs, or self-schemas that support academic success. Individuals with low domain identification will not be as motivated to engage in academic

activities, nor will their self-esteem be related to the academic outcomes that they receive whether those outcomes are positive or negative.

Walker, Greene, and Mansell (2006) provided support for this model, showing in a study of upper-level undergraduates that identification with academics was correlated with other motivation and cognitive engagement constructs and was negatively related to amotivation. They found that identification with academics, as measured with Osborne's (1997b) School Perceptions Questionnaire, was statistically correlated with self-efficacy, intrinsic motivation, and meaningful cognitive engagement. Meaningful cognitive engagement was described as relating new information to prior knowledge to construct more complex cognitive structures (Walker et al., 2006, p. 4). Identification with academics was negatively correlated with amotivation, which could be described as the lack of any type of motivation. Thus, individuals who scored high on identification with academics tended to score low on amotivation. Additionally, the researchers, using path analysis, found that identification with academics, along with self-efficacy and intrinsic motivation, predicted meaningful cognitive engagement. These results support Osborne and Jones' (2011) model of identification with academics, both by showing that identification with academics is statistically related to other motivation constructs and by showing that the concept predicts a unique amount of the variance in cognitive engagement.

Osborne and Jones (2011) explain that domain identification is likely cyclical. Thus, while domain identification may be a stable concept, it is not static, and could be impacted by frequent positive or negative academic outcomes. In this way, Osborne and Jones's (2011) model still incorporates the possible impact of stereotype threat. An individual's identification with a domain may decrease if he or she begins to receive academic outcomes that do not reflect his or

her perception of ability or if the climate of the domain begins to emphasize negative stereotypes. Alternatively, this model shows how shifts in school climate or other precursors may also work to increase students' identification with the academic domain (see Osborne & Jones, 2011 for a detailed explanation of strategies to increase identification).

Participation/Identification model. On first view, Finn's (1989) model appears to have many differences from other conceptualizations of domain identification. As noted in the operational definition, identification in this model refers to the institution of school rather than the domain of "schooling" or academics. Additionally, identification with school incorporates both a sense of belonging and value for school. Within this model, participation in academic experiences impacts academic outcomes that in turn impact identification with school (see Figure 3). Teacher quality and ability are also included as variables that are related to participation, academic outcomes, or identification (Finn, 1989). Finn describes the model as recursive or cyclical, so that identification is impacted by the other components of the model, but in turn impacts a student's level of participation.

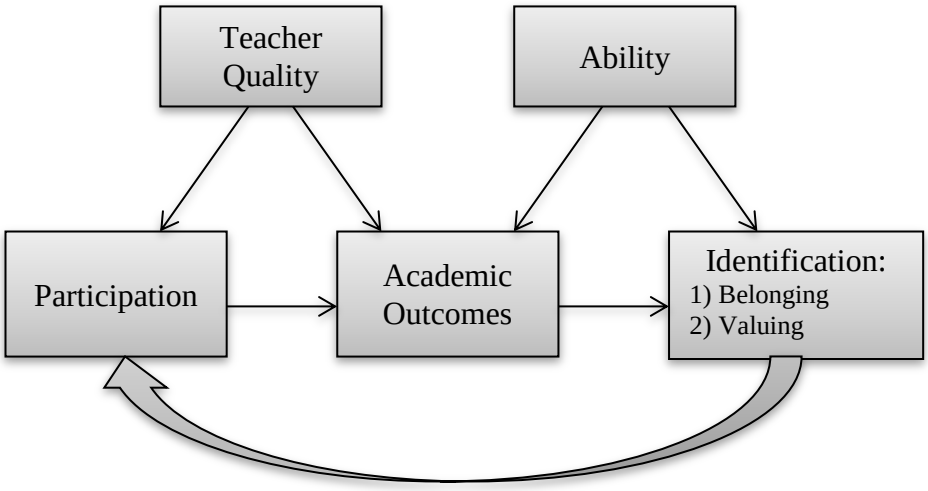

Figure 3: Participation/Identification Model adapted from Finn (1989).

Many of the components of Finn's (1989) model are similar to the previous models. Participation and academic outcomes are aspects of prior educational experiences that are background factors in Osborne and Jones's (2011) model. Teacher quality can be viewed as one aspect of school climate and perceptions of ability are included of Steele's (1997) self-assessments. In the previous models these components were described as precursors to identification, as they are in this model; however, in Steele (1997) and Osborne's (year for referenced model) explanations, identification was related to both academic engagement and/or academic outcomes. Finn's (1989) model describes a more fluid view of identification where identification with school is more directly impacted by academic outcomes and in turn more directly impacts an individual's participation in school activities.

Finn (1989) connects both components of identification with school to other branches of research. Belonging is described as the sense of belonging that an individual feels with the institution. From this perspective, belonging is related to concepts such as attachment, bonding, emotional engagement, and involvement (Finn, 1989; Finn & Voelkl, 1993). Finn (1989) describes valuing as similar to the concept of commitment – in this case an individual's commitment to the role of student (p. 124). Finn also points to research that breaks commitment into two components: commitment to learning and commitment to place. Thus, Finn (1989) suggests that identification is an "internal state" with external manifestations that are exhibited through participation in school experiences (p. 127). Finn connects identification to academic outcomes through the argument that "active participation is the minimal essential condition for formal learning to occur" (1989, p. 127).

Similar to Steele's (1992, 1997) conception of academic identification, Finn's (1989) Participation/Identification model developed from research on student withdrawal from school.

However, whereas Steele focused on the possible negative outcomes related to stigmatized students with high academic identification, Finn's (1989) model suggested that withdrawal was linked to a cycle of lack of participation and low identification. In the Participation/Identification model, nonparticipation leads to unsuccessful school outcomes which lower identification with school. As students cycle through this model, decreasing identification translates to emotional withdrawal from school, whereas decreasing participation translates to physical withdrawal from school (Finn, 1989).

Finn (1989) asserts the need for measures of the different elements of identification with school because his model is based on research of vocational identification. However, Finn's later research on the Participation/Identification model was focused on the examining the participation side of the model that linked participation with engagement among different populations using large-scale dataset and large, longitudinal studies (Finn & Cox, 1992; Finn & Voelkl, 1993).

Identification with school. Just as Voelkl refined Finn's (1989) definition of identification with school, she also refined the model of identification and participation and developed a measure of identification with school (Voelkl, 1996, 1997). This refined view of identification with school is also tightly focused on the relationships between school experiences, identification, and outcomes. In developing this model, Voelkl (1996) incorporated Finn's conceptualization of identification with school and his research on the impact of participation on engagement (Finn & Cox, 1992; Finn & Voelkl, 1993) with the research by Goodenow and Grady on the relationship between a students' sense of belonging and their level of engagement in school, expectation of success, and valuing of schoolwork (Goodenow, 1993; Goodenow & Grady, 1993).

Voelkl simplified Finn's (1989) model by grouping participation and perceptions of achievement together as prior school experiences (see Figure 4). These school experiences then are directly related to identification with school, which is comprised of sense of belonging and value for school. Voelkl (1997) described the outcomes of identification with school as cyclical, wherein students who are more highly identified with school are more likely to have positive experiences (e.g., academic achievement and participation) that increase their sense of belonging and value for school, and consequently, their identification with school.

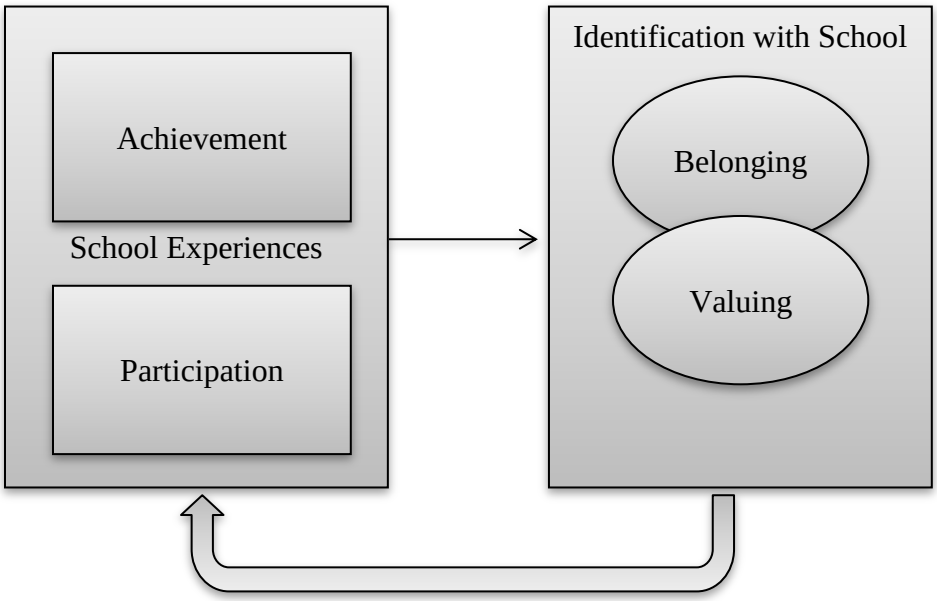

Figure 4: Model of identification with school adapted from the text of Voelkl (1997).

Voelkl (1997) developed the Identification with School Questionnaire to measure individual's levels of valuing of school and sense of belonging with school. Using this instrument, she has tested aspects of identification with school with middle and high school student samples. She found, similar to Osborne and Walker's (2001) findings of with high school students, that race and gender impacted student's identification with school. Among a large sample (~3,500) of eighth-grade students from Tennessee and contrary to popular assumptions,

African American students had statistically higher levels of identification with school than white students, and female students had higher levels of identification with school than male students. White, male students had a significantly lower identification with school than all other groups (Voelkl, 1996).

Voelkl (1997) then compared longitudinal measures of academic achievement and participation among a smaller sample (~1,300 student) of eighth graders from Tennessee with their level of identification with school. Using regression, Voelkl found that while gender, race, forth-grade achievement, and eighth-grade participation predicted a statistically significant, though small, percentage of the variance in identification with school for all students, the results were different when the sample was divided into groups. For African American students, only eighth-grade participation significantly predicted variance in identification, whereas for white students all of the variables (gender, forth-grade achievement, and eighth-grade achievement) predicted variance in identification. These results supported Voelkl's (1997) assertion that there are both achievement and behavioral (participation) precursors to identification with school.

Voelkl and Frone (2001) highlight an outcome related to low identification with school in a study in which they examined the relationships among identification with school, academic performance, academic self-efficacy, and cheating for a small (~300) sample of working, full-time high school students. They found that gender (male), age (younger), lower academic performance, lower identification with school, and lower academic self-efficacy were all related to academic cheating. The students who were both low achieving and had a low identification with academics were most likely to cheat in school, while students with a high identification with school were less likely to cheat regardless of their performance. Voelkl and Frone (2001) connected academic cheating with both fear of failure and a sense of alienation from school.

Thus, students who have a history of negative school experiences (through low academic achievement and academic self-efficacy as well as lack of participation) are more likely to feel alienated from school (with a low sense of belonging and value for academics) and act in ways that violate school rules and procedures. Voelkl and Frone (2001) suggested that improving identification with school can play a role in preventing negative behaviors such as academic cheating. Educators can do so by working to include at risk students in class activities, setting reasonable levels of academic achievement, and ensuring that students' efforts within the classroom do not go un-noticed (Voelkl & Frone, 2001).

My Analysis of the Models of Academic Identification

Domain identification is a concept that is an important component of an individual's academic motivation, and is closely connected to a number of other components of motivation and achievement. Researchers studying identification have approached the concept from several different perspectives by examining the role of identification in stereotype threat theory, in student engagement, in academic motivation, and in student success. Several commonalities emerge when the models are closely examined: the impetus for model development, the abstract level of the value component, and the inclusion of academic performance. However, these commonalities are balanced by two key differences between the models: (1) the inclusion or exclusion of belonging as a component of identification and (2) the internal or external focus of the models (see Table 1).

Impetus for model development. The impetus for examining domain identification, for both Steele (1997) and Finn (1989), was the desire to better understand dis-identification and withdrawal from school. Finn (1989) described identification as one part of the participation-identification model of withdrawal. He suggested that participation in academics leads to

increased academic success and increased identification with school, whereas lack of participation leads to decreased academic success, decreased identification, and increased likelihood of withdrawal from school. Steele (1992, 1997) highlighted the impact of negative stereotypes on domain identification in his description of stereotype threat theory in an attempt to understand why African American students were leaving high school and college. The initial desire to understand why students are emotionally and physically disassociating with academics frames the development of both models with researchers focusing on the relationships between academic environments, academic performance, and theorized reasons for withdrawal or dis-identification.

Value. Aside from the initial impetus for developing a model of identification, these models also connect identification with a sense of value for school, suggesting that students are more likely to continue with their schooling if they value the institution of school or the domain of schooling. Value, in all of these models, describes the abstract value that an individual would have for school, either the domain of school or the institution of school (Smith, Estudillo, & Kang, 2010; Voelkl, 1996). The abstract nature of the valuing component is described in the operational definitions and then manifest in the valuing items included in measures of identification associated with these models. Academic domain identification measures developed by several stereotype threat researchers (Aronson et al., 1999; Keller, 2007; Spencer, Steele, & Quinn, 1999), as well as measures developed by Voelkl (1996) and Osborne (1997) include items asking individual to rate how important the domain is to them, such as: “math is important to me” (Aronson et al., 1999, p. 33), “school is important to life” (Voelkl, 1996, p. 764), and “school is very boring for me” and “I'm not learning what I feel is important” (Osborne, 1997b, p. 63).

Table 1

Comparison of Key Aspects of the Four Models of Academic Identification

Researcher	Components of identification	Operational Definition	What is the individual identifying *with*?	Related outcomes	Where does belonging fit?
Steele	Valuing	• The extent to which an individual forms a relationship with the domains of schooling	Schooling/ Academics as a domain	Academic Performance	Self-Assessment precursor
Osborne	Valuing	• Selective valuing of a domain as important to self-esteem or self-concept	Academics as a domain	Academic engagement and performance	Part of several background factors
Finn	Valuing and sense of belonging	• Sense of belonging with school • Value for success in school	School as an institution	Participation and Academic Outcomes	Component of identification
Voelkl	Valuing and sense of belonging	• Sense of belonging in school and sense of pride for belonging in school • Value for school as an institution and for schooling as a path to personal advancement	School as an institution	Participation and Achievement	Component of identification

By focusing on the more abstract value for the domain or institution, domain identification researchers have distinguished identification from other value-based concepts such as attainment value. Attainment value is the personal value that an individual places on doing well on a task or activity (Eccles, 2009; Eccles & Wigfield, 2000). Eccles (2009) has recently restated her conceptualization of attainment value to connect this concept to identity. In terms of attainment value, an individual places a higher value on tasks and chooses to participate in activities that allow them to "fulfill their identities or are consistent with their identities" (Eccles, 2009, p. 83). Even though Eccles has incorporated identity into her conceptualization of attainment value, the description still remains focused on the task level rather than the domain level (Osborne & Jones, 2011).

Academic performance. In each of these models, domain identification is linked with academic performance; however, the relationship of the two concepts varies among the models. Steele (1997) describes domain identification as directly impacting academic outcomes; Osborne and Jones (2011) also show domain identification leading to academic outcomes though acting in concert with other variables; Finn (1989) and Voelkl (1996) suggest that academic outcomes and achievement impact identification with school, while also noting that the concepts are likely cyclical. The recursive nature of domain identification makes academic performance both a possible antecedent and an outcome. Both Steele (1997) and Osborne and Jones (2011) include prior academic experiences as a background factor leading to identification. Thus, a student's perception of identification with an academic domain is influenced by previous positive or negative academic outcomes. The student's level of identification may then impact current and future academic outcomes from participation in class to performance on high-stakes exams.

Sense of belonging. The sense of belonging is a key component of Finn (1989) and Voelkl's (1996) models of identification with school. A significant portion of each author's literature review is devoted to explaining the importance of belonging to identification, while only one to two paragraphs are devoted to explaining the importance of valuing school. Over half of the items on Voelkl's (1996) Identification with School questionnaire are related to sense of belonging. Yet, neither Steele (1997) nor Osborne (1997a, 1997b) includes sense of belonging as a component of domain identification. This difference leads to the models of identification frequently being selectively used in identification research. At times Voelkl's (1996) model of identification and instrument are cited or used by researchers interested in sense of belonging and engagement (e.g., Wang, Willet, & Eccles, 2011) who do not make reference to Osborne or Steele. Conversely, researchers examining identification in relation to stereotype threat or value refer to the models and instruments used by Steele or Osborne (e.g., Smith, Estudillo, & Kang, 2010; Walker et al., 2006). These studies often have different purposes, and as a result, while the study may refer to identification with academic as a key variable, the aspect of identification that is studied is different.

Steele (1997) and Osborne (1997a, 1997b) do not incorporate sense of belonging as a component of domain identification; however, belonging is not excluded from their explanations of the concept. Steele (1997) describes the individual's sense of belonging within the domain as one of the self-assessments that leads to domain identification. Osborne and Jones (2011) do not explicitly include a sense of belonging within their model of domain identification, but discuss how fostering a sense of belongingness can be an important precursor that can affect one's academic domain identification. In Osborne and Walker's (2001) study, students completed both the value-based School Perceptions Questionnaire and Voelkl's (1996) Identification with

School Questionnaire. The two instruments were highly correlated (r = .78) leading the researchers to combine them into one larger instrument with a Cronbach's alpha of .91.

In contradiction to these findings, Walker, Winn, Arnold, and James (2008) did not find a strong relationship between sense of belonging and academic identification in a recent study of college students. Sense of belonging was measured using Goodenow's (1993) Psychological Sense of School Membership scale and identification with academics was measured using Osborne's (1997b) School Perceptions Questionnaire. Although the researchers found a moderate correlation between belonging and identification with academics (r = .35), belonging was not found to be a statistically significant predictor of identification with academics.

The need for greater understanding of how the sense of belonging is related to domain identification is highlighted by the differences in the placement of sense of belonging among the models and the measurement of belonging in the associated research.

Extent to which identification is filtered through the individual's perceptions. The placement of sense of belonging within the model of domain identification (either as a precursor or component of identification) is indicative of a larger difference between the two conceptualizations of identification to the extent to which the model is filtered through an individual's perceptions of value and sense of belonging.

For both Finn and Voelkl, identification describes the relationship between the individual and an external institution. Finn (1989) noted that self-esteem is an individual's judgment of the worthiness of the individual's self and is shown through the individual's attitudes and actions in relation to him or herself *not* in the attitudes directed toward an external institution (p. 134). Finn and Voelkl have developed models of identification with school that show identification is an internal, latent variable that develops from externally observable and measureable concepts, such

as participation and academic outcomes. Both of these components can be observed through a student's behavior, including involvement in class, performance on classroom assessments, interaction with peers and teacher, and so forth. Finn's research following his presentation of the Participation/ Identification model includes a focus on the connection between participation and academic outcomes (Finn & Cox, 1992; Finn & Voelkl, 1993) with a particular focus on the relationship between observed participation and academic outcome hypothesizing that these show the development of identification.

Voelkl's (1996) Identification with School Questionnaire included a number of questions that appear to measure students' perceptions of sense of belonging with school and value for school (e.g., "I feel proud being a part of my school"; "School is important to life"; "School is one of my favorite places to be"). These items incorporate the student's internal sense of belonging and perception of value. However, even when including statements that gauge the individual's internal sense of pride or value for the institution of school, Voelkl (1996) did not include items that push students to relate the importance of school to their sense of self or self-esteem. The Participation/Identification model provides a broadly focused view of identification with school; however, the model, as described by Finn and Voelkl, does not provide an explanation for why students with similar academic backgrounds and ability may respond differently to the same academic outcome. Even Voelkl's (1996, 1997) initial testing of her measure showed differences between groups in terms of identification with school and the impact of participation on academic outcomes. The Participation/Identification model provides researchers with a model for examining of the aspects of school or class environment that positively or negatively impact student's sense of belonging and value (for the institution), and thus, their identification with the class or institution.

Steele (1997) and Osborne (1997a, 1997b) conceptualize domain identification as the selective valuing of a domain such that an individual's sense of self-esteem is connected to outcomes in the domain. This conceptualization of domain identification stands in contrast with Finn and Voelkl primarily because an individual's response to academic outcomes is filtered through his or her value for the domain. This conceptualization shifts domain identification to an internal mechanism. For Steele (1997) and Osborne (1997a, 1997b), individuals do not develop an identification with an institution; rather, identification becomes the internal construct or filter through which a student's perceptions of a domain, past experiences with the domain, feelings of support from peers and family, and current expectations determine how they will choose to react to an academic outcome.

By approaching the concept of domain identification as an internal construct or filter Osborne and Steele have developed models of identification that embrace the complexity of student's prior social and academic experiences as well as their perceptions about academic domains. In addition, Osborne and Jones (2011) have integrated other motivation constructs known to impact academic outcomes into the model of academic identification making it possible to test the direct and indirect relationships between these constructs.

Academic Identification in a First Year Context

Researchers have begun to examine the role that identification plays in college students' persistence and success with in a domain, such as engineering (Beam et al., 2009; Jones et al., 2010; Ladesic & McClellan, 1995; Rippon, Collofello, & Hammond, 2011) or music education (Jones & Parkes, 2010). Most of the research on identification and domain identity has been conducted in scientific and medical fields. Further, this research has been reported within particular fields, but not as commonly in journals aimed at a more general college student

development audience. For example, a search of the Engineering Village set of online databases returns over 200 articles and conference presentations related to the development of engineering, math, or STEM (science, technology, or engineering) identity or identification in first year students. However, a search of the articles in the *Journal of College Student Development*, one of the top tier college student development journals, returns no articles related to identification with academics or domain identification among first year students. Identity development is a topic that has been frequently explored in the journal as a search of identity and first year students (or freshman) returned over one hundred responses. These articles examine identity through a psychosocial or cognitive development lens (Bergerson & Huftalin, 2011; Cullaty, 2011; Strayhorn, 2011); while the authors frequently place identity development within a social context (e.g., gender, ethnic, racial, or sexual orientation) they do not examine the impact of academic or domain identification on college-related outcomes.

Even though academic identification is not yet part of the student development lexicon, the concept is closely related to vital aspects of college student development and retention. These concepts are all components of a student's involvement and integration into the academic environment (Astin, 1993; Terenzini & Reason, 2005; Tinto, 1993). Osborne's (1997b) study of incoming community college students showed a long-term relationship between identification with academics and engagement related outcomes. As noted above, incoming students with higher levels of identification with academics were more likely to have higher GPAs and higher academic standing both one semester and two years after entering. These findings suggest that students who value schooling as an important part of their overall self, may be more likely to be the students who become engaged and involved in a college setting. In addition, Voelkl and Frone (2001) found that older secondary students who are struggling academically and have low

identification with their school (i.e., who do not value the school or feel that they belong) are most likely to report cheating in an academic setting.

These studies of academic identification are similar to Walton and Cohen's (2007) study of African American computer science students' sense of belonging in an academic setting. Students' perception of their social fit within the academic program impacted their sense of belonging in the program. An intervention with a set of these first year African American students to increase their sense of belonging in their field increased academic outcomes (i.e., GPA) over the control group for at least two semesters following the intervention.

Student Interest

Until recently, the concept of interest was used as an umbrella term to include a range of related areas of study. These areas of study included the examination of external aspects of activities that make some classroom activities more interesting (Hidi & Baird, 1986; Mitchell, 1993**)**, the relationship between more interesting learning activities and learning (Alexander, Kulikowich, & Schulze, 1994; Sansone, Weir, Harpster, & Morgan; 1992**)**, and the exploration of why some learners choose to persist or re-engage with learning content while other students do not (Prenzel, 1992). A theoretical framework dating back to Dewey (1913) connected these lines of study in which interest is related to an object (activity, area of content, or field of study) and engagement with the object of interest provides the learner with a sense of pleasure. This positive emotional response leads the learner to develop a level of personal meaning and value for the object of interest (Dewey, 1913; Schiefele, 1991). Most of the research on interest as a motivation construct has focused on two separate conceptions of interest. Researchers examining *situational interest* examined the types of activities that trigger or "catch" interest with the understanding that this type of interest emerged from specific features in the environment and

may be context specific (Alexander, Kulikowich, & Schulze, 1994; Hidi & Baird, 1986; Hoffman, 2002; Lipstein & Renninger, 2007; Mitchell, 1993; Schraw & Lehman, 2001). Researchers examining *individual interest* defined the concept as a psychological disposition that was consistent within an individual across different environments (Alexander, 2003, Lawless & Kulikowich, 2006; Renninger, Hidi, & Krapp, 1992; Schiefele, 1991). These researchers focused on how the personal interests of learners could impact how they respond to learning situations.

Recently, interest researchers have begun to synthesize the research on situational and individual interest into models of interest development (Hidi & Renninger, 2006; Krapp, 2002; Krapp, 2007). Hidi and Renninger (2006) and Krapp (2002, 2007) have proposed separate, but complementary, models of the development of interest within an educational context integrating research on both situational and individual interest. The developmental process described in these models is drawn from showing situational and individual interest as empirically distinct but highly related concepts (Ainley et al., 2002; Linnenbrink-Garcia et al., 2008; Mitchell, 1993). Hidi and Renninger (2006) and Krapp (2002, 2007) propose methods by which situational interest may develop or grow into individual interest.

Four-Phase Model of Interest Development

Hidi and Renninger (2006) describe interest as a psychological state of engaging both cognitively and affectively with "particular classes of objects, events, or ideas" (p. 112); a predisposition to re-engage with this content over time; and a construct that is comprised of the knowledge, stored value, and feelings related to the content which result from the individual's engagement with the content over time (Renninger, 2010). This working definition integrates aspects of prior operational definitions of both situational and individual interest (Prenzel, 1992; Schiefele, 1991). Hidi and Renninger suggest that the growth in affect or positive feelings, stored

knowledge, and stored value are the key components propelling the development of interest from an externally supported situational interest to an internally supported individual interest. In describing the components of interest Hidi and Renninger define *affect* as the positive (generally) feelings that an individual connects with engagement with a subject matter (Renninger, 2010). They define *stored knowledge* as changes in cognitive structure related to engagement with the content and *stored value* as the combination of feelings of competence and the emotions related to engagement with the content (Renninger, 2010; Schiefele, Krapp, Prenzel, Heiland, & Kasten, 1983).

Development of interest in the Four Phase model of interest is related to the different components of interest. Hidi and Renninger (2006) propose that situational interest is initially triggered by an affective response to an engagement with an activity or piece of content material. This affective response leads individuals to re-engage with the material and in the process develop knowledge related to the specific material and the larger content topic. As this happens, Hidi and Renninger propose that individuals also begin to develop stored value for the content area.

Hidi and Renninger (2006) also integrate situational and individual interest in their Four Phase model of interest development. Hidi and Renninger (2006) propose that the phases of interest development are sequential in that an individual is highly unlikely to develop an individual interest in a content area without initially showing a situational interest in some aspects of the area. However, they do not specify the amount of time that an individual will stay in a certain phase, suggesting that individuals may never move beyond a triggered or maintained situational interest or may move quickly through triggered and maintained situational interest to

levels of individual interest. Individuals may also regress or decrease interest at any phase of interest development if their interest is not supported.

Phase 1: Triggered situational interest. The initial phases of interest are externally supported with the individual initially making an emotional/affective connection with a specific activity or task (Hidi & Renninger, 2006; Mitchell, 1993). This phase of situational interest may be triggered by a structured, in-class educational activity or an informal, unstructured event such as viewing a television show, visiting a museum, or reading a magazine article. Mitchell (1993) described trigger or "catch" activities within a secondary math setting (e.g., group work, puzzles, or computers) as providing "a change of pace or variety to the usual state of affairs" (p. 427). Triggered situational interest may also come from novelty, physical activity, personal relevance, or connection to individual interests (Alexander, Kulikowich, & Schultze, 1994; Palmer, 2009; Renninger, Ewen, & Lasher, 2002; Schraw & Lehman, 2001).

In all of these examples, the affective response is externally supported and leads the individual to pay attention to the content or activity. This phase of interest may be fleeting if the individual's interest is not held or maintained past the initial activity or topic. Renninger (2010) suggests that the external support of interest is important at this stage as the learner may be drawn to the activity or content, but having a low amount of stored content knowledge or value may not pursue the triggered interest further without some level of external support. External support may come from the structure of the activity (e.g., a scaffolded computer program; Hidi & Renninger, 2006**)** or from other individuals.

Phase 2: Maintained situational interest. As an individual reengages with the topic or content her interest may become maintained. Reengagement may be supported through a number of different means. Mitchell (1993) suggested that while students responded to novelty and

variety to “catch” interest, more was needed to “hold” it. Through focus groups with secondary math students, Mitchell suggested that meaningfulness and involvement were two facets of content that held students’ interest beyond a specific activity. Mitchell described meaningful content as the mathematic content that students perceived to be meaningful to their daily lives. Mitchell used involvement to describe the degree to which students felt they were active participants in the learning process. Other researchers have found that students perceived their coursework as more interesting when the instructor used autonomy-supportive teaching methods, such as taking the students’ perspective and providing students with some control over activities (Palmer, 2009; Tsai et al., 2008); when students had the opportunity for social involvement (Barron, 2006; Palmer, 2009); and when students find value or personal relevance in the material (Harackiewicz et al., 2008; Hulleman, Durik, Schweigert, & Harackiewicz, 2008).

The means of support for student interest described by Mitchell and other researchers continues to be primarily external with teachers developing autonomy-supportive coursework or helping students to develop meaningful connections with content. With the help of this external support, Hidi and Renninger (2006) propose that as students reengage with content of interest they begin to develop stored knowledge about the content and stored value for the content to accompany their affective response to the content. The development of value for the content as well as knowledge and interest is necessary for interest to be maintained and develop (Renninger & Su, 2012). Hulleman et al. (2008) found that in studies of using different educational settings (i.e., an introductory undergraduate psychology course and a high school football camp) that students’ perceptions of task and utility value of the content predicted their subsequent interest in the course or satisfaction with the camp independent of prior interest. However, at the maintained situational phase of interest development the student’s interest is still supported

externally through the course structure or social support of teachers or peers; if a student has not begun to develop value for the content in addition to content knowledge, his or her interest may begin to fade if the external support is reduced or removed (Barron, 2006; Hidi & Renninger, 2006; Renninger & Su, 2012).

Phase 3: Emerging individual interest. Hidi and Renninger (2006) propose that as individuals shift from the phases of situational interest to those of individual interest that support for reengaging with the content becomes internally supported. Individuals with an emerging individual interest have developed the positive feelings, stored value, and stored knowledge that lead them to seek opportunities to reengage with the content of interest without relying on external support. Individuals at this stage of interest development begin to self-identify with their content of interest and to more actively seek out learning opportunities. Barron (2006) found variety of methods by which adolescents with developing individual interests take control of their own learning within a topic of interest within a technology setting (e.g., web page development, computer programming, videography). These adolescents were motivated to find text based information related to their interest, create interactive activities, explore media (e.g., experimented with programing or analyzed existing web designs), and seek out opportunities for structured learning, and joined knowledge networks (e.g., joined clubs, found mentors). All of these activities are linked to the desire for knowledge related to the content of interest and are frequently propelled by "curiosity questions." Curiosity questions are self-generated questions that develop as the learner begins to individually explore the content of their individual interest. These questions may not be novel questions within the domain or content of interest, but are novel questions for the individual with an emerging individual interest (Hidi & Renninger, 2006; Renninger, Ewen, & Lasher, 2002).

This phase of interest development provides some challenges for instructors, mentors, and other individuals. At this point, a learner may become very focused on the questions and content within the content that they find most engaging and, paradoxically, may become frustrated in response to constructive feedback (Hidi & Renninger, 2006; Renninger & Su, 2012). These individuals may also continue to experience varying levels of situational interest within their content of interest. As Tsai et al. (2008) found that students with an individual interest in a subject domain showed wide variation in their situational interest in specific assignments. Similarly, Ainley, Hidi, and Berndorff (2002) found that students who enjoyed reading showed more interest in some reading topics than others. Support for individuals at this level of interest is comparable to the support that is needed to help individuals maintain situational interest: learning environments that support the individual's autonomy (Tsai et al., 2008); provide challenge (Renninger, 2000); and in which the individual has the time, freedom and resources needed for learning (Barron, 2006).

Phase 4: Well-developed individual interest. Individuals with a well-developed individual interest actively reengage with the content or domain of their interest over time (Hidi & Renninger, 2006). Similar to the prior phase, individuals with a well-developed individual interest generate questions and seek out knowledge related to their interest and to persevere when faced with frustration (Renninger & Hidi, 2002). As noted earlier, key aspects of interest development in the Four-Phase model are stored knowledge, stored value, and affect. Stored knowledge enables individuals with a well-developed individual interest to develop more strategies completing interest-related tasks (Alexander & Murphy, 1998) and more easily learn new information related to the area of individual interest (Alexander, 2003; Lawless & Kulikowich, 2006).

Harackiewicz et al. (2008) examined student interest and goals over time for a cohort of students participating in an in an introductory psychology course. They found that an interest the domain of psychology at the beginning of the course was reciprocally related to mastery goals over time. Students who entered the course with an interest in psychology were more likely to develop mastery goals during the course and more likely to have continued interest in the domain when measured again several semesters after completing the original course. Harackiewicz et al. (2008) also found that students with high initial interest as well as high background knowledge in psychology were significantly more likely to go on to major in psychology after completing the introductory course than those with a high initial interest but low background knowledge.

Person-Object Theory of Interest

Krapp (2002, 2007) has integrated the study of situational and individual, or personal, interest through the Person-Object Theory of Interest (POI). This model has emerged through the work of a number of European interest researchers and places the development of personal interests within the framework of personality development (Krapp, 2002). The development of personal interests is integrally linked to an individual's developing "self" during ontogenesis (2002). The key aspect of the POI is the relationship between the person (P) and the object of interest (O). Whereas Hidi and Renninger (2006) describe interest as being primarily focused at the content or domain level (particularly for individual interests), Krapp (2007) has a more open definition of interests referring to "concrete things, a topic, subject-matter, an abstract idea, or any other content of the cognitively represented life-space" (p. 8).

This relationship between the person and the object of interest is composed of *feeling-related valences* and *value-related valences*. Feeling-related valences encompass the emotions, primarily positive, that an individual derives in relation to the interest object; whereas value-

related valences focus on the point at which the individual's value for the object of interest is aligned with the general "attitudes, expectations, and values" by which the person defines him or herself (Krapp, 2002, p. 388). The POI is focused on the current relationship between an individual and his or her object of interest. For an individual to develop an interest in math, the individual must have value and feelings for math that are based on the current relationship not in relation to other domains (e.g., valuing math because it is an important part of physics) or future events (e.g., valuing math because skill in math is a requirement for entrance into an engineering major; Krapp, 2002).

Interest development within the POI. The POI illustrates three potential ontogenetic steps of interest development during which an individual moves from the first occurrence of situational interest to a stabilized situational interest and finally to an individual interest. Similar to Hidi and Renninger (2006), Krapp (2002) relates the initial steps of situational interest to Mitchell's (1993) "catch" and "hold" facets. During the initial step the individual's interest is triggered by an external stimuli (first occurrence). Krapp (2002) describes the second step as a form of working interest, in which the individual's connection with the object of interest remains more or less enduring over a period of time and across different learning situations. Similar to Mitchell (1993), Krapp (2002) suggests that in order for learning situations to sustain an individual's interest he or she must perceive the learning as "meaningful." Krapp (2002) describes the development of individual interest as a rare occurrence that happens when an individual integrates the interest into their self-esteem and identifies "with the goals, values, actions, and topics" related to the object of interest (p. 400).

In describing the POI, Krapp (2002) refers to a number of large-scale studies of adolescents that seem to suggest that interest for academic subjects decreases as students move

through school, particularly in the area of science (Eccles & Wigfield, 1992; Todt & Schreiber, 1998). He suggests that the decrease in interest found in large studies may be capturing part of the developmental process, as students shift from a broader interest in an academic subject to more narrow content interests within the subject. Lewalter, Wild, and Krapp (2001) found that students in a German vocational program provided contradictory descriptions of their level of interest when their responses on surveys were compared to their interview responses. Students as a whole reported a decrease in their interest in insurance sales over the course of the program; however, a majority of students interviewed reported the development of new interests within the area of insurance sales. Of note, the development of new interests occurred when the students were participating on job sites rather than in the classroom, suggesting that the learning situations the students experienced in the job setting may have been more helpful in creating personal relevance and meaning for the students than the classroom settings.

Krapp (2002, 2007) also uses the framework for self-determination theory (Deci & Ryan, 1985) to describe the process of interest development, suggesting that the basic psychological needs of an individual of competence, relatedness, and autonomy must be met if a person is to develop a relationship with an object of interest. Thus, an individual will re-engage with certain tasks or topics if he or she believes that engaging with the task or content is "sufficiently important" (thus connecting re-engagement with the value-related valence) or if the interactions is "emotionally satisfactory"(connecting the experience with the feeling valence; Krapp, 2002, p. 403).

Analysis of Models of Interest Development

Hidi, Renninger, and Krapp have developed models of interest development in educational settings that emerge from much of the same research and theoretical background.

Both Hidi and Renninger (2006) and Krapp (2002) are focused on understanding how interest develops from an initial situational trigger into a long-term individual interest. Both developed models that are experienced based, incorporated affective and value components, and acknowledge that the transition between situational and individual interest involves the internalization of the content or object of interest. However, in contrast to Hidi and Renninger (2006), Krapp (2002) examines the development of interest in relation to the broader development of the self. Also, Krapp's definition of interest, descriptions of the components of interest, and his explanations of the transitions within interest are framed within the development of the individual's growing self-awareness and grounded in self determination theory (Deci & Ryan, 1985); whereas Hidi and Renninger (2006) have a broader, less theoretically bound conception of interest development.

Prior experiences. Both models describe a conceptualization of interest that is based on how individuals react to experiences. As Hidi and Harackiewicz (2000) note, and Krapp (2002, 2007) cites, even situational interest is impacted by individuals' prior experiences, and how a learner reacts to a novel activity or content is often connected to his or her prior experiences. These experiences form the basis for engagement with the object of interest in both models, and individuals may reevaluate their feelings or value for an object of interest based on the outcomes of these learning experiences, particularly during the early phases of interest (Hidi, Berndorff, & Ainley, 2002; Nolen, 2007; Pasupathi & Rich, 2005).

Knowledge component. Hidi and Renninger (2006) describe interest as a concept incorporating affective, value, and cognitive components. In contrast, Krapp does not include a knowledge valence in the POI. Krapp (2002, 2007) postulates that the value and feeling-related valences are part of the individual's knowledge networks related to the object of interest, and that

these knowledge networks become more sophisticated over time. However, he does not include knowledge as a necessary component of interest development and suggests that learners develop an internalized individual interest with a range of knowledge (Krapp, 2007; Schiefele, 2009).

Value. Value is a term that has been used to describe a number of similar, but not identical concepts. *Stored value*, as defined by Renninger (2010), is the combination of feelings of competence and the emotions related to engaging with the content. The value-related valence described by Krapp (2002) is focused on a more person-centered view of value: an individual's value for the object of interest is aligned with the general "attitudes, expectations, and values" through which the person defines him or herself (p. 388). Some interest researchers using the Four-Phase model have used an operational definition that matches Hidi and Renninger (Lipstein & Renninger, 2007), others have integrated Krapp's value-related valence within the Four-Phase model (Harackiewicz et al., 2008; Linnenbrink-Garcia et al., 2008), and others have defined value using aspects of the expectancy-value model (Hulleman et al., 2008). In each of these cases, developing value for the content of interest was related to or predicted interest at a later time. As noted, value is an umbrella term that has been applied to a number of similar concepts, and more research is needed to tease out the aspects of value that are most related with the development of interest.

Development of interest and transition between phases. Although the theoretical framework may vary, interest researchers tend to agree that interest develops when individuals have opportunities to learn about their object of interest within an autonomy supportive environment (Nolen, 2007; Renninger & Su, 2012). Researchers working within the Four Phase Model of interest describe support for interest to be based in the development of knowledge and feelings of competence (Hidi, Berndorff, & Ainley, 2002; Hidi & Renninger, 2006; Lipstein &

Renninger, 2007; Nolen, 2007; Renninger & Su, 2012). Krapp (2007) proposes similar environmental supports for transitions between the first occurrence of situational interest to a stabilized situational interest that mirror Mitchell (1993), suggesting that at this point in interest development learners need a learning environment that makes the content meaning full and helps to connect the content to the student's own goals and values.

Working from within a self-determination theoretical framework, Krapp (2002, 2007) proposes that learners will only be able to form an individual interest in their object of interest if their psychological needs of autonomy, competence, and relatedness are met in relation to the content of their interest. Although the development of knowledge is a key mechanism for transition between phases within the Four Phase model of interest, Krapp (2002, 2007) does incorporate knowledge as a component of interest and suggests that learners may form individual interests with varying amounts of knowledge. Krapp (2002) suggests that individual interest can develop from a satisfactory emotional connection with the object of interest *or* through valuing an activity or content; whereas Hidi and Renninger (2006) assert that value for a domain is needed in addition to emotional connection for individuals to move beyond a brief situational interest in content. Extrapolating from Krapp's (2002) proposal that individuals transition between phases when their psychological needs are met, the accumulation of stored knowledge is less important for individuals to transition between situational and individual interest than the development of feelings of competence within the POI.

Taken together, these models all suggest that individuals are more likely to develop interests in a learning environment in which the learner has numerous opportunities to reengage with the content of their interest; has support from others (e.g., peers, teachers, parents, mentors) to develop both knowledge and feelings of competence; and feels some sense of control or

autonomy over how they learn about their object of interest. One final aspect of transitions between phases incorporated by both models is the tendency for individuals to self-identify with the content, object, or domain of their interest as they shift from a stabilized or maintained situational interest to an individual interest (Hidi & Renninger, 2006; Krapp, 2002, 2007).

Chapter 3

Intersections and Overlaps: A Theoretical Examination of Domain Identification and Student Interest

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Abstract

Two separate strands of research have examined the roles of student interest and domain identification in relation to academic motivation and outcomes. This manuscript highlights the theoretical and practical intersections and gaps between these two constructs through a review of the theory and research supporting Osborne and Jones' model of domain identification as well as Hidi and Renninger's (2006) and Krapp's (1999, 2002) models of interest development. All of the models frame domain identification and interest as value-based concepts that develop through experience. However, the models of domain identification and interest vary in regards to the specific components included in the model, the level of focus (e.g., the potential for interest in an activity as compared to identification with a domain), and, primarily, in the operational definition of value. The differences between the definitions of value emphasize domain identification and interest highlight theoretical and practical differences between domain identification and interest.

Identity and interest are two constructs that have been discussed, debated, and postulated about for well over a century. Identity, described broadly as how an individual perceives his or her "Self," has been examined through the frameworks of psychology, sociology, psychoanalysis, and human development (Erikson, 1968; James, 1890). Interest has also been examined through numerous frameworks including human development and vocational interests. Recent research on the development of domain identification, the selective valuing of a field or discipline as important to an individual's self-concept, has led to the development of a model of domain identification that shares many qualities with contemporary theories of interest development in education. Domain identification and interest are both described as constructs that develop through experiences with a content or domain leading a learner to develop value for the domain or content area.

The purpose of this manuscript is to highlight the theoretical and practical intersections between the constructs of domain identification and interest through the close examination of current models of the constructs and research that supports these models. The review is divided into three main sections. The first section closely examines Osborne and Jones's (2011) model of domain identification and a set of complementary models of identification (Finn, 1989; Steele, 1997; Voelkl, 1997). The second section examines the development of individual interest in two models of interest development: Hidi and Renninger's (2006) Four Phase model and Krapp's (2002) Person-Object Theory of Interest (POI). Finally, the third section compares the models of domain identification and interest, examining the areas of overlap between these two constructs and the areas that theoretically and practically differentiate between the two constructs.

Domain Identification

Domain identification is the *selective valuing* of a given domain as important to the self-concept or self-esteem of an individual (Osborne & Jones, 2011). This definition is grounded in the symbolic interactionist conception of self-esteem, in which the feedback an individual receives from the environment is filtered through the individual's perception of the outcomes and evaluation of the importance of the domain to their self-esteem (Osborne & Jones, 2011). Thus, individuals are affected more by their performance (whether it is high or low) in a domain they value greatly, rather than in a domain in which they place little value (Osborne, Walker, & Rausch, 2002).

Osborne (1997a, 1997b) applied the symbolic interactionist description of self-esteem to the concept of domain identification developed in stereotype threat research (Steele, 1992). Osborne examined domain identification through large-scale datasets and longitudinal studies (Osborne, 1995, 1997b; Osborne & Walker, 2001). The results of these studies highlighted relationships that formed the basis for the model of domain identification developed by Osborne and his colleagues (Osborne, 2004; Osborne & Jones, 2011) showing the connections between domain identification, social and motivational background factors, and academic and behavioral outcomes (see Figure 5).

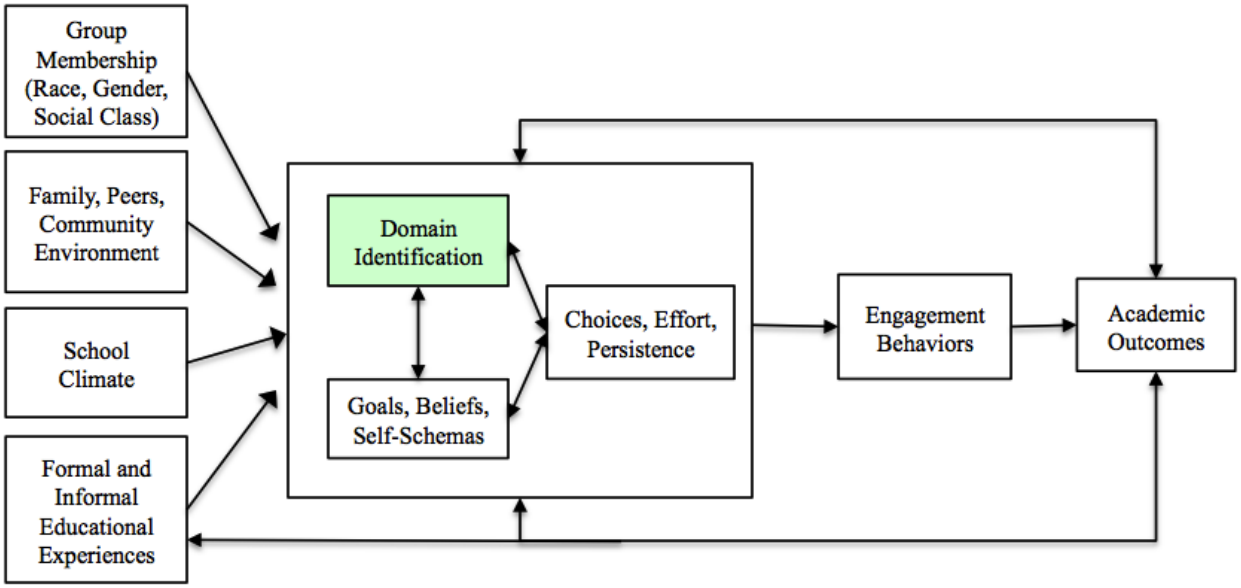

Figure 5. Antecedents and consequences of domain identification (adapted from Osborne & Jones, 2011).

Antecedents of Domain Identification

The model of domain identification developed by Osborne and his colleagues describes the process by which a set of social and academic background factors affect domain identification and related motivation constructs which, in turn, influence behavioral and academic outcomes. These factors include group membership (e.g., gender, race, ethnicity, class); family, peer, and community environment; school climate; and both formal and informal educational experiences (see Osborne & Jones, 2011 for more information). Through this set of precursors, Osborne's model of domain identification is linked to other motivation constructs such as a student's feelings of interest, sense of control, belief that the domain is useful for both long and short term goals, and sense of belonging. These motivation constructs can be viewed as aspects of a student's prior educational experiences; their perception of school climate; and the input they receive from their family, peers, and community based on their group membership. As

background factors, the constructs impact both the student's development and maintenance of identification with an academic domain (Osborne & Jones, 2011).

Consequences of Domain Identification

Domain identification, as described by Osborne and Jones (2011), is linked to academic engagement and outcomes in relationship with the individual's effort and persistence, as well as the goals, beliefs, and self-schemas that are related to academic success. Osborne and Jones (2011) hypothesized that, in general, higher identification with the academic domain is closely related to greater effort to succeed; persistence when faced with failure or frustration; and the goals, beliefs, and self-schemas that support academic success. Conversely, low domain identification is related to low effort in the domain; low persistence; as well as the lack of goals, beliefs, or self-schemas that support success. Walker, Greene, and Mansell (2006) provided support for this model, showing in a study of upper-level undergraduates that identification with academics was correlated with other motivation and cognitive engagement constructs and was negatively related to amotivation. They found that identification with academics, as measured with Osborne's (1997b) School Perceptions Questionnaire, was statistically correlated with self-efficacy, intrinsic motivation, and meaningful cognitive engagement. Meaningful cognitive engagement was described as the student's ability to relate new information to prior knowledge in order to construct more complex cognitive structures (Walker et al., 2006).

Academic domain identification upon entering high school has been positively correlated with learning and performance goals as well as with the intrinsic valuing of academics, perceived ability, self regulation, and both deep and shallow cognitive processing and negatively correlated with absenteeism and behavioral referrals (Osborne & Rausch, 2001; Osborne & Walker, 2006). At a college level, academic identification significantly predicted GPA after one semester and

again after two years, even when controlling for sex, race, and self-esteem (Osborne, 1997a). In addition, students at different levels of academic standing had significantly different levels of identification with academics. A high level of identification with academics measured upon entering community college was related to positive academic outcomes such as achieving Dean's List or Honor's standing; whereas a low level of academic identification was related to withdrawal, academic dismissal, or academic probation (Osborne, 1997a).

Osborne and Jones (2011) explain that domain identification is likely cyclical. Thus, while identification with academics may be a stable concept, it is not static, and could be impacted by frequent positive or negative academic outcomes. An individual's identification with a domain may decrease if he or she begins to receive performance outcomes that do not reflect his or her perception of ability or if the climate of the domain begins to emphasize negative stereotypes. Alternatively, this model shows how shifts in school climate or other precursors may also work to increase a student's identification with the academic domain.

Alternative Models of Identification

Academic identification. Steele (1992) first connected domain identification to the study of academic motivation by placing academic identification as a central element of stereotype threat theory (Osborne, Keller, & Jones, 2007). Stereotype threat theory describes the depressed performance of individuals from stigmatized groups (groups associated with a negative stereotype) in high stakes performance contexts due to the anxiety of confirming a negative stereotype. In describing stereotype threat theory, Steele (1997) was clear to note that in order to be affected by stereotype threat, an individual must have a high identification with the domain. He defined academic identification as the extent to which an individual forms a relationship with

the "domains of schooling," so that his or her self-esteem or self-regard depends in large part on their achievement in academic domains (Steele, 1997, p. 616).

Identification with school. Finn (1989) and Voelkl (1996, 1997, 2012) have suggested a different definition of academic identification that is based on the study of student engagement with school. Finn (1989) described identification as how an individual perceives the congruence between the self and an object (e.g., institution, family, group). Students who are identified with school feel that they are "discernibly part of the school environment and that school constitutes an important part of their own experience" (Finn, 1989, p. 123), thus the student both feels a sense of belonging with the school and values his or her success in school-related experiences. This view of identification with school is tightly focused on the relationships between school experiences, identification, and academic outcomes. Voelkl (1997) described the outcomes of identification with school as cyclical, wherein students who are more highly identified with school are more likely to have positive experiences (e.g., academic achievement and participation) that increase their sense of belonging and value for school, and consequently, their identification with school.

Comparison of Models of Identification

A comparison of the key aspects of the four models of identification that I have described is presented in Table 2. The second column shows that the Finn (1989) and Voelkl (1996, 1997, 2012) models include the sense of belonging, which the Steele (1997) and Osborne (1997a, 1997b) models do not include. The fourth column shows that students identify with the institution of school in the Finn and Voelkl models and that students identify with a domain (e.g., academics or schooling) in the Steele and Osborne models.

Value. All of the models of identification include a component that is based on a sense of value for school, suggesting that students are more likely to continue with school if they value the institution of school or the domain of schooling. Value, from this perspective, describes the abstract value that an individual would have for school, either the domain of schooling or the institution of school (Smith, Estudillo, & Kang, 2010; Voelkl, 1996). By focusing on the value for the domain or institution, identification researchers have distinguished identification from other value-based concepts such as attainment value, which is the personal value that an individual places on doing well on a task or activity (Eccles, 2009; Eccles & Wigfield, 2000).

Academic performance. In each of these models, identification is linked with performance; however, the relationship of the two concepts varies among the models. Steele (1997) describes academic identification as directly impacting academic outcomes; Osborne and Jones (2011) also show academic identification leading to academic outcomes though acting in concert with other variables; Finn (1989) and Voelkl (1996) suggest that academic outcomes and achievement impact identification with school, while also noting that the concepts are likely cyclical. The recursive nature of academic identification makes academic performance a possible antecedent as well as an outcome. Both Steele (1997) and Osborne and Jones (2011) include prior academic experiences as a background factor leading to identification. Thus, a student's perception of identification with an academic domain is influenced by previous positive or negative academic outcomes.

Sense of belonging. The sense of belonging is a key component of Finn (1989) and Voelkl's (1996) model of identification with school. Yet, neither Steele (1997) nor Osborne (1997a, 1997b) includes sense of belonging as a component of domain identification; however, belonging is not excluded from their explanations of the concept. Steele (1997) describes the

individual's sense of belonging within the domain as one of the self-assessments that leads to academic identification. Osborne and Jones (2011) do not explicitly include a sense of belonging within their model of academic identification, but discuss how fostering a sense of belongingness can be an important precursor that can affect one's domain identification.

Focus of identification. For both Steele and Osborne, identification describes the relationship between an individual and the "domains of schooling" (Steele, 1997, p. 616), whereas for Finn (1989) and Voelkl's (1996), identification describes the relationship between an individual and an institution of schooling. Thus, what an individual is identifying *with* is different in the two sets of definitions.

Relating Alternative Models of Identification With Interest

Domain identification is an important component of an individual's academic motivation and is closely connected to a number of other components of motivation and achievement. Researchers studying identification have approached the concept from several different theoretical perspectives by studying the role of identification in stereotype threat theory, in student engagement, in academic motivation, and in student success. Several commonalities emerge when the theoretical models are closely examined including the component of value and the relationship between identification and academic performance in all of the models. However, these commonalities are balanced by two main differences between the models: (1) the inclusion or exclusion of belonging as a component of identification and (2) how the researchers focus identification (see Table 2). These differences are key for researchers examining the intersection between interest and identification. Although the construct of identification with school may help researchers to examine student engagement with academic institutions or communities, this conceptualization of identification does not overlap current theories of interest which link the

development of interest, in part, to increases in an individual's value for a domain or content area (Hidi & Renninger, 2006; Krapp, 2007).

Table 2

Comparison of Key Aspects of the Four Models of Academic Identification

Researcher	Components of identification	Operational Definition	What is the individual identifying *with*?
Steele	Valuing	• The extent to which an individual forms a relationship with the domains of schooling	Schooling/ Academics as a domain
Osborne	Valuing	• Selective valuing of a domain as important to self-esteem or self-concept	Academics as a domain
Finn, Voelkl	Valuing and sense of belonging	• Sense of belonging in school and sense of pride for belonging in school • Value for school as an institution and for schooling as a path to personal advancement	School as an institution

Interest

Until recently, the concept of interest was used to describe a wide-range of related areas of study. These areas of study included the examination of external aspects of activities that make some classroom activities more interesting (Hidi & Baird, 1986; Mitchell, 1993**)**, the relationship between interest in learning activities and learning (Alexander, Kulikowich, & Schulze, 1994; Sansone, Weir, Harpster, & Morgan, 1992**)**, and the exploration of why some learners choose to persist or re-engage with learning content while other students do not (Prenzel, 1992). Most of the research on interest as a motivation construct has focused either on the types of activities that trigger or "catch" interest and students' responses to the activities (Alexander, Kulikowich, & Schulze, 1994; Hoffman, 2002; Lipstein & Renninger, 2007; Mitchell, 1993) *or* how the personal interests of learners impact how they respond within a learning situation (Sansone, Weir, Harpster, & Morgan, 1992).

Hidi and Renninger (2006) and Krapp (2002, 2007) have proposed separate, but complementary models describing the development of interest within the scope of education (Hidi & Renninger, 2006; Krapp, 2002, 2007). Both Hidi and Renninger's (2006) Four-Phase model and Krapp's (2002, 2007) Person-Object Theory of Interest examine interest in relation to learning, incorporate value as a key component, and connect interest to self definition (see Table 2 for comparison). Thus these two models of interest development provide areas of overlap with the concept of domain identification.

Four-Phase Model of Interest Development

Hidi and Renninger (2006) developed a model of interest development bringing together the research and theories related to both situational and personal (i.e., individual) interest. They have modified the working definition of interest and describe interest as a psychological state of engaging both cognitively and affectively with "particular classes of objects, events, or ideas" (Hidi & Renninger, 2006, p. 112); a predisposition to re-engage with this content over time; and a construct that is comprised of the knowledge, stored value, and feelings related to the content which result from the individual's engagement with the content over time (Renninger, 2010). Hidi and Renninger (2006) suggest that the growth in affect or positive feelings, stored knowledge, and stored value are the key components propelling the development of interest from an externally supported situational interest to an internally supported individual interest. In describing the components of interest, Renninger, (2010) defines *affect* as the positive feelings that an individual connects with engagement with a subject matter. Renninger and colleagues define *stored knowledge* as changes in cognitive structure related to engagement with the content and *stored value* as the combination of feelings of competence and the emotions related to

engagement with the content (Renninger, 2010; Schiefele, Krapp, Prenzel, Heiland, & Kasten, 1983).

Development of interest in the Four Phase model of interest is related to the different components of interest. Hidi and Renninger (2006) propose that situational interest is initially triggered by an affective response to an engagement with an activity or piece of content material. This affective response leads individuals to re-engage with the material and in the process develop knowledge related to the specific material and the larger content topic. As this happens, Hidi and Renninger (2006) propose that individuals also begin to develop stored value for the content area.

The initial situational phases of interest are externally supported with the individual initially making an emotional/affective connection with a specific activity or task (Hidi & Renninger, 2006; Mitchell 1993). Initially, situational interest may be *triggered* (phase 1) through novelty, physical activity, personal relevance, or connection to individual interests (Alexander, Kulikowich, & Schultze, 1994; Mitchell, 1993; Palmer, 2009; Renninger, Ewen, & Lasher, 2002; Schraw & Lehman, 2001). As an individual reengages with the topic or content her interest may become *maintained* (phase 2). Reengagement is supported through a number of different means including autonomy-supportive teaching methods, such as taking the students' perspective and providing students with some control over activities (Palmer, 2009; Tsai et al., 2008); opportunities for social involvement (Barron, 2006; Palmer, 2009); and student perception of value or personal relevance in the material (Harackiewicz et al., 2008; Hulleman, Durik, Schweigert, & Harackiewicz, 2008).

As individuals shift from the phases of situational interest to those of individual interest, that support for reengaging with the content becomes internally supported. Individuals with an

emerging individual (phase 3) interest have developed the positive feelings, stored value, and stored knowledge that lead them to seek opportunities to reengage with the content of interest without relying on external support (Hidi & Renninger, 2006). Individuals at this stage of interest development begin to self-identify with their content of interest and to more actively seek out learning opportunities (Hidi & Renninger, 2006; Krapp, 2002, 2007). Individuals with a *well-developed individual* (phase 4) interest actively reengage with the content or domain of their interest over time (Hidi & Renninger, 2006). Individuals with a well-developed individual interest generate questions and seek out knowledge related to their interest and persevere when faced with frustration (Renninger & Hidi, 2002).

Hidi and Renninger (2006) propose that the phases of interest development are sequential in that an individual is highly unlikely to develop an individual interest in a content area without initially showing a situational interest in some aspects of the area. However, they do not specify the amount of time that an individual will stay in a certain phase, suggesting that individuals may never move beyond a triggered or maintained situational interest or may move quickly through triggered and maintained situational interest to levels of individual interest. Individuals may also regress or decrease interest at any phase of interest development if their interest is not supported.

Person-Object Theory of Interest

Krapp (2002, 2007) also integrated research on situational and individual interest into the Person-Object Theory of Interest (POI). His theory works within the framework of personality development and focuses on how interests develop as a part of an individual's developing of the "self" during ontogenesis (Krapp, 2002). The key aspect of the POI is the relationship between the person and the object of interest. Whereas Hidi and Renninger (2006) describe interest as being primarily focused at the content or domain level (particularly for individual interests),

Krapp (2007) has a more open definition of interests referring to "concrete things, a topic, subject-matter, an abstract idea, or any other content of the cognitively represented life-space" (p. 8).

This relationship between the person and the object of interest is composed of *feeling-related valences* and *value-related valences*. Feeling-related valences encompass the emotions, primarily positive, that an individual derives in relation to the interest object; whereas value-related valences focus on the point at which the individual's value for the object of interest is aligned with the general "attitudes, expectations, and values" by which the person defines him or herself (Krapp, 2002, p. 388). The POI is focused on the current, internal relationship between an individual and his or her object of interest. For an individual to develop an interest in math, the individual must have value and feelings for math that are based on the current relationship; these values and feelings must *not* be in relation to other domains (e.g., valuing math because it is an important part of physics) or future events (e.g., valuing math because skill in math is required for entrance into an engineering major; Krapp, 2002).

The POI illustrates three potential ontogenetic steps of interest development during which an individual moves from the first occurrence of situational interest to a stabilized situational interest and finally to an individual interest. During the initial step, the individual's interest is triggered by an external stimulus (first occurrence of interest). Krapp (2002) describes the second step as a form of working interest, in which the individual's connection with the object of interest remains more or less enduring over a period of time and across different learning situations. Similar to Mitchell (1993), Krapp (2002) suggests that in order for learning situations to sustain an individual's interest he or she must perceive the learning as "meaningful." Krapp (2002) describes the development of individual interest as a rare occurrence that happens when

an individual integrates the interest into their self-esteem and identifies "with the goals, values, actions, and topics" related to the object of interest (p. 400).

Krapp (2002, 2007) also uses self-determination theory (Deci & Ryan, 1985) as a framework to explain the process of interest development, suggesting that the basic psychological needs of an individual of competence, relatedness, and autonomy must be met if a person is to develop a relationship with an object of interest. Thus, an individual will re-engage with certain tasks or topics if he or she believes that engaging with the task or content is "sufficiently important" (thus connecting re-engagement with the value-related valence) or if the interactions is "emotionally satisfactory" (connecting the experience with the feeling-related valence; Krapp, 2002, p. 403).

Analysis of Models of Interest Development

Hidi, Renninger, and Krapp have developed models of interest development in educational settings that emerge from much of the same research and theoretical background. Both Hidi and Renninger (2006) and Krapp (2002, 2007) focus on understanding how interest develops from an initial situational trigger into a long-term individual interest. Both developed models that are experience-based, incorporated affective and value components, and acknowledge that the transition between situational and individual interest involves the internalization of the content or object of interest. However, in contrast to Hidi and Renninger, Krapp (2002, 2007) examines the development of interest in relation to the broader development of the self. Also, Krapp's (2002) definition of interest, descriptions of the components of interest, and his explanations of the transitions within interest are framed within the development of the individual's growing self-awareness and grounded in self-determination theory (Deci & Ryan,

1985); whereas Hidi and Renninger (2006) have a broader, less theoretically bound conception of interest development (see Table 3 for a summary).

Table 3

Comparison of Key Aspects of the Two Models of Interest Development

Researcher	Components of interest	Phases of development	Impetus for transition between phases
Hidi & Renninger	Affect, stored knowledge, stored value	• Triggered situational interest • Maintained situational interest • Emerging individual interest • Well-developed individual interest	Positive affect → development of stored knowledge → development of stored value
Krapp	Feeling-related valences and value-related valences	• Situational interest • Stabilized situational interest • Individual interest	Progression occurs when students psychological needs are met

Prior experiences. Both models describe a conceptualization of interest that is based on individuals' reactions to experience. As Hidi and Harackiewicz (2000) note, and Krapp (2002, 2007) cites, even situational interest is impacted by individuals' prior experiences; a learner's reaction to a novel activity or content is often connected to his or her prior experiences. These experiences form the basis for engagement with the object of interest in both models, and individuals may reevaluate their feelings or value for an object of interest based on the outcomes of these learning experiences, particularly during the early phases of interest (Hidi, Berndorff, & Ainley, 2002; Nolen, 2007; Pasupathi & Rich, 2005).

Knowledge component. Hidi and Renninger (2006) describe interest as a concept incorporating affective, value, and cognitive components. In contrast, Krapp (2002, 2007) does not include a knowledge valence in the POI. Krapp (2002, 2007) postulates that the value- and feeling-related valences are part of the individual's knowledge networks related to the object of interest, and that these knowledge networks become more sophisticated over time. However, he

does not include knowledge as a necessary component of interest development and suggests that learners develop an internalized individual interest with a range of knowledge (Krapp, 2007; Schiefele, 2009).

Value. Value is a term that has been used to describe a number of similar, but not identical, concepts. *Stored value*, as defined by Renninger (2010), is the combination of feelings of competence and the emotions related to engaging with the content. The value-related valence described by Krapp (2002) is focused on a more holistic value: an individual's value for the object of interest is aligned with the general "attitudes, expectations, and values" through which the person defines him or herself (p. 388). Some interest researchers using the Four-Phase model have used an operational definition that matches Hidi and Renninger (Lipstein & Renninger, 2007), others have integrated Krapp's value-related valence within the Four-Phase model (Harackiewicz et al., 2008; Linnenbrink-Garcia et al., 2008), and others have defined value using aspects of the expectancy-value model (Hulleman et al., 2008). In each of these cases, developing value for the content of interest was related to or predictive of interest at a later time. Value is a broad term that has been applied to a number of similar concepts, and more research is needed to tease out the aspects of value that are most related with the development of interest.

Development of interest and transition between phases. Although the theoretical framework may vary, interest researchers tend to agree that interest develops when individuals have the opportunity to engage with their object of interest within an autonomy supportive environment (Nolen, 2007; Renninger & Su, 2012). Researchers working within the Four Phase Model of interest describe support for interest to be based in the development of knowledge and feelings of competence (Hidi, Berndorff, & Ainley, 2002; Hidi & Renninger, 2006; Lipstein & Renninger, 2007; Nolen, 2007; Renninger & Su, 2012). Krapp (2007) proposes similar

environmental supports for transitions between the first occurrence of situational interest to a stabilized situational interest; suggesting that at this point in interest development learners need a learning environment that makes the content meaningful and helps to connect the content to the student's own goals and values.

Working from within a self-determination theoretical framework, Krapp (2002, 2007) proposes that learners will only be able to form an individual interest in their object of interest if their psychological needs of autonomy, competence, and relatedness are met in relation to the content of their interest. Although the development of knowledge is a key mechanism for transition between phases within the Four Phase model of interest, Krapp (2002, 2007) does incorporate knowledge as a component of interest and suggests that learners may form individual interests with varying amounts of knowledge. Krapp (2002) suggests that individual interest can develop from a satisfactory emotional connection with the object of interest *or* through valuing an activity or content; whereas Hidi and Renninger (2006) assert that value for a domain is needed in addition to emotional connection for individuals to move beyond a brief situational interest in content. Extrapolating from Krapp's (2002) proposal that individuals' transitions between phases when their psychological needs are met, the accumulation of stored knowledge is less important for individuals to transition between situational and individual interest than the development of feelings of competence.

Taken together, these models all suggest that individuals are more likely to develop interests in a learning environment in which the learner has numerous opportunities to reengage with the content of their interest; has support from others (e.g., peers, teachers, parents, mentors) to develop both knowledge and feelings of competence; and feels some sense of control or autonomy over how they learn about their object of interest. One final aspect of transitions

between phases incorporated by both models is the tendency for individuals to self-identify with the content, object, or domain of their interest as they shift from a stabilized or maintained situational interest to an individual interest (Hidi & Renninger, 2006; Krapp, 2002, 2007).

Intersections Between Domain Identification and Student Interest

When examined together and in contrast, the intersections between domain identification and student interest provide opportunities for researchers to develop a better understanding of the two concepts and to explore the relationships between the two concepts.

Similarities Between Domain Identification and Interest

Domain identification and interest both develop through experience and can develop at any age. Even learners' initial situational interest in an activity or content is often connected to their prior experiences (Hidi & Harackiewicz, 2000). Learners then reevaluate their feelings or value for a domain or content area based on the outcomes of their experiences, particularly during the early phases of interest (Nolen, 2007). Similarly, learners who identify with a domain reevaluate their domain value if performance outcomes do not reflect their ability perceptions. Thus, strengthening value for the content or domain is a key component in the development of both domain identification and interest.

Value-based concepts. As value-based concepts, domain identification and interest can be differentiated from motivation constructs that are based primarily on self-beliefs, such as self-efficacy and academic self-concept, which are based on individuals' perceptions of their abilities (Dennison, Zarrett, & Eccles, 2007; Pintrich, 2003; Wigfield & Cambria, 2010). If interest is regarded as the predisposition to reengage with a domain, then domain identification can be viewed as the internal construct or filter through which a student's perceptions of a domain, past

experiences with the domain, feelings of support from peers and family, and current expectations determine how he or she will interpret and respond to an academic outcome.

Awareness. In the situational phases of interest, learners are likely to be unaware of their potential interest in a domain or content area (Renninger, 2009). But, as learners continue to progress to an emerging individual interest and begin to identify with the domain or content area, it is probable that they also become more aware of their interest, more self-regulated in their learning, and more capable of selecting experiences that support the development of their interest (Renninger, 2010). Without supportive conditions, however, domain identification and interest can go dormant, regress, or disappear (Renninger, 2009).

Differences Between Domain Identification and Interest

Despite having a number of similarities, domain identification and interest differ in some key aspects including construct components, level of focus, and the definition of value.

Construct components. Although value for the domain is the key component of domain identification (Osborne, 1997; Osborne & Jones, 2011), the interest construct incorporates affective and cognitive components in addition to value. Interest is initially engaged through an emotional response to an activity and increases as an individual develops content knowledge within the domain. Positive affect and increasing content knowledge then lead the individual to develop value for the content or domain (Linnenbrink-Garcia et al., 2010; Renninger, 2010). In contrast, domain identification may develop prior to substantive content knowledge and may continue even when positive affect for the domain has diminished. In this way, domain identification overlaps with Krapp's proposition that individual interests can develop in individuals with a wide range of knowledge levels (Krapp, 2007; Schiefele, 2009).

Focus of interest. The domain identification literature generally refers to a domain as a broader field or content area, such as academics, history, physics, or dance. In comparison, learners initially may develop an interest in a particular topic or task within a content area, such as exothermic reactions in chemistry or Shakespeare's sonnets in literature and not immediately incorporate it as part of the self (Renninger, 2009). As interest develops from a maintained situational interest into an emerging individual interest this type of identification may begin. For example, someone could shift from a maintained situational interest in exothermic reactions to an individual interest in chemistry and the shift in his or her interest may be accompanied by a change in identification.

Definition of value. Within both domain identification and interest, as individuals develop a greater value for the domain through experience they begin to self-identify as being part of the domain (Osborne & Jones, 2011; Renninger, 2010). Value is a broad concept and domain identification researchers and interest researchers have definitions of value that do not always overlap. *Selective valuing* for a domain is the central aspect of domain identification (Osborne, 1997a, 1997b; Osborne & Jones, 2011), referring to a relative ordering of importance of domains within the self (Harter, 1986; Tesser & Campbell, 1980). Thus, selective valuing highlights the centrality or importance of the domain. For example, a student may consider mathematics to be more central to the self (i.e., more valued) than swimming but less central than family relationships. *Stored value*, as defined by Renninger (2010), is the combination of feelings of competence and the emotions related to engaging with the content. For example, learners who gain competence in chemistry and who enjoy chemistry activities may also have a developing interest in chemistry, whereas learners who have low perceived competence in chemistry or who do not enjoy chemistry activities are likely to be in an earlier phase of interest

development in chemistry. Krapp describes a more encompassing conceptualization of value than Hidi and Renninger. His value-related valence focuses on the personal significance of an object of interest. Thus, value for a major would be related to how relevant the object of interest is to a learner's sense of self. This conceptualization of value is more closely related to selective valuing and provides a more fluid link between the development of interest and the development of domain identification.

Points of Overlap and Divergence

The differences between the concepts allow researchers to explore nuances between the concepts by examining the cases with different levels of alignment between domain identification and interest. In cases where domain identification and interest align, the difference between the two definitions of value is likely to be of little practical significance. For instance, when students feel competent in and have positive feelings related to a domain (i.e., they have developed stored value), their domain identification (i.e., their selective valuing of the domain) likely increases. In contrast, when students feel incompetent in and have negative feelings related to a domain, their domain identification likely decreases. However, if domain identification and interest are conceptually distinct constructs with difference conceptualizations of value, then examples of high domain identification and low interest, as well as low domain identification and high interest should be conceivable.

High domain identification and low individual interest. Some students may have a low level of individual interest in a domain but be unable to avoid making it a valued aspect of their self-concept; and thus, have a high level of domain identification. In these cases external pressures from society, family, and peers can have strong effects on how students define themselves. An instance of this would be a student who feels family pressure to become a doctor

when he has low interest in and aptitude for biomedical science. Osborne (2004) explored the issue of high domain identification and low interest in relation to school violence by proposing that some students are frustrated when they are forced to identify with a domain wherein they consistently receive negative outcomes.

Low domain identification and high individual interest. In contrast to the student who feels pressure to become a doctor but has low interest to do so, some students might have a high level of interest in a domain but be unable to make it a central, valued aspect of their self-concept. Family and societal expectations are one possible source of discordance between domain identification and interest, but age, sex, and racial norms can also play a strong role. This could be the case for a girl who enjoys and is interested in traditionally-male pursuits (e.g., studying high-level mathematics or physics, programming computers, or playing ice hockey) or a boy who is interested in traditionally-female pursuits (e.g., cooking, working with young children, theatre). Although girls may see examples of women pursuing these traditionally-male pursuits and defining themselves through their pursuits, they may feel unable to identify with traditionally-male domains due to familial or societal pressure to conform to gender-based expectations (Schmader, Johns, & Barquissau, 2004); and the same is true for boys who are unable to define themselves with traditionally-female domains.

This example is one area of contrast between the two models of interest development: the contrast between a low domain identification and high individual interest is possible when comparing Osborne and Jones' (2011) definition of domain identification with Hidi and Renninger's (2006) definition of individual interest. However, Krapp (2002) notes that individual interest develops only when an individual identifies with the goals and values of the object (e.g., domain) of interest and integrates the interest into his or her self-esteem. Using

Krapp's conception of individual interest low domain identification should be associated with low individual interest if the individual is unable or unwilling to integrate the values and goals of the domain of interest with his or her sense of self.

Furthermore, not all interests become central aspects of the self, even when society, family, and peers are supportive. As discussed previously, there are only so many domains that can be central, defining (i.e., highly valued) aspects of the self. Thus, a student who has many different abilities may enjoy biology, do well in the subject, and have a growing sense of competence, but still not consider biology as a centrally defining characteristic of his self because he is more highly identified with other domains.

Conclusions and Future Research

The purpose of this manuscript was to examine the theoretical and practical intersections between domain identification and interest. These concepts are both useful in understanding how students engage, re-engage, and persevere in a wide variety of academic, performance, and social pursuits. This article provides researchers with a guide through this set of closely related concepts. Better comprehension of the models of domain identification and interest provides researchers with nuances in examining the transition between situational interest and individual interest in the Four Phase Model and the internalization of interest in the POI (Hidi & Renninger, 2006; Krapp, 2002).

Although researchers have a good empirical and theoretical foundation for starting a discussion about the similarities and differences among these constructs, further research is needed to fully explore the areas of overlap between them because the domain identification and interest constructs have developed from different theoretical traditions. Thus, understanding the similarities and differences between these constructs could help to strengthen the distinctiveness

of both. In addition, research is needed to further explore how domain identification and interest develop over time. Both identification and interest develop via cyclical dynamics over periods of time, but this process has not been fully explained. It is reasonable that this process is complex, with domain identification and interest waxing and waning over long periods of time, either together or independently.

Finally, aside from these conceptual and theoretical concerns, researchers need to better understand how these constructs can be used to improve educational outcomes for students in school subjects. Because lack of interest in schooling can be indicative of future problems (Finn & Rock, 1997), it would be useful have more evidence as to whether monitoring students' domain identification or interest would allow school counselors and educators to identify those at risk for problems prior to the problems becoming evident.

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Chapter 4

Development of Domain Identification and Interest in First Year Science Majors

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Abstract

Students entering college with a pre-selected major have chosen their major in response to academic and social experiences prior to college. The purpose of this exploratory qualitative study was to examine how first year college students perceive their development of domain identification with and interest in their prospective science major during their initial year of college. Four themes emerged from the coding and analysis of interviews with eight first year science students: *Self-Definition in Flux*, *Feeling Competent*, *Expressing Interest through Enjoyment*, and *Keeping Things Relevant*. These themes were mainly consistent with the current model of domain identification (Osborne & Jones, 2011), but differ from the current model of interest development (Hidi & Renninger, 2006).

When students arrive for their first year of college, they bring with them prior educational experiences that influence their perceptions of the academic experiences they encounter at a collegiate level and inform their initial choices in college (Astin, 1993; Thompson, 2007; Tinto, 1993). Students who enter college with a pre-selected major have chosen their major based on a variety of academic and social experiences outside of the college context. They have already developed some level of knowledge and interest related to their major. They may self-identify with their major, even before attending their first college course. Domain identification and interest are two constructs that have shown to be useful for examining how this set of first year college students perceive their experiences within their prospective major.

Domain identification describes "the extent to which an individual defines the self through a role or performance in a particular domain" (Osborne & Jones, 2011, p. 132), whereas interest encompasses both an individual's engagement with a domain and the individual's predisposition to re-engage with the domain (Renninger, 2010). Domain identification and interest are motivation constructs that develop from an individual's educational and social experiences and influence later academic outcomes (Harackiewicz, Durik, Barron, Linnenbrink-Garcia, & Tauer, 2008, Osborne & Jones, 2011; Renninger, 2010). Additionally, both of these constructs focus attention on the impact of the value that an individual holds for a domain on later academic, social, and emotional outcomes (Renninger, 2010; Renninger & Hidi, 2011; Krapp, 2002, 2007; Walker, Greene, & Mansell, 2006).

The initial courses that students take in their prospective major provide students with an opportunity to increase their domain knowledge and the value they hold for the domain. Ideally, these courses provide students with an opportunity to envision themselves within the domain of their major. Through their initial courses, students have academic and social experiences that

may reinforce, negate, or cause them to re-evaluate their prior experiences and perceptions (Harackiewicz et al., 2008). In each of these cases, students' identification and interest in the major may further develop or weaken.

Theoretical Background

Domain Identification

Domain identification is the *selective valuing* of a domain as important to the self-concept or self-esteem of an individual (Osborne & Jones, 2011). This definition is based in the symbolic interactionist conception of self-esteem, in which the feedback an individual receives from the environment (in terms of academic performance, among other things) is filtered through the individual's perceptions of the outcomes and evaluation of the importance of the domain to their self-esteem (Osborne & Jones, 2011). Thus performance in a domain that an individual highly values has a greater impact on an individual than performance in a domain the individual does not value (Osborne, Walker, & Rausch, 2002).

Academic domain identification upon entering high school has been positively related to learning and performance goals as well as with the intrinsic valuing of academics, perceived ability, self regulation, and both deep and shallow cognitive processing and negatively correlated with absenteeism and behavioral referrals (Osborne & Rausch, 2001; Osborne & Walker, 2006). At a college level, academic identification predicted GPA after one semester and again after two years, even when controlling for sex, race, and self-esteem (Osborne, 1997a). In addition, students at different levels of academic standing had significantly different levels of identification with academics. A high level of identification with academics measured upon entering community college was related to positive academic outcomes such as achieving Dean's

List or Honor's standing; whereas a low level of academic identification was related to withdrawal, academic dismissal, or academic probation (Osborne, 1997a).

Osborne and Jones (2011) describe the process by which social and academic background factors influence the development of domain identification. These background factors include group membership (e.g., gender, race, ethnicity, class); family, peer, and community environment; school climate; and both formal and informal educational experiences (see Osborne & Jones, 2011 for more information). Through the background factors, domain identification is linked to other motivation constructs such as a student's feelings of interest, sense of control, belief that the domain is useful for both long and short-term goals, and sense of belonging (see Figure 6 for an example of a student's physics identification). These factors are consistent with those identified by Jones (2009) in the MUSIC model of Academic Motivation, namely, eMpowerment, Usefulness, Success, Interest, and Caring. Jones, Ruff, and Osborne (in press) have proposed that science and mathematics teachers can encourage students' development of domain identification by supporting these background factors: *eMpowering* students by supporting their sense of control, helping students to understand the *Usefulness* of concepts to current and future goals, providing students with opportunities for *Success* in their learning, incorporating and supporting students' *Interest*, and showing students that the teacher *Cares* for them both academically and personally.

Osborne and Jones (2011) explained that domain identification is likely cyclical. Thus, while identification with academics may be a stable concept, it is not static, and could be impacted by frequent positive or negative academic outcomes. An individual's identification with a domain may decrease if he or she begins to receive performance outcomes that do not reflect his or her perception of ability or if the climate of the domain begins to emphasize

negative stereotypes. Alternatively, this model shows how shifts in school climate or other precursors may also work to increase students' identification with the academic domain.

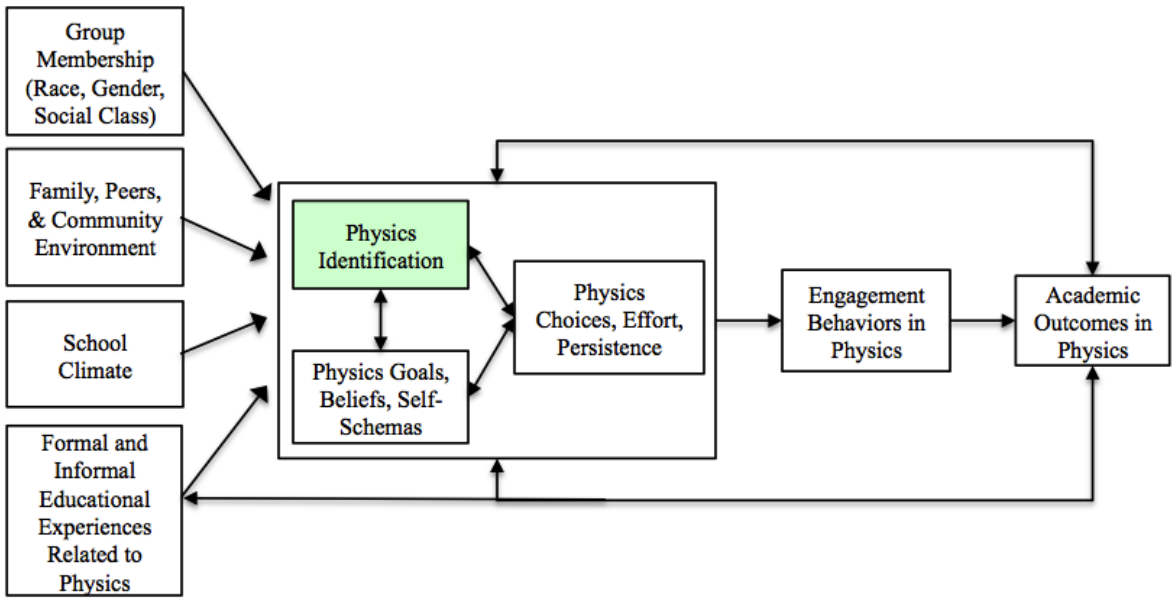

Figure 6. Model of a student's physics identification (adapted from Osborne and Jones, 2011).

Existing research on domain identification examines domain identification writ large in the form of academic identification (Osborne, 1997; Osborne & Walker, 2006) and more focused forms of domain identification such as math identification or engineering identification (Jones, Paretti, Hein, Knott, 2010; Schnittka, Brandt, Jones, & Evans, 2012). Although theoretical models provide a description of how the development of domain identification should occur, further research is needed to understand how students develop different domain identifications (Osborne & Jones, 2011; Voelkl, 1997).

Researchers examining students' persistence in science have also used the framework of "science identity." Science identity is based in a situated learning framework in which students' beliefs, goals, and sense of themselves as a "science person" grow from their participation in various communities of practice (e.g., home, classroom, extracurricular; Aschbacher, Li, & Roth,

2010; Brickhouse, Lowery, & Schultz, 2000; Gee, 2000). Researchers have used science identity as one method of studying students' persistence in science-related disciplines, particularly when examining the persistence of under-represented minority groups in science (Aschbacher, Li, & Roth, 2010; Carleon & Johnson, 2007; Olitsky, 2007; Shanahan, 2009). Research on science identity is focused on the development of identity through the interplay between the individual and social support (or lack of support) from teachers, parents, counselors, and peers. Harzari, Sadler, and Sonnert (2013) examined how college students' participation in science-related communities of practice and perception of themselves as a "science person" influenced their future plans in science. This research overlaps with the "group membership" background factor in Osborne and Jones (2011) model of domain identification. However, domain identification is focused on the internal interplay between students' performance in science and their perception of value for the science domain. Whereas science identity explores the influence of participation in a community on an individual's identity, science identification explores how the individual internally evaluates and values the participation. The two frameworks likely work in concert; however, the present study is focused on students' internal perceptions and evaluation of their experiences, and thus, domain identification is a more appropriate framework.

Interest

Interest has been used as a broad term to include a range of related areas of study. These areas of study include the examination of external aspects of activities that make some classroom activities more interesting (Hidi & Baird, 1986; Mitchell, 1993**)**, the relationship between more interesting learning activities and learning (Alexander, Kulikowich, & Schulze, 1994; Sansone, Weir, Harpster, & Morgan; 1992**)**, and the exploration of why some learners choose to persist or re-engage with learning content while other students do not (Prenzel, 1992). Most of the research

on interest as a motivation construct has focused on two separate conceptualizations of interest. *Situational interest* has described the types of activities that trigger or "catch" interest with the understanding that this type of interest emerged from specific features in the environment and may be context specific (Alexander, Kulikowich, & Schulze, 1994; Hidi & Baird, 1986; Hoffman, 2002; Lipstein & Renninger, 2007; Mitchell, 1993; Schraw & Lehman, 2001). *Individual interest* has been defined as a psychological disposition that was consistent within an individual across different environments (Alexander, 2003; Lawless & Kulikowich, 2006; Renninger, Hidi, & Krapp, 1992; Schiefele, 1991).

Hidi and Renninger (2006) have integrated the two concepts of situational and individual interest into the Four-Phase model of interest development. They define interest as a psychological state of engaging both cognitively and affectively with "particular classes of objects, events, or ideas" (p. 112); a predisposition to re-engage with this content over time; and a construct that is comprised of the knowledge, stored value, and feelings related to the content which result from the individual's engagement with the content over time.

Hidi and Renninger (2006) suggest that the growth in affect or positive feelings, stored knowledge, and stored value are the key components propelling the development of interest from an externally supported situational interest to an internally supported individual interest. In describing the components of interest, they define *affect* as the feelings that an individual connects with engagement with a subject matter (Renninger, 2010). They define *stored knowledge* as changes in cognitive structure related to engagement with the content and *stored value* as the combination of feelings of competence and the emotions related to engagement with the content (Renninger, 2010; Schiefele, Krapp, Prenzel, Heiland, & Kasten, 1983).

Hidi and Renninger (2006) propose that situational interest is initially triggered by an affective response to an engagement with an activity or piece of content material. This affective response leads individuals to re-engage with the material and in the process develop knowledge related to the specific material and the larger content topic. As this happens, Hidi and Renninger (2006) propose that individuals also begin to develop stored value for the content area and may come to have a well-developed individual interest.

The first year of college is a transition point for many students and provides a context for examining how interests develop or change within the student. Harackiewicz et al. (2008) reported that that interest development in introductory courses was related to both academic performance and later course selection of college students who participated in an introductory psychology course. Harackiewicz et al. used self-report measures and quantitative analysis of situational and individual interest in their study.

Research Question

The purpose of this study was to examine how first year college students perceive and experience the development of domain identification with and interest in their prospective science major during their initial year of college. This study focused on students who are entering college with a pre-selected major and participating in an introductory course related to their major, as these students have potentially begun to develop some level of identification with their major. By exploring the nuances of how first year college students experience, reflect on, and describe their identification with and interest in their prospective major, this study provides an alternative exploration of students' perceptions of domain identification and interest to complement the existing quantitative studies of these concepts in first year students

(Harackiewicz et al., 2008; Osborne, 1997a). The following research question has guided the process of collecting and analyzing data:

- **RQ:** How do first year college students perceive their interest in and identification with their prospective science major?

Method

Research Design

This study was an exploratory qualitative examination of identification with and interest in a prospective major through the lived experiences of first year college students. I collected data through a set of two in-depth interviews with each participant. The interviews took place during participants' first two semesters at the university with one interview near the beginning of their first semester and the second interview at the beginning of their second semester.

Working Definitions

Rather than focusing on a set of operational definitions to delineate a set of variables, I grounded my research in working definitions of the constructs that I was exploring. By viewing these as working definitions rather than operational definitions, I acknowledge the theoretical framework that I work within, while at the same time providing space for the language of my participants. For this study, I used Osborne and Jones' (2011) description of *domain identification* as: "the extent to which an individual defines the self through a role or performance in a particular domain" (p. 132). Thus, domain identification is the degree to which an individual values a domain as an important part of the self. The working definition of *interest* that I used is drawn from Hidi and Renninger's (2006) Four-Phase model in which they describe interest as "the psychological state of engaging [cognitively and affectively] or the predisposition to reengage with particular classes of objects, events, or ideas over time" (p. 112). Interest,

within this model, is comprised of knowledge, stored value and feelings related to the content and results from the individual's interactions with the content (Hidi & Renninger, 2006; Renninger, 2010).

Participants

In Fall 2012, I recruited participants through a brief presentation to two First Year Experience courses and a recruitment email sent to the students by the course professor. Eight students volunteered to participate (see Table 4). All eight students were traditional first year college students and entered the university directly after graduating from high school. Three students did not participate in the second round of interviews. Two students, male and female biochemistry students, had repeated scheduling conflicts. The third student, a female biochemistry student, did not respond to the emails and phone calls to schedule a follow-up interview.

Table 4

Student Participant Demographics

Participant	Major	Gender	1st Interview Participation	2nd Interview Participation
Kelley	Physics	Female	Y	Y
Max	Physics	Male	Y	Y
Emilia	Physics	Female	Y	Y
Rosalyn	Physics	Female	Y	Y
Cody	Biochemistry	Male	Y	N
Josh	Biochemistry	Male	Y	Y
Melissa	Biochemistry	Female	Y	N
Kate	Biochemistry	Female	Y	N

First Year Experience Courses

Many first year students participate in introductory courses that are designed to build the students' content knowledge within their prospective major; fewer first year students participate

in courses specifically designed to help students develop both content knowledge and an understanding of what it means to *be* a member of the domain. This study focused on the latter and I purposefully sampled university students in two first year experience (FYE) courses designed for students majoring in biochemistry and physics. Approximately 150 incoming first year and transfer students were enrolled in the biochemistry course. The biochemistry course was a one semester, one credit hour, pass/fail course. Class sessions included a set of large group lectures and small group discussion sessions led by undergraduate teaching assistants who were junior or senior biochemistry majors. Approximately 60 incoming first year and transfer students were enrolled in the physics course. The physics course was part of a two semester series. Each course was three credit hours and students were graded on an A-F scale. All class sessions included the whole group. Both courses were part of a university-wide focus on strengthening students' first year experiences and had learning outcomes and objectives that focused on building students problem solving, information literacy, and integration of learning within the discipline.

Data Collection

I used a set of in-depth individual interviews as a method for gaining information about the students' lived experiences related to identification with and interest in their major. Using in-depth individual interviews helped me to understand the individual student's perspectives, deepen my own understanding of the constructs, and generate rich descriptive data (Rossman & Rallis, 2003; Seidman, 2006). Each student was asked to participate in two interviews: one that was conducted in the first quarter of the Fall 2012 semester and one at the beginning of the Spring 2013 semester. Each interview lasted 45 minutes to one hour. To keep the interviews focused on the constructs, I used a semi-structured interview guide (see Appendix A for

Interview Guide; Patton, 2002). The interview protocol was pilot-tested on three undergraduate student volunteers. The students interviewed during the pilot phase answered the questions and completed the selective valuing activity and also provided feedback regarding the clarity of the questions and instructions. Some interview questions and the directions to the selective valuing activity were revised for clarity following the pilot interviews.

Prior to the first interview, all students were asked to complete an informed consent form approved by the university's Institutional Review Board. The first interview was a life history interview narrowly focused on the experiences that led the student to have an interest in their major (Seidman, 2006). Participants were asked questions about their past experiences related to their major, social support for choosing their major, and the value that they and their social network (e.g., parents, teachers, peers, mentors) held for their major. During this interview, the students also completed a selective valuing activity. Students were asked to list the aspects of themselves that they consider most important on small pieces of paper. Aspects were defined as roles they played (e.g., physics student, son, drummer) rather than characteristics (e.g., driven, hard-working). The students were asked to include their major as one aspect on their list. After listing their most important aspects, the students were asked to rank these aspects from most important to least important. They were then asked to create a pie graph with sections for each aspect showing the relative amount of space for each aspect and to label the piece with a percentage (e.g., see Appendix B). Following the activity, the students were asked to explain the relative importance of the role as a student in their major to other aspects on the circle map.

The second, follow-up, interview in Spring 2013 was focused on the student's experiences within the first year experience course and within his or her major. This interview included questions directing students to reflect on their interest in and value for their major as

well as to reflect on how their interest and value for their major had changed over the semester. The final section of the interview included a set of questions adapted from Evans, Jones, and Akalin (2012), and worded to specifically relate to components of the MUSIC Model of Academic Motivation (Jones, 2009).

I recorded all of the interviews using a digital audio recorder. I took notes during each interview and supplemented them with detailed field notes recorded immediately following the interviews to note any questions for follow-up (for the fall semester interviews) and to capture my first level of analysis.

Data Analysis

I transcribed each fall interview and a professional transcriptionist transcribed the spring interviews. I read through all of the fall semester interview transcripts and my field notes for each interview to immerse myself in the data and focus on the portions of the interviews that were most directly related to my research question before beginning to code the transcripts (Patton, 2002; Seidman, 2006). Even though I did not use a grounded theory framework of analysis, I did use a constant comparative method of data analysis (Charmaz, 2009). My initial coding was both inductive and descriptive. I used line-by-line open coding to allow key concepts to emerge from the data (Charmaz, 2009; Patton, 2002). In the second iteration of analysis, I consolidated the initial codes into a set of focused codes. These focused codes provided an initial description of the categories and subcategories emerging from the data (see Appendix C for Code Mapping Table). I used the focused codes when coding the second round of student interviews. As I coded the second round of interviews, I made note of any sections of transcripts where the focused codes did not fit and returned to descriptive coding when needed to develop additional focused codes (Charmaz, 2009). In the third iteration of my analysis, I wrote

analytical memos to develop my focused codes into categories and themes. Through the process of writing analytical memos, I grounded my categories and analysis in the voices of my participants by returning to the interview transcripts to provide support for the categories that I developed through the coding process (Charmaz, 2009).

Findings

The purpose of this study was to explore the nuances of students' perceptions of their interest in and identification with their prospective science major. Four main themes emerged from the coding and analysis of interviews with eight first year physics and biochemistry students: *self-definition in flux*, *feeling competent*, *expressing interest through enjoyment*, and *keeping things relevant* describe how the students expressed the connection they felt with their prospective major during their first year at college. In the following sections, I explain each theme in detail.

Self-Definition in Flux

Even though this group of students entered college with a declared major, their self-definition in relation to their major remained in flux. Seven of the eight students initially applied to the university with a different major and had changed to a physics or biochemistry major during the period of time between their acceptance to the university and the first interview (see Table 5). The mutability in the students' self-definition also showed in the language that students used to talk about their major. The descriptions of their major were hedged in terms related to desire (e.g., "I want to be," "I want to do," "I wanted to be") and internal processing (e.g., "I think that," "I think I am"). Only two students made declarations of identification (i.e., "I am a physicist" and "as a physics major") during the interviews and in both cases the declarative statement was connected with a future goal, for example "I cannot understand everything about

the universe obviously, but as a Physics major, I want to make a difference in the world" (Kelley).

Table 5

Changes in Student's Science Major Prior to First Interview

Participant	Major listed at time of application to college	Major at time of 1st Interview
Kelley	Music/Theater	Physics
Max	Engineering	Physics
Emilia	Engineering	Physics
Rosalyn	Undeclared	Physics
Cody	Biochemistry	Biochemistry
Josh	Physics	Biochemistry
Melissa	Engineering	Biochemistry
Kate	Agriculture	Biochemistry

Although students rarely defined or identified directly with their major, they often described their interest in their major in relation to the characteristics or values that they felt defined themselves or characteristics by which they wanted to define themselves in the future. In part, by highlighting the values that they considered important, the students were also keying in on the aspects of their major that were most important to them. For example, Max explained his connection with physics as: "I guess just natural curiosity. That's why it's the most important. It's just a natural curiosity for learning how things work and that is what physics is. So that's why I find it important just to know certain things." In students' future oriented self-definitions, they described who they wanted to be and what they wanted to do in the field in relation to the characteristics they hoped to find there. These characteristics were broad "to help people" (Josh, Emilia, Rosalyn) and "to make an impact" (Kelley). They also described changes in their academic or career interests to better align their prospective major or career with personal values

and goals. Max described changing to physics because it was more "self-enriching" though less "lucrative" than engineering.

The mutability of students' self-definition is logical considering their position as incoming college students. These students were taking their first college level courses in their fields. In fact, for the students in biochemistry, the biochemistry first year seminar was the first classroom exposure the students had to the specific field of biochemistry. Experiences in college were already impacting how they viewed their major: Melissa began college as a chemical engineering major, but changed to biochemistry after the first two days of engineering courses. She described feeling capable of completing an engineering degree, but was not "excited" by the classes and the concepts.

Feeling Competent

Each of the students in this sample spent time describing their competence in the area of their prospective major. Competence, in these descriptions, encompassed both their self-confidence in their abilities ("math and science were always easy for me") and their perception of their current and developing abilities in the subject areas related to their major. Competence was one way that the students assessed their interest in the content of their major. If they felt that they had or were developing an understanding of the knowledge needed to be successful in the subject, then their confidence in their own ability to do well in their courses and, by extension, the major increased. Students frequently used their perceptions of their competence in high school courses or other related experiences to explain how they came to select their prospective major. Students frequently used their perception of growing competence and feelings of success in courses related to the major to explain their continued interest in their major. Feelings of lower competence were important also in how students described both their interest and identification

with a prospective major. Sometimes lack of competence spurred students to follow a new interest and change majors. At other times, students acknowledged feeling that their abilities were not represented by course grades, but attributed the discrepancy to other internal or external aspects of the experience other than lack of competence.

"I have always been good at…" As the students described their earlier educational experiences, five of the eight participants described long-term feelings of competence in areas related to their current major. These descriptions ranged from: " I have always been good at biology" (Cody) to "I guess I've always kind of thought better in math, like it just always made sense to me" (Rosalyn). Each of these students distinguished their competence in math and/or science from how they felt about other academic areas either by specifying the subject (e.g., biology) that was easy or by contrasting subjects: "I always excelled in science and had to work really hard at everything else" (Kelley).

Getting Better. Although math and science may have always been easier for some of the students to understand, they all described experiences in high school and college in which they felt that their understanding and self-confidence in their major was improving. Max described choosing to switch into an advanced math and science track in high school to prepare for a potential major in engineering and then developing a feeling of competence through success in difficult classes: "It [advanced math and science track] was hard, but I still managed to get good grades in it, like As, even though it was a different level of course rigor." Similarly, Kelley requested to switch into AP Physics in high school even though she did not have the same level of math background as her classmates. She described an initial confusion and lack of competence with the course, but with encouragement from both her father and teacher, Kelley remained in

the class: "[My father] helped me a lot and I needed his help less and less and I started doing really well." Both her father and teacher emphasized that "doing well" meant learning:

> I was crying and said [to her teacher], "How am I going to major in this? I did horrible on this test!" And he was like, "Kelley, you've got to think about this. It doesn't matter if you are not getting straight As, it's that you are learning it and a lot of people in this class aren't learning it." (Kelley)

A number of students described a similar growth in their feelings of competence related to their initial math and science related college courses and often related their growing feelings of competence to happiness with their choice of major. These initial college-level courses provided students with the opportunity to increase their understanding of the knowledge-base and their confidence in their ability to successfully apply this knowledge. For some students, feelings of competence were enhanced by the lack of difficulty in courses, "It seems pretty basic for what a biochem course could be like, but I feel it's a nice introduction to make sure people are in the major they want to be in" (Melissa). Other students developed a greater sense of competence through the successful completion of their first courses:

> The fact that I got pretty good grades has also kind of made me feel more confident about it [choosing to major in physics]. You know, I kind of went in thinking maybe I'm not smart enough to be a physics major, but I got an A in physics, at least the first semester, so yeah – my confidence has definitely increased. I feel really good about it" (Emilia).

"The person that people go to." Developing competence in a content area at times led students into the role of tutor or "unofficial teacher's assistant" (Cody). Cody described helping to prepare his high school classmates for tests by "re-teaching" material. In a college setting, tutoring came in several forms. Emilia explained that being a physics major had made her "the

person that people go to" for help with physics concepts now that many of her friends who are engineering majors are taking their first physics course. Kelley was training to be a paid mentor in her science-themed residence hall and viewed tutoring in broader terms. She described helping other students with both study strategies and advice about how to approach and talk to their professors.

Feeling less competent. Developing competence in a field or content area is not always a linear process. Many of the students described times during college or high school when they did not feel as competent or successful. Sometimes students used this as a contrast to help explain their current interest/major. For example, Melissa related that she had never felt competent in English, writing, or history that these were not her "strong suit" in contrast to science and math which always were easy to understand. Similarly, Josh explained that he was good in math but "[math] wasn't something I could afford to really be doing all the time, so that's what made me shy away from physics" as part of his explanation for choosing to major in biochemistry.

Not all students who felt a lower level of competence in their course work changed their major. Cody detailed his struggles with his biochemistry course, but associated his frustration with a lack of connection between the course and what he expected to be learning in an introductory biochemistry course:

> I expected to be learning like different theories . . . different rules of trades . . . and things that you need to know if you are going to continue studying Biochemistry. Instead the class has been, you know, go home and watch this movie come back to class and . . . we are going to ask you questions about this movie, but you have to have already taken Biochemistry to be able to answer and understand.

Even though he did not feel that he could competently participate in the discussion, the problem he described was as much about a mismatch between the course description and the reality of the assignments as it was between his abilities and the level of the course work.

The end of semester grades also caused some students to examine their level of competence. Both Max and Kelley did not feel that they received grades that represented their level of competence though they attributed the mismatch in different ways. Similar to Cody, Max and Kelley provided a rationale for their grades that separated their performance in this physics course from their competence in physics as a whole. Max described a mismatch between his professor's teaching and tests. Thus the unexpected level of challenge on the tests in a class that Max described as a "refresher course" led to his lower than expected grade in Foundations of Physics. "I understood the material; it's just that his tests were challenging." Kelley viewed her lower than expected grade in physics as the result of her attitude toward the course impacting her study habits:

> With physics lecture, I went in with the idea that I already know all this stuff and it is really annoying, I didn't really like the class at all, and because I had that attitude, I didn't do as well as I thought I was going to do. I got a B in the class, which isn't bad by any means, but I never tried because I was frustrated that it was so easy.

Competence is a key piece of how students perceive their interest in and identification with their major; however, students did not describe developing or maintaining interests solely in subjects where they felt successful. Several students described classes or subjects that were easy or where they felt successful that did not engage their interest. For example, Cody described his high school biology class as easy, but then explained how he finished his work quickly and slept

or read for the remainder of class. Competence is one of several themes that students' described as they explained how they developed a connection with their prospective major.

Often competence was a springboard encouraging students' connection with a discipline, particularly for students reporting long-term competence in a subject area. For example, even though he admitted to reading and sleeping through general biology, Cody described an ongoing interest in biology throughout high school. He chose to take Anatomy and Marine Biology in addition to his required science courses (Chemistry and Physics) and was majoring in biochemistry. In describing Anatomy and Marine Biology in contrast to other science courses, Cody explained both competence ("it was much more challenging, but that [Anatomy] was probably the first class I ever studied for, and it was because I really wanted to study in my class because I wanted to do well") and his enjoyment of the class ("the most fun classes I had ever had in high school").

Expressing Interest Through Enjoyment

"I fell in love with physics" (Kelley), "Anatomy was my favorite subject" (Cody), and "I am enjoying all of my classes" (Melissa) are all descriptions that students related to the field of their major. Throughout the interviews, the students described their positive interactions with experiences and content that they related to their majors. As a reoccurring theme, enjoyment highlighted the students' positive emotional and cognitive response to the activities, courses, and subjects that comprise the field of their prospective major. Broadly, the students' enjoyment focused on their positive feelings for a course or subject, such as when Cody described Anatomy as his favorite subject. Narrowly, the students described specific content (e.g., the study of light in physics) or activities within their high school and college courses that they enjoyed.

When students described their emotional response to courses and subjects related to their major, they used terms such as liked, loved, fun, favorite, interesting, and enjoyed to describe the course or subject. The students focused on how they felt about a course or subject without describing what they learned. Emilia explained that she chose to major in physics and minor in astronomy in terms of broad enjoyment: "I really liked math and I really enjoyed physics, and also I really like astronomy." Melissa used similar language when describing her continued interest in her major: "I'm enjoying all of my classes, which, I guess, is the most important part."

My favorite class. Students frequently phrased their broad descriptions of enjoyment in comparative or superlative terms. As they described courses and subjects related to their major, the students used this language to compare the field of their major to other courses or subjects. In general terms, Melissa noted that she "always liked the maths and sciences better since I was younger" and Cody expressed that Anatomy and Marine Biology were "the most fun classes I ever had in high school." In these general comparisons, the students are staking out their area of interest. Students also expressed focused comparisons of enjoyment related to specific courses or majors. Emilia described her enjoyment in physics by comparing it to prior science courses:

> I was good at math and I enjoyed my math classes and I had enjoyed – I had enjoyed chemistry a little bit, but I sort of – I hadn't really enjoyed any of my science *classes* as much as I did until I took physics which was my junior year [her emphasis].

Similarly, Rosalyn described choosing a physics major in terms of comparative enjoyment:

> I was looking mostly at math, computer science, or astronomy—because I was actually planning on going to [another large school which offered an astronomy major] and when I decided to come here . . . physics it's more of the astronomy track here. So I really

> decided that I would major in physics because I liked astronomy the best of those three majors.

Rosalyn was one of several students who described how their enjoyment of a subject impacted their selection of a major. Melissa provided a negative example through her explanation of choosing to change from an engineering major: "When I got to engineering classes I heard [the instructors] talking about, you know, the outlook of what it was going to be and none of it was difficult, it just wasn't exciting." Melissa changed her major from chemical engineering to biochemistry because "the biochem was just the most appealing thing out of all of them [majors that would lead to medical school]."

Enjoyable experiences. The students also used enjoyment to describe their affective and cognitive responses to specific content or experiences related to their major. In these more focused descriptions students provided examples of highly positive experiences that led them to view the subject or themselves in a different way, connected them more deeply to the field, or fine-tuned their broad enjoyment and interest in the subject.

Positive emotional and cognitive connections emerged when students were able to make a connection between their current courses and prior interests. For example, Kate (a biochemistry student) contrasted her enjoyment of chemistry to other science courses. In biology, she enjoyed being able to understand the relationship between her work with horses (an interest of hers) and course content, "What I liked about that class [chemistry] was different. It didn't relate to my animals or anything, but it was just neat to see how things interacted with each other" (Kate). This content pushed Kate to look at her animals in a different way and begin to consider the role of chemical and biological interactions with questions that she linked to her interest in biochemistry (e.g., Why was her stallion spooked by the zebra her family owned, what were

possible chemical differences in the skin of horses and zebras that kept the zebra free of flies in the summer?).

The positive emotional response associated with a growing understanding of the field also occurred within college courses. Emilia's feelings for astronomy and physics became more nuanced as she developed a greater understanding of the field:

> I've been loving my astronomy class and really look forward to taking more in the future. And also I, one thing I sort of discovered is that I really love learning about light and that it's very deeply related to astronomy because everything we know about space comes from information we get from light.

At times the positive emotions that students felt came through their immersion in the subject. For Kelley, one pivotal moment that helped shape how she viewed physics occurred while completing homework:

> I remember one night I was working on physics homework and I thought it was fun and I ended up doing a bunch of physics problems just for fun and loving it. I looked up at the clock and it was like three in the morning and I was like "What?!" I thought it was really weird that I liked doing homework for physics. . . . I loved it more and more, I kind of fell in love with physics. It was my favorite thing, I would go home and do physics after school and I loved it."

Social experiences. Although these experiences often occurred when the student was engaging individually with content, several students also described experiences in which engaging in the activity or content with like-minded peers increased their enjoyment. Sometimes enjoyable experiences happened within a class structure. For example, Cody described dissecting a cat with his study group in high school anatomy as his "funniest memory" from this course and

Rosalyn explained that the small size of her calculus course made it "fun because by that point we all knew each other really well." Social experiences also occurred outside of the class structure; Kelley described making connections with other students interested in physics at a regional Physics Olympiad:

> It got me really excited to be in college and to be with a bunch of people who loved physics too. Because in my [high school] class, there were a lot of calculus students who were very intelligent . . . but I was the only one in my class who really loved physics. So going to see a bunch of other people who were so enthusiastic about college, I thought, "Going to college, I'm going to be with people that are into physics for fun and want to major in it." I do remember being excited for college when I went. I was like ear to ear smile all day it was so much fun.

Kelley's positive emotional response to the activity supported her growing identification as a physics student, even before attending college.

Enjoyment did not appear spontaneously for the students in this sample. The courses and subjects that they describe as fun, interesting, and enjoyable are ones in which they also felt competent and often describe having put forth effort to develop competence. The courses and subjects that students described (e.g., Chemistry, Anatomy, Advanced Placement [AP] Physics, Foundations of Physics) are courses that involved knowledge and skills that were foundational to the disciplines in which the students were majoring. The students used their enjoyment with courses and academic subjects to narrate the development of their connection with the field of their major. By reflecting on particularly enjoyable activities and content areas, the students often pointed to pivotal experiences in their developing interest and identification with their major.

Keeping Things Relevant

In addition to feeling competent and enjoying the academic subject, students described in detail the relevance of their major to their current and future plans. Students focused on majors that they felt were connected to their current interests and also described how they viewed their major as useful preparation for a future career. The students described activities, courses, and majors that they perceived to be relevant as important and helpful. When the students talked about the relevance of a course or major, they evaluated the course in relation to their personal or career aspirations. The students' views of relevance can be divided into an evaluation of how a concept, course, or major was useful to them in the present, how it might be useful to them in later college courses related to their major, or how it was relevant to their plans for the future.

Important to me now. When reflecting on high school science courses, several students explained their developing connection with an academic subject in terms of the relevance of the course to their outside interests. For example, Kate described a general disconnection with her high school courses, "I just didn't really like high school. I just kind of felt trapped." In contrast, she described liking her biology and chemistry courses because her teacher was willing to engage in conversations and answer questions relevant to her interest in horses and zebras. Kate's desire to make concepts in class relevant to out-of-class knowledge continued in her perception of her college biochemistry seminar. The movie *Contagion* was used in the seminar as a way of introducing biochemical research. When Kate described the course, she highlighted the movie and, in particular, the fact that horse trainers are the first people to die from the virus depicted in the film. Kate described her interest in biochemistry initially in terms of the desire for deeper understanding of questions originating from working with horses and other animals. The

relevance of the topic to her interest in horses helped to engage Kate with these academic courses.

Alternatively, Max, a physics major, did not find his high school physics courses relevant to his developing interest in physics. He described his physics learning as being "self-directed" because his interest in the field was focused on the "advanced physics" that he was reading in books and on the internet outside of class whereas the physics being taught in his high school courses was basic and foundational. He viewed his high school courses as providing basic learning, but less relevant to his growing interest in physics and choice of physics as a major than his self-directed learning. In each of these cases, the students' perceptions of relevance were focused on the connection between their coursework and their current interests.

Relevance within the major. Even at the beginning of their college career, all of these students examined potential courses for relevance to their major. For students coming into the university with AP credits, this evaluation included how they could use their credits to reduce the number of courses that were not directly applicable to their major. For other students, planning out their courses over the next several years helped them to hone in on the areas of the major, or supplement with a double major or minor, to develop a course of studies that they perceived to be most relevant to their goals. For example, Rosalyn changed from a broad University Studies major to physics so that she could see "how she liked it and how she did with it" and avoid "spending some of the time I got through like AP credit on things that I should not be taking." Both Rosalyn and Emilia described being careful in how they used their AP credits and choosing to take some physics and calculus courses that they could have exempted. Emilia explained:

> The only credits that I actually used from high school were things like history classes. And so that's nice. It helps me to focus on the courses that I feel like are more relevant to what I'll be doing in my career in the future.

Planning for careers. The focus on relevance also occurred when the students reflected on choosing their major. All of the students expressed how their selection of major was relevant to their plans and goals for the future. They described researching potential career opportunities associated with different fields and at times changing or modifying their academic interest to better fit their future plans. They also evaluated the college courses that they were taking or planned to take in terms of relevance to their major or future career.

In addition, all of the students described talking with their parents and teachers about potential majors and careers related to their high school academic interests. As they recounted these conversations and their other research into majors and careers, one focus of their reflection was the potential relevance of a major to their plans for the future. Several students explained how they changed or adapted their plans for a major to better fit their plans for life after college.

Many of these students understood that multiple paths were available to them, but they changed their major to a path that they perceived was more direct and relevant to their future plans. For example, Melissa, a biochemistry major, planned initially to major in chemical engineering in order to meet all of the prerequisites for medical school while fulfilling a major that could provide a back-up career if she could not attend medical school. Josh applied to the university as a physics major planning eventually to become a doctor; however, when attending a summer program at the university for incoming science majors, he met a number of biochemistry students who were also planning to go to medical school. He decided that biochemistry would be more relevant as a pre-medical major and switched majors to better align with his future plans.

The adjustments these students made in college to align their major with their career goal were not the only times that students recounted shifting their academic focus to be more relevant to future careers. Both Josh and Max described having early and strong interests in history. Both students explained that they chose not to pursue a history major because they did not want to teach and viewed teaching as the only career option available to history majors. Similarly, even though Kate referred to the time and effort she spent working with and training horses throughout her interview, her career goals were related to medicine rather than horse training because "training horses would be a waste of college."

When relevance trumps interest. During the interviews, the students described participating in courses and majors that aligned with their academic interests and long-term goals. However, students also described times when they perceived concepts and activities within courses as being relevant, but not interesting. Participating in these activities and learning these concepts did not appear to reduce their identification in their major even though they made clear that they would rather be learning something that was more personally engaging.

All of the students were participating in first year experience courses within their major. These courses were developed with the intention of helping students to learn skills that the faculty felt were necessary to the students' success within the field but did not fit easily within the introductory physics, chemistry, or biology courses (no introductory biochemistry courses were offered to first year students). When describing these first year seminars, the students spoke of some activities as helpful, useful, or important. At times they also described liking activities:

> I like that he [the professor] really just covers things that are useful to be able to do and it's cool because he can use like his own experience in physics, I guess, to tailor the material that we cover in the seminar to be what he feels is most useful to know. (Kelley)

However, each of the students also evaluated some of the course activities as important, but not "interesting." Physics students discussed the professor's focus on developing their problem solving skills as important in helping to increase their competence in solving a variety of problems, but all acknowledged that they did not enjoy the continued focus on problem solving: "that part, I don't find that interesting, I mean I know it well help me, I don't find it that enjoyable" (Max). Similarly, students in the biochemistry course focused on activities related to reading scientific literature, explaining that they understood the importance, but would rather be "learning about the medicine and everything" (Josh).

These activities were part of the course and were perceived by the students as important and relevant to their major. They did not find the activities "interesting"; however, none of the students expressed feeling their interest in or identification with the academic field was diminished by having to participate in the less personally engaging activities.

Discussion

Domain Identification

Throughout the interviews, students described and made connections between their *perceived ability* in courses and subjects related to their major, their *enjoyment* in these courses and subjects, and the *relevance* of these courses and subjects to their current and future plans. Although these students did not explicitly self-identify as a physics major, physicist, biochemistry major, or biochemist, their perceptions were consistent with the background factors that encourage students' development of domain identification. Specifically, the experiences and perceptions described by students in the themes of *Self-Definition in Flux*, *Feeling Competent*, *Expressing Interest through Enjoyment*, and *Keeping Things Relevant* align closely with the

concepts of eMpowerment, Usefulness, Success, Interest, and Caring; the five constructs that comprise the MUSIC Model of Academic Motivation (Jones, 2009).

These findings help to elucidate how students perceive these five components in relation to their academic major. In many cases, students also made connections among their feelings of empowerment, usefulness, success, interest, and caring. Three of the MUSIC components emerged as themes: Feeling Competent (Success), Expressing Interest through Enjoyment (Interest), and Keeping Things Relevant (Usefulness). Empowerment can be found both in the theme Self-Definition in Flux and integrated into the other three themes. Students described choosing and changing their major (Self Definition in Flux) along with a range of activities in and out of school in which their teachers and parents supported their sense of control in choosing activities and topics to explore. The Caring component did not emerge as a primary theme, but can be found in as a subtheme in Feeling Competent and Expressing Interest through Enjoyment as students described their social experiences with teachers, peers, and parents.

The findings also overlap with the results of quantitative studies of domain identification. Similar to the results of Osborne (1997a) and Osborne and Walker (2006), many of these students perceived themselves as having a high level of ability upon entering college. This perception of high ability continued after completing a semester of introductory coursework for the students who were interviewed in the second semester. Also, the students in this study expressed their value for their academic major as they described the relevance of their major to their future goals and plans. In expressing the relevance of their major to these goals the students often compared their current major to other academic subjects and outside interests. Their selective valuing of their academic major was expressed through the language that they used to

describe how their major was relevant to their future plans (both career plans and broader goals such as helping people or making an impact).

The findings of this study provide further insight into how students selectively value their academic major that is not available in existing quantitative studies. When students were asked to consider their academic major within the context of other important roles (i.e., daughter, volunteer, body-builder, band member) during the selective valuing activity, each student incorporated their major into a pie graph showing the comparative importance of each role. However, when explaining the pieces of the pie graph, students tended to describe the connections between their different roles and the different domains that were important to them even when explicitly asked to compare the importance of the different roles and domains. Similarly, the students avoided making definitive statements related to their major both during the activity and during the other parts of the interviews. Instead, students tended to focus on their perceptions ("I think") and their goals ("I want to be"). These findings lead me to believe that students are still developing an understanding of themselves in relation to their major and making connections between their major and the other pieces of their self as well as to their future goals.

The findings also provide a more detailed account of how these first year students perceive the value and usefulness of their academic major. All of these students expressed the practical nature of their choice of major, often during the initial minutes of the interview, by describing potential careers related to the major. They all explained that the relevance of the major to potentially interesting careers played a role in their selection. Students specifically described shifting their academic focus or major because they felt that an earlier academic interest/major was not associated with careers that they wanted to pursue. These students had a

perception of value that was based as much on their future goals as it was on their past or current academic experiences within the field. These findings are likely impacted by the current culture within the United States in which high school and college students are encouraged to begin planning for their first career as early as possible. High school students are encouraged to choose college majors that will prepare them for professions and most of the students in this study described having conversations with their parents about potential careers related to their prospective majors. Thus, these students may be articulating their personal value for and identification with their major by explaining how their major fits into their long-term career plans.

Interest

The students used terminology and descriptions similar to Hidi and Renninger's (2006) model of interest development when expressing their connection to their major. The overlap in language was most prevalent in the findings related to enjoyment. Students highlighted the importance of enjoying, loving, and being excited by the subject and the concepts they were learning. These descriptions of their affective and cognitive response to concepts, activities, and courses align with Hidi and Renninger's (2006) definition of interest as a psychological state of affectively and cognitively engaging with an activity, subject, or content area. The students re-engaged with the area of their interest by choosing to take additional courses in high school, to major in the academic field, and to participate in out-of-school reading and optional activities (e.g., Physics Olympiad).

The students in this sample had difficulty explaining when their interest in math or science began, which is consistent with how Renninger (2010) has described interest as an unreflective state, particularly when an interest is developed at a young age. Even students whose

interest in science or math began in high school generally could not delineate the moment when their interest began. Some students, such as Kelley and Emilia, could point to a specific class that helped to focus their general interest in math or science on a particular area (e.g., physics).

The students in this sample did not follow a single, direct trajectory in their development of interest in their major. Some students' interests developed along the most direct path described by Hidi and Renninger (2006), moving from an interest sparked by an activity or class to a more self-guided interest. Other students followed less direct trajectories. Josh described finding his high school biology and chemistry courses moderately interesting, but not did pursuing the interest further (instead becoming immersed in a new interest in physics). This changed when he took a college chemistry course in a summer program and viewed chemistry with "a new mindset" which led to him changing his major to biochemistry.

Two main differences between the findings in this study and Hidi and Renninger's (2006) model of interest development are (a) the ways that the students perceived value or relevance of their major and (b) the students' focus on developing competence rather than increasing stored knowledge. These students primarily focused on the relevance of their major to future goals and frequently to future careers. Many of the students described changing majors in order to align their major with their future goals. This type of value does not match Hidi and Renninger's working definition of stored value (as stored knowledge and feelings of competence). Other interest researchers explicitly state that an individual interest must be internally motivated and not tied to future goals (Krapp, 2002; Schiefele, 1991**)**. However, most of the students in this study viewed their academic major as one part of a longer path that included graduate school, medical school, or both. Their academic interest was developing along the trajectory suggested

by Hidi and Renninger (2006), but the students perceived their major as satisfying both their current interests and their future goals.

Although the students described in depth their increasing (or decreasing) competence with areas of academic interest, they rarely focused on their increasing their levels of stored knowledge. The development of stored knowledge, which Hidi and Renninger (2006) define as changes in cognitive structure related to engagement with the content, may be difficult for students to reflectively explain. Describing their increasing competence could be viewed as a method for the students to explain their increased knowledge in the subject; however, Hidi and Renninger (2006) place increasing competence as a part of stored value. Other interest researchers have chosen to exclude the development of knowledge from models of interest development (Krapp, 2002; Schiefele, 1991) by proposing that individual interests may develop in learners with varying levels of content knowledge (Krapp, 2002, 2007).

Where Domain Identification and Interest Diverge

Relevance, selective valuing, and stored value. Domain identification and interest overlap in many of the students' accounts of their sense of connection with their major. Enjoyment and Competence, themes that align with both domain identification and interest, were prevalent topics throughout the interviews. However, the theme of Relevance does not fully align with the working definitions of either selective valuing in domain identification or stored value in interest. When viewed as the students' perceptions of a connection between their major and their future academic and career goals, Relevance aligns with the Usefulness component of the MUSIC model (Jones, 2009). Relevance aligns with the definition of selective valuing only insomuch as students' perceptions of relevance directly connect their value for their major to personally significant future goals. Therefore, the theme of Relevance aligns with the definition

of selective valuing for the students in this sample majoring in physics, but does not align with the definition for students majoring in biochemistry who perceived their major as preparation for future goals in medicine (a different domain).

Hidi and Renninger's definition of stored value aligns with only one of the sub-themes of Relevance, "Important to Me Now." In this sub-theme, the student's perception of relevance is focused on the present and connected to the student's feeling and experiences within the domain. Hidi and Renninger (2006) and interest researchers have also found that teachers can support students' situational interest by making content and activities personally relevant to students (Harackiewicz et al., 2008; Hulleman, Durik, Schweigert, & Harackiewicz, 2008; Mitchell, 1993; Renninger, Ewen, & Lasher, 2002).

However, the other sub-themes show the emphasis students placed on the relevance of activities, courses, and their major to future goals distinguishing Relevance from Hidi and Renninger's (2006) stored value component. Krapp (2002) describes a more encompassing conceptualization of value than Hidi and Renninger. His value-related valence focuses on the personal significance of an object of interest. Thus, value for a major would be related to how relevant the major is to a student's sense of self. This conceptualization of value integrates more of the students' perceptions of Relevance than Hidi and Renninger's definition of stored value and potentially provides a more fluid link between the development of interest and the development of domain identification.

Separating individual interest from academic majors. Through the interviews and the selective valuing activity, students in this study described having a variety of interests in activities and content areas other than their academic major. These interests ranged from playing video games and reading about European history to training horses and teaching ballet. Often,

students had participated in ballet, playing video games, or training horses for years. They felt competent and enjoyed the activities; however, they did not connect these interests with their future academic or career goals. Many of the students described actively choosing *not* to pursue a major related to the activity (i.e., history, theater, dance, or agriculture). These students displayed the components of a developing individual interest (i.e., stored knowledge, value, and positive affect), but did not display high domain identification. They considered their interests to be personally relevant, but had chosen to integrate the areas of interest into their lives in ways that put less emphasis on their ability to perform for others or build a career and more emphasis on their sense of personal competence and enjoyment (i.e., taking general education courses in history or teaching ballet to pre-school-aged children during the summer). They included these interests in their selective valuing pie graphs that were part of their interview, but explained that these were activities that were "for fun" and not related to their career goals. This separation between level of interest and level of domain identification appears fundamentally different from descriptions of dis-identification, de-valuing, or disengaging (Aronson & Steele, 2005; Schmader, Major, & Gramzow, 2001). The students had not devalued their area of interest per se as they continued to engage with their area of interest. However, they did not perceive the interest to be a viable career option or they worried that pressure to perform (particularly related to interests in dance and theater) would reduce their feelings of competence and enjoyment. Rather than dis-identify with the domain, the students had chosen to re-contextualize their identification as a "hobby" rather than a potential career.

Conclusion

Theoretical Considerations

The descriptions of students' interest in and identification with their major in this study provide researchers and practitioners with a more nuanced view of the development of interest and identification in science majors. This study highlights the connections students make in their lived experience between concepts that are often studied separately. Each student incorporated the themes of Self-Definition in Flux, Feeling Competent, Expressing Interest through Enjoyment, and Keeping Things Relevant when describing their interest in and identification with their academic major. They enjoyed (for the most part) and were excited by what they were learning, felt they were growing more competent, and viewed their academic major as relevant to their future personal and career goals. This study also illuminates potential differences between first year college students' perceptions of the relevance of their major and how concepts related to relevance (i.e., usefulness, value, importance) have been defined in the current literature. Students may be evaluating the usefulness, value, or personal importance of their major through their perception of how relevant the discipline (or the current class activity) will be to their future academic or career goals. This perception of value for the major is *future*-directed, whereas the value-related concepts in the current models of domain identification and interest (e.g., selective valuing, stored value, and value-related valences) focus on individuals' value for the discipline or domain in the *present*. Students' perceptions of the value of their major *may* be linked to their present perception of the inherent value of the discipline, but are also likely to be related to their understanding of the relationship between their major and their future goals and aspirations. Researchers need to be aware of the potential differences in the understanding of *value* when developing interview and survey questions so as to clearly place value for the major in either a

present (e.g., “How useful is what your are learning in the first year physics seminar to you right now?”) or a future context (e.g., “How valuable is what you are learning in your first year physics seminar to your future goals?”).

The present study provides an opportunity to examine how well the Osborne and Jones (2011) and Hidi and Renninger (2006) models of domain identification and interest development align with the lived experiences of students. Osborne and Jones’ (2011) model of domain identification is generally consistent with the findings of this study. The students did selectively value their major in comparison to other disciplines and they related their current identification with their major to prior educational experiences. The current study also provides qualitative support for the inclusion of the MUSIC Model of Academic Motivation (Jones, 2009) within the larger model of domain identification to express how students perceive their formal and informal educational experiences, particularly as all five of the MUSIC components could be associated with the themes and sub-themes that emerged from this study.

Hidi and Renninger (2006) have created a comprehensive model of interest development designed to incorporate all of the components that explain the development of interest. Nonetheless, this model is difficult to examine through the context of students’ lived experience. Two of the three components (i.e., knowledge, value, and affect) of this model of interest development were not consistent with the findings that emerged from this study. The students spent more time describing their perception of competence than they did describing how they developed domain knowledge. Therefore, simply building domain knowledge should not be viewed as synonymous with developing interest; these students perceived their interest more in relation to how confident they felt about their knowledge, how relevant they felt the knowledge was to their future goals, and how much they enjoyed their experiences in the discipline rather

than the amount of knowledge they had. In addition, Hidi and Renninger's definition of stored value was more closely aligned with the students' perception of competence rather than their perception of relevance. By framing the definition of value as students' affective feelings and feelings of competence, Hidi and Renninger (2006) minimize the relevance of a developing interest to an individual's long-term goals and to their developing sense of self.

Hidi and Renninger's (2006) model would be more consistent with the findings of this study with several revisions. The stored knowledge component could be adapted to represent learners' feelings of competence and the stored value component could be revised to focus on students' perception of the importance or usefulness of the content or domain. Alternatively, other models of interest development, such as Krapp's (2002) Person-Object theory of interest, may provide a more applicable model for researchers examining the relationships between interest development and domain identification by removing the component of stored knowledge and framing value as the personal significance (e.g., relevance) of the content of interest.

Practical Implications

This study provides faculty who work with first year students several key areas in which they could support their students' development of interest and identification with their major. First year students are still integrating their interest in their major into how they view themselves now and into who they hope to be in the future. Based on these findings, it seems reasonable to infer that faculty and advisors can support students by explaining how a given course and activities within the course are relevant and useful to their future within the major (especially at the prerequisite or introductory level). Students in this study described understanding that some activities were useful and important for their future success even if the activities were not immediately "interesting." Alternatively, some students felt frustrated with activities and their

level of competence when they did not perceive an activity or concept to be necessary for their future success in the major. Faculty and advisors should be aware that students' perceptions of their future options within their major arise from their prior educational experiences. I would suggest that faculty and advisors can help to broaden students' perceptions of their future options by highlighting potential research opportunities and careers related to the academic major.

Future Studies and Limitations

A broader study is needed to examine the themes which emerged from this study in first year students in other majors (e.g., science, professional, and humanities based) and in students who are entering into college without a declared major. Also, a longitudinal study is needed to follow students through college in order to examine how their perceptions of identification and interest in their academic major(s) changes over the course of their college career.

This study was an exploratory, qualitative study and thus the themes may not be generalizable to the general population of first year science students. The students in this study had declared a major before entering college; therefore, they may have been more focused on the relevance of their major to future goals than students entering college without a declared major. Also, the students' focus on future relevance may not be representative of students in non-scientific academic majors.

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Chapter 5

Supporting Student Interest and Domain Identification in Science Majors: Faculty Perceptions of First Year College Students' Domain Identification and Interest Development

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Abstract

This exploratory qualitative study examines how professors of first year college students perceive students' development of domain identification and interest in biochemistry and physics and how they actively support this development. The study also compares how professors and first year students perceive identification with and interest in a science domain. The participating professors provided different descriptions of their students' levels of domain identification and interest. Although neither of the participating professors (a physicist and biochemist) was familiar with the academic research in domain identification or interest, their beliefs about their students interest and identification and the methods they used to support their students generally aligned with the Osborne and Jones (2011) and Hidi and Renninger (2006) models. The professors' perceptions of student interest and identification were similar to, but did not fully align with those of the students. The main difference being that students in both majors evaluated their major in relation to their future goals and aspirations. The comparison of student and faculty perceptions provided support for some methods the professors used to encourage the development of interest and domain identification in their students.

When students enter college with a pre-selected major, the initial major-related courses immerse them in academic and social experiences that may reinforce their beliefs about their prospective major or cause them to re-evaluate these beliefs (Harackiewicz, Durik, Barron, Linnenbrink-Garcia, & Tauer, 2008). The professors in these first year, major-related courses have the opportunity to support these students as they envision themselves within the domain of their major. Although the primary purpose of most introductory courses is often to build students' knowledge in their major domain (e.g., physics, biology, chemistry), professors can also use these courses to create learning environments that can develop students' interest in and identification with their prospective major. Understanding factors that influence students' interest in and identification with their major are especially important in science-related majors because there is a lack of graduates in those fields. Understanding why students choose to stay or leave their major during their first year may be helpful in providing implications that faculty and administrators can use to help retain students in these majors.

Domain identification and interest are motivation constructs that develop from an individual's educational and social experiences and influence later academic outcomes (Harackiewicz et al., 2008; Osborne & Jones, 2011; Renninger, 2010). Domain identification describes "the extent to which an individual defines the self through a role or performance in a particular domain" (Osborne & Jones, 2011, p. 132); whereas, interest incorporates both an individual's engagement with a domain and the individual's predisposition to re-engage with the domain (Renninger, 2010). Both of these constructs focus attention on the impact of the *value* that an individual holds for a domain on later academic, social, and emotional outcomes (Krapp, 2002, 2007; Renninger, 2010; Renninger & Hidi, 2011; Walker, Greene, & Mansell, 2006).

Although both interest and domain identification are related to positive academic outcomes (Harackiewicz et al., 2008; Hidi & Renninger, 2006; Osborne, 1997b; Osborne & Jones, 2011), few studies have examined how instructors perceive or support these concepts (Jones, Osborne, Paretti, & Matusovich, 2012; Kunter, Baumert, & Köller, 2007; Long & Hoy, 2006). In this study, we examined how professors of first year students perceive and support the development of their students' interest in and identification with their prospective major. We conclude by comparing these professor perceptions with the perceptions of first year college students that were obtained as part of a larger study.

Theoretical Framework

Interest

Most of the research on interest as a motivation construct has focused on two separate conceptualizations of interest. *Situational interest* describes the types of activities that trigger or "catch" interest with the understanding that this type of interest emerged from specific features in the environment and may be context specific (Alexander, Kulikowich, & Schulze, 1994; Hidi & Baird, 1986; Hoffman, 2002; Lipstein & Renninger, 2007; Mitchell, 1993; Schraw & Lehman, 2001). *Individual interest* is defined as a psychological disposition that is consistent within an individual across different environments (Alexander, 2003; Lawless & Kulikowich, 2006; Renninger, Hidi, & Krapp, 1992; Schiefele, 1991).

Hidi and Renninger (2006) have integrated the two concepts of situational and individual interest into the Four-Phase model of interest development. They define interest as both a predisposition to re-engage with content over time and as a construct that is comprised of the knowledge, stored value, and affect related to the content which results from the individual's engagement with a specific content over time (Hidi & Renninger, 2006; Renninger, 2010). In

this model, the growth in affect or positive feelings, stored knowledge, and stored value are the key components propelling the development of interest from an externally-supported situational interest to an internally-supported individual interest. In describing the components of interest, *affect* is defined as the positive feelings (although the feelings could be negative) that an individual connects with engagement with a subject matter (Renninger, 2010). *Stored knowledge* is defined as changes in cognitive structure related to engagement with the content and *stored value* is defined as the combination of feelings of competence and the emotions related to engagement with the content (Renninger, 2010; Schiefele, Krapp, Prenzel, Heiland, & Kasten, 1983).

The initial situational phases of interest are externally supported with the individual initially making an emotional or affective connection with a specific activity or task (Hidi & Renninger, 2006; Mitchell 1993). This phase of situational interest may be *triggered* (phase 1) through novelty, physical activity, personal relevance, or connection to individual interests (Alexander, et al., 1994; Mitchell, 1993; Palmer, 2009; Renninger, Ewen, & Lasher, 2002; Schraw & Lehman, 2001). As an individual re-engages with the topic or content her interest may become *maintained* (phase 2). Re-engagement may be supported through a number of different means including autonomy-supportive teaching methods, such as taking the students' perspective and providing students with some control over activities (Palmer, 2009; Tsai et al., 2008); opportunities for social involvement (Barron, 2006; Palmer, 2009); and student perception of value or personal relevance in the material (Harackiewicz et al., 2008; Hulleman, Durik, Schweigert, & Harackiewicz, 2008).

As individuals shift from the phases of situational interest to those of individual interest, the support for re-engaging with the content becomes internal. Individuals with an *emerging*

individual (phase 3) interest have developed the positive feelings, stored value, and stored knowledge that lead them to seek opportunities to re-engage with the content of interest without relying on external support (Hidi & Renninger, 2006). Individuals at this stage of interest development begin to self-identify with their content of interest and to more actively seek out learning opportunities (Hidi & Renninger, 2006; Krapp, 2002, 2007). This phase of interest development provides some challenges for instructors, mentors, and other individuals. At this point, a learner may become very focused on the questions and content within the content that they find most engaging and, paradoxically, may become frustrated in response to constructive feedback (Hidi & Renninger, 2006; Renninger & Su, 2012). Support for individuals at this level of interest is comparable to the support that is needed to help individuals maintain situational interest: learning environments that support the individual's autonomy (Tsai, Kunter, Lüdtke, Trautwein, & Ryan, 2008), provide challenge (Renninger, 2000), and in which the individual has the time, freedom and resources needed for learning (Barron, 2006). Individuals with a *well-developed individual* (phase 4) interest actively re-engage with the content or domain of their interest over time (Hidi & Renninger, 2006). Similar to the prior phase, individuals with a well-developed individual interest generate questions and seek out knowledge related to their interest and to persevere when faced with frustration (Renninger & Hidi, 2002).

Domain identification

Domain identification is the *selective valuing* of a domain as important to the self-concept or self-esteem of an individual (Osborne & Jones, 2011). This definition is based in the symbolic interactionist conception of self-esteem, in which the feedback an individual receives from the environment (in terms of academic performance, among other things) is filtered through the individual's perceptions of the outcomes and evaluation of the importance of the domain to

their self-esteem (Osborne & Jones, 2011). Thus, individuals are affected more significantly by their level of performance in a domain that they value greatly, than in a domain in which they place little value (Osborne, Walker, & Rausch, 2002).

Within academic settings, domain identification is related to a number of positive academic outcomes. At the high school level, identification with the academic domain is positively correlated with learning and performance goals, as well as with the intrinsic valuing of academics, perceived ability, self regulation, and both deep and shallow cognitive processing and negatively correlated with absenteeism and behavioral referrals (Osborne & Rausch, 2001; Osborne & Walker, 2006). At the college level, academic domain identification significantly predicted GPA after one semester and again after two years, even when controlling for sex, race, and self-esteem. In addition, students at different levels of academic standing had significantly different levels of identification with academics. A high level of identification with academics measured upon entering community college was related to positive academic outcomes such as achieving Dean's List or Honor's standing; whereas a low level of academic identification was related to withdrawal, academic dismissal, or academic probation. (Osborne, 1997b)

The results of these studies highlight relationships that form the basis for the model of domain identification developed by Osborne and his colleagues (Osborne, 2004; Osborne & Jones, 2011), which shows the connections between domain identification, social and motivational background factors, and academic and behavioral outcomes.

Antecedents of domain identification. The model of domain identification developed by Osborne and his colleagues describes the process by which a set of social and academic background factors impact domain identification and related motivation constructs which, in turn, impact behavioral and academic outcomes. These background factors include group

membership (e.g., gender, race, ethnicity, class); family, peer, and community environment; school climate; and both formal and informal educational experiences (see Osborne & Jones, 2011 for more information). In relation to the background educational experiences, Osborne and Jones (2011) explained how the instructional strategies specified in the MUSIC Model of Academic Motivation (i.e., eMpowerment, Usefulness, Success, Interest, and Caring; MUSIC is an acronym; Jones, 2009) can also reinforce students' domain identification. Jones, Ruff, and Osborne (in press) have documented this process more specifically within the domain of science by explaining that teachers can encourage students' development of domain identification by: *eMpowering* students by supporting their sense of control, helping students to understand the *Usefulness* of concepts to current and future goals, providing students with opportunities for *Success* in their learning, incorporating and supporting students' *Interest*, and showing students that the teacher *Cares* for them both academically and personally.

Consequences of domain identification. Domain identification interacts with students' goals, beliefs, and self-schemas to affect their effort, persistence, and academic engagement and outcomes. Osborne and Jones (2011) hypothesized that, in general, higher identification with an academic domain is closely related to greater effort to succeed, persistence when faced with failure or frustration, and the goals, beliefs, and self-schemas that support academic success. Conversely, low domain identification is related to low effort in the domain, low persistence, and the lack of goals, beliefs, or self-schemas that support success.

Domain identification is likely cyclical (Osborne & Jones, 2011). Thus, although domain identification may be a stable concept, it is not static, and could be impacted by frequent positive or negative academic outcomes. For example, a student's identification with a domain may decrease if she begins to receive performance outcomes that do not reflect her perception of

ability or if the climate of the domain begins to emphasize negative stereotypes. Alternatively, this model shows how shifts in school climate or other precursors may also work to increase students' domain identification.

Influence of Social Support in the Development of Interest and Domain Identification

The first year of college is a transition point for many students and provides a context for examining how interests and domain identification develop or change within the student and how those interests may be supported in formal academic settings. For example, Harackiewicz et al. (2008) reported that interest development in introductory courses was related to both academic performance and later course selection of college students who participated in an introductory psychology course. They also found that students with high initial interest and high background knowledge in psychology were significantly more likely to go on to major in psychology after completing the introductory course than those with a high initial interest but low background knowledge.

Researchers of both interest and domain identification have noted the influence of others (e.g., teachers, parents, peers, mentors) on the development of the constructs (Barron, 2006; Kunter et al., 2007; Osborne & Jones, 2011; Pugh, Linnenbrink-Garcia, Koskey, Stewart, & Manzey, 2010; Renninger, 2010; Renninger & Hidi, 2011; Steele, 1997; Thoman, Sansone, Fraughton, & Pasupathi, 2012).

Prior studies within these two constructs have examined the impact of teaching strategies on interest (Kunter et al., 2007), the impact of instructors' domain interest on their students' level of interest (Long & Hoy, 2006), and the role of teachers from the perspectives of students (Jones et al., 2012). However, few studies of interest or domain identification have examined how professors perceive their students' development of interest or identification or the methods by

which professors perceive interest or identification is developed (Morales, 2008). Developing a better understanding of professor perceptions and where these perceptions overlap with their students' self-perceptions of their developing interest and identification can provide a stronger basis to develop interventions and instructional strategies related to the development of interest and identification in the science domains.

Research Questions

The overarching goal of this study was to examine how professors' beliefs and instructional strategies can affect students' interest in and identification with their prospective science major. The three specific research questions were as follows.

- **RQ 1:** How do professors of first year college students perceive their students' interest in and identification with their prospective science major?
- **RQ 2:** How do professors support first year students' interest in and identification with a prospective science major?
- **RQ 3:** How are the perceptions of students and faculty related to the prospective science major interest and identification similar and different?

To answer the first two research questions, we collected data from university professors who taught first year students in science-related courses. To answer the third research question, we compared the results of the present study to those of a related study that was part of a larger study investigating the beliefs of first year students and their professors.

Method

Research Design

This study was an exploratory qualitative examination of two professors' beliefs about their first year students' interest in and identification with their prospective science major and the

instructional strategies these professors' used to support their students' development of interest and identification with the major. Data were collected through interviews with two professors who had designed and were teaching first year experience courses in biochemistry and physics.

Working Definitions

Rather than focusing on a set of operational definitions to delineate a set of variables, the study was grounded in working definitions of domain identification and interest. For this study, our working definition of *interest* was drawn from Hidi and Renninger's (2006) Four-Phase model in which they describe interest as "the psychological state of engaging [cognitively and affectively] or the predisposition to re-engage with particular classes of objects, events, or ideas over time" (p. 112). Interest, within this model, is comprised of knowledge, stored value and feelings related to the content and results from the individual's interactions with the content (Hidi & Renninger, 2006; Renninger, 2010). We used Osborne and Jones' (2011) description of *domain identification* as: "the extent to which an individual defines the self through a role or performance in a particular domain" (p. 132).

Participants

The two participating professors were purposefully sampled from the faculty at a large, public, U.S. university because they were teaching first year experience courses. Dr. B was a Caucasian, female professor of Biochemistry and Dr. P was a Caucasian, male professor of Physics. Both professors were full-time, tenured full professors who had developed and were teaching a first year experience course for students who had declared a major in either biochemistry or physics.

Course Descriptions

Many first year students participate in introductory courses that are designed to build their content knowledge within their prospective major; fewer first year students participate in courses specifically designed to help them develop both content knowledge and an understanding of what it means to *be* a member of their major discipline. This study focused on the latter and included one first year experience seminar in biochemistry and one in physics.

Approximately 150 incoming first year and transfer students were enrolled in the biochemistry course. The biochemistry course was a one semester, one credit hour, pass/fail course that was taught by Dr. B and a graduate teaching assistant. Class sessions included a set of large group lectures and small group discussion sessions led by undergraduate teaching assistants (peer mentors) who were junior or senior biochemistry majors. Approximately 60 incoming first year and transfer students were enrolled in the physics seminar. The physics course was part of a two semester series where each course was three credit hours and students were graded on an A-F scale. Dr. P and a graduate teaching assistant taught both semesters; all class sessions included the whole group. Both the biochemistry and physics courses were part of a university-wide focus on strengthening students' first year experiences and had learning outcomes and objectives that focused on building students problem solving, information literacy, and integration of learning within the discipline.

Data Collection and Analysis

We used in-depth individual interviews to assess the professors' perceptions of their students' interest in and identification with their major. Using in-depth individual interviews helped us to understand the individual professor's perspectives and generated rich descriptive data (Rossman & Rallis, 2003; Seidman, 2006). Each professor was asked to participate in one

30 to 45 minute interview. To keep the interviews focused on the constructs, we used a semi-structured interview guide (see Appendix A for Interview Guide; Patton, 2002). Prior to the interview, all professors were asked to complete an informed consent form approved by the university's Institutional Review Board.

We transcribed the interviews and used a constant comparative method of data analysis (Charmaz, 2009). Our initial coding was both inductive and descriptive using line-by-line open coding to allow key concepts to emerge from the data (Charmaz, 2009; Patton, 2002). In the second iteration analysis, we continued the process of analysis by consolidating the initial codes into a set of focused codes. These focused codes provided an initial description of the categories and subcategories emerging from the data (See Appendix C for Code Mapping Table). In the third iteration of analysis, we used analytical memos to ground our categories and analysis back in the voices of the participants and returned to the interview transcripts to provide support for the categories we had developed through the coding process (Charmaz, 2009).

Findings

Three themes emerged from the coding and analysis of the faculty interviews: *Building on Prior Experiences and Significant Others, Thinking Like a Scientist,* and *Making Connections*. The first theme describes the professors' views of their students' development of interest in and identification with their prospective major. The second theme describes how the professors explicitly teach knowledge and skills that students will need to be successful in their science major. The third theme encompasses the strategies that the professors use to encourage students to make connections to older students, faculty, and researchers within their major. We explore each theme in detail in the following sections.

Building on Prior Experiences and Significant Others

Both of the professors connected their students' selection of a biochemistry or physics major to the students' prior experiences in high school math and science classes. In each case, the faculty described students who chose to enter the major as first year students as "liking" and "doing well" in related high school courses (Dr. B, biochemistry) and suggested that their students' value for and beliefs about their major were drawn from these high school experiences. However, the professors' explanations differed in describing their students' entering interest in and value for their science major[2]. Dr. B, the biochemistry professor, focused on students' pragmatic choices in relation to their major and the influence of advice from teachers, parents, and school counselors in students' selection of a biochemistry major. In contrast, Dr. P, the physics professor, focused on the specific characteristics that he felt were common among physics students. In each of these cases, even when describing students' plans for the future, the professors connected their students' choices back to students' understanding of the field in high school.

Biochemistry student profile. Dr. B described three reasons why students choose to major in biochemistry: "they're good at chemistry," they view biochemistry as preparation for "medical school or other biomedical professions," or they are interested in and "like life sciences and they're not really certain how they ended up in biochemistry." Dr. B suggests that students are influenced in their choice of biochemistry by both their experiences in high school biology and chemistry and by the guidance of parents, teachers, and high school counselors. Professor B described students whose teachers introduced them to biochemistry because they "did well" in both biology and chemistry. Other students were guided toward biochemistry for more pragmatic

[2] In these interviews, the professors were asked about their students' value for the domain rather than their level of domain identification to focus on the components of domain identification and prevent misunderstanding.

reasons; she described students and parents who reported that the earning potential for biochemistry "is higher than biology." Also, she pointed out that high school counselors introduced some students to biochemistry as preparation for medical school entrance exams.

Dr. B described some students as not having a strong individual interest in the field of biochemistry or any level of identification with the field. These students, Dr. B noted, chose their major based on their plans for the future, "not what I am interested in, but what I want to be when I am finished." These students value biochemistry for a highly pragmatic reason as "training potential" for future schooling and careers. Although their value for biochemistry is based in their plans for the future, Dr. B suggested that students' understandings of the fundamental concepts of biochemistry are based in their high school coursework in biology and chemistry. Thus, students view biochemistry as the application of chemistry in the medical field or the study of the "chemical mechanisms of life."

Physics student profile. Dr. P described students who begin their physics major during their first year as students who "probably were interested in science or something technical like that most of their lives." These students "enjoyed math" as well as the sciences that they took in high school and were drawn to the more mathematical science subjects (e.g., physics, chemistry). Dr. P described a set of students who are drawn to physics because they are "motivated by the curiosity." These students' curiosities to understand how the world works is a personal "itch to scratch" rather than an attempt to change the world or prepare for their future careers:

> I don't know if they think [physics is] an important thing to do for society or for them to be doing because they want this, that, or the other situation. . . . We didn't choose physics because we wanted to change the world. We chose it because it chose us, despite of the

topic that we are plugged into. And we like to see more. And in a sense it's kind of a selfish thing.

The value of physics to society, or even to themselves is not a key reason for these students choosing physics, as Dr. P notes, "I don't know if they *think* [physics is] important. They may be thinking that this is a subject that they liked in high school" (his emphasis). The same high school courses that sparked students' enjoyment and curiosity also have shaped their understanding of the field. Dr. P explained that students initially view physics as the "hardest, most detailed [subject] . . . because many students think of it as memorizing formulas and they're all very detailed mathematical formulas" and view the application of physics as limited because "they're seeing only specific examples, specific cases, and so it doesn't apply to other things." Dr. P suggests that the focus on memorizing in their high school courses (and even in early college courses) reinforces the idea that physics has few applications outside of the classroom: "What can I do with a physics degree? Is one of the things that they ask all the time. Like – anything that you like!"

Thinking Like a Scientist

Both of the professors described developing and changing their first year experiences courses to help incoming students to develop a more sophisticated understanding of the field and to explicitly teach them critical thinking skills that were essential to the students' success in upper level undergraduate and graduate courses. The professors described their courses as areas where students could go beyond the basic facts they were learning in introductory physics, biology, or chemistry to develop a better understanding of how physicists or biochemists think about the world and approach problems. Thus, these courses both exposed students to new ways of thinking about what they were learning in the field (and potentially new areas of interest) and

the professors began to address misconceptions they felt that incoming students had about physics and biochemistry.

Encouraging big picture understanding. In both biochemistry and physics, the professors integrated experiences into the courses to help students to develop a "big picture" understanding of the field. These experiences tacitly or explicitly encouraged students to expand their understanding of the discipline, their role (or potential role) within the discipline, and their value for it. In biochemistry, Dr. B invited three working biochemists to talk with the class and to tour one of the biochemistry labs at the university. Dr. B described the guest speakers as helping to provide the big picture and enhancing "our understanding of the natural world versus the student-centric view of this as a training potential . . . they [students] may not see the big pictures being asked, they see more the products that are used by society." Thus, by having researchers talk to students about their research, students were developing a better understanding of how questions are asked and studied in biochemistry.

Dr. P described the first year experience course as providing the opportunity to expose students to the wider culture of physics and to provide students with an understanding of how they fit within this larger understanding of the field. He suggested that by explicitly talking with students about the broad culture of physics that he encourages students to develop a broader understanding of physics:

> I mean what we try to do is to tell them about the culture of physics, about the point of physics—the kind of things you don't get in intro physics, where you are just: "Okay, here's how to solve this problem, blah blah blah." So what is physics in general? What is the point of physics?

He also built time into the course to talk with students about their own plans, "it's the only course where they get to talk about what they are planning to do . . . this is a broader look at their lives and physics, how physics will fit into their lives or not or what ever." Dr. P explained that students have a basic idea of what physics is, but often end up getting into the "deeper spots" before understanding the breadth of the field of physics and options that the students may have for research or careers.

Early experiences in domain thinking. Both of the professors described integrating the explicit teaching of critical thinking and problem solving skills that are specific to the domain into the first year experience course. In both cases, the professors explained that these skills are important to the students' success in upper level courses, and research within the discipline, but are rarely included in the foundational physics, biology, or chemistry classes that are prerequisite courses within the majors. Both professors also described teaching critical thinking skills as one way of addressing the misconceptions that incoming first year students often have about the discipline.

Biochemistry. Dr. B described intentionally designing the biochemistry first year experience course to focus on critical thinking skills rather than facts or knowledge about the domain:

> The intention was that when they got to General Biochemistry, they would not necessarily be better prepared with facts and information, but for context. Mostly we're worried about our students taking multiple-choice tests and then hitting the beginning of the third year being asked to integrate knowledge in a different way.

Critical thinking skills are introduced to students in this course through the process of reading scientific articles to uncover the purpose of the research and to find descriptions of the scientific

data used in the research. Dr. B described learning to read and interpret scientific research as a process that begins in the first year and can continue into graduate school for many students.

For the first year students "one of the goals is for them to understand that scientific data is contained in publications, and data is what is used to back up a scientific claim." Dr. B explained that this goal supports the students' access to the scientific literature in the domain and challenges students' misconceptions about the role of scientists and research. Dr. B assigns students articles to read and has students find an article of their own choice; however, "the language is usually so well developed in the introduction and the background of the paper that they do struggle with it even if they choose really simple papers." Dr. B's intention is not for students to fully understand what they read, but to provide them with a first experience with the literature: "for me as an instructor, I understand you get your feet wet, then you get up to your knees, and then you get up to your waist and all of the sudden the water doesn't feel so cold anymore."

Dr. B also described introducing students to scientific literature and scientific data to begin to challenge her students' misconceptions about the role of the scientist. She described many students as entering college with the belief that "it is a scientist's job to figure out what all those facts mean and present in classes and that they [students] have no business trying to figure out if the conclusions follow from the data." She explained that the purpose of immersing first year students in research articles was one method the department was using to reduce the number of upper level biochemistry students who struggled to understand and interpret scientific data.

Physics. Dr. P designed the first year experience course in physics with the intention of supporting students' problem solving abilities. In particular, the ability to "think flexibly" and confidently approach problems without clear solutions. He immersed students in problems

without easy or obvious solutions from the beginning of the course using “Fermi problems.” In this type of problem, students are given very little information and must use estimation, approximation, and even educated guesses rather than formulas to develop a possible solution. Dr. P explained that he used these at the beginning of the course to help students to develop the confidence to approach and work through difficult and unclear problems:

> We start right off with that guy [Fermi] and say Fermi problems are problems where you estimate the answer to some physical situation without really knowing what to do. But you do it that way because you’re a physicist. You do it because you have the confidence to start the process. And if you don’t know how to solve the problem, you make a simpler form that’s related and you solve that. . . . So the idea is to develop in them the confidence that they can think on their own.

In addition to solving Fermi problems in class, Dr. P assigned his students a large group problem during their first semester. He explained that the assignment was prefaced with the explanation that he was giving them “a large problem to solve which doesn’t have an answer at all” and then told the students that they had been asked to serve on a panel to help solve the global energy crisis. The students were then assigned to groups and charged with working together to propose and research one method of addressing the global energy crisis. Dr. P used this project to support the students’ ability to approach the problem thinking flexibly, have the confidence to choose a possible solution, and then to use research and their understanding of physics to test the solution, “and even if that idea doesn’t work out, it’s not successful, they work it out and decide that it’s not . . . that’s okay. They’ve done something, that’s what I want.”

Dr. P also believed that he was addressing one of the main misconceptions that students have about physics by providing students with many opportunities to solve ill-structured

problems: the belief that physics is "extremely authoritative." He explained that students have been taught that "F does equal MA" but as physics majors they need to understand that the equations they have learned do not work under all conditions. He challenges their understanding of well-defined problem solving because:

> Most students are just glad to hear the gospel given to them and regurgitate it; but they need to think differently. So we need to get inquisitive about everything. We try to teach them that you have enough information to actually work something out yourself without having to be told how it should work.

Making Connections With Research and Researchers

Both professors emphasized the importance of the first year experience course as a method of helping students make connections with other students, faculty, and researchers in the discipline. They felt that first year students involved in the course had the opportunity to learn more about what it meant to be a student in the discipline and to learn about research within the discipline at the university.

Informal mentoring. The biochemistry and physics first year experience courses both included forms of informal mentoring of the incoming students. Both of the classes were too large (150 students in biochemistry and 60 students in physics) for the professors to engage in a formal mentoring with all of the students; however, both of the professors were tenured professors who were engaged in both research and teaching in the field.

Dr. P, in physics, explained that while the large size of the class prevented one-on-one mentoring with all incoming students, he focused on making personal connections with his students:

> I want to hear from them and I want to react to what they're talking about and I want them to react and tell *me* what they're doing. So yeah, the more I can make a personal connection the better. To me teaching and learning is a personal thing. It is not online, passive courses. It's that personal interaction. You can't quite do one-on-one and mentor-mentee, but the more you get that feeling in the course the better.

Within the physics course, Dr. P encouraged students to talk about their future plans for college and post-college to help them move beyond viewing physics as a collection of assignments to a broader understanding of "how physics will fit into their life."

Dr. B shared teaching responsibilities for the biochemistry first year experience course with a set of undergraduate peer mentors. Dr. B taught half of the class sessions as a whole class lecture in a large lecture hall and peer mentors (junior- and senior-level biochemistry majors) facilitated half of the sessions as small group discussions. The peer mentors guided students through the process of completing their course-of-study planner in which the first year students mapped out the courses they planned to take during their years in college. The peer mentors also helped to guide the students through reading and talking about research articles. Dr. B described the peer mentors as "a good source of tips" for the incoming students.

Access to research opportunities. Both the biochemistry and physics professors emphasized the importance of introducing their students to researchers and to possible undergraduate research opportunities at the university. In biochemistry, Dr. B included three activities intended to help students understand and access research at the university. Throughout the semester three researchers visited the class to talk about their research with the students and discuss how their research fit into the field of biochemistry. Near the end of the semester, students participated in a laboratory tour, choosing one of the biochemistry labs on campus to

visit with a small group of other students in the class. Dr. B also included one assignment in which students brought to class information about an undergraduate research opportunity of interest to them. Dr. B explained that increasing the number of first year students participating as undergraduate researchers was not an intended consequence of these activities; however:

> Many of them [the first year students] end up becoming employed because of that [the assignments] and are taking it [undergraduate research] for credit . . . really there was never any intention for first year students to do undergraduate research, but they started doing it and are successful. . . . I think that is probably the single most, largest gain.

In physics, Dr. P invited researchers from the physics department to discuss their research with the class during the second semester of the course. For Dr. P the research talks served multiple purposes: (a) to expose students to areas of research within physics at the university in order to introduce students to topics for research they could be involved in as undergraduate or graduate students; (b) to encourage them to think about how they could use their physics degree, either in research or in other fields such as medicine or law; and finally, (c) to introduce students to "the community of the physics department" with the idea that students would be taking courses or researching with many of the researchers who spoke with the class.

Summary

To summarize the main beliefs and instructional strategies associated with the themes, we organized them for each of the courses into Tables 6 (main beliefs) and 7 (instructional strategies). These beliefs and instructional strategies are factors that could affect the development of students' interest, domain identification, or both. At the end of each instructional strategy bullet point in Table 7, we included the means through which it could do so (as we explained previously in the "Theoretical Framework" section of this paper). For the development of

interest, we considered factors identified by Hidi and Renninger (2006) as supportive of interest development, such as stored knowledge, value, affect, novelty, relevance, social involvement, and external support. For the development of biochemistry and physics identification, we considered factors identified by Osborne and Jones (2011) and Jones, Ruff, and Osborne (in press), such as empowerment, usefulness, success, interest, and caring. In the "Discussion" section of this paper, we discuss these ideas in more detail.

Table 6

Beliefs Associated with Theme of Building on Prior Experiences and Significant Others

Theme	Biochemistry	Physics
Building on Prior Experiences and Significant Others	• Students had more interest in life sciences or chemistry than in biochemistry • Students had more knowledge of life sciences, chemistry, or both than biochemistry • Students valued the "training potential" of biochemistry • Students had been advised to choose biochemistry by teachers, parents, or high school counselors	• Students have had a long-term interest in science • Students enjoyed math and sciences (chemistry and physics) in high school • Students had been successful in high school physics • Students had a knowledge of physics • Students were curious about how the world works

Table 7

Instructional Strategies Associated with Themes of Thinking Like a Scientist and Making Connections

Theme	Biochemistry	Physics
Thinking Like a Scientist	• Connected activities to students' long-term goals (usefulness) • Took a tour of a biochemistry lab (usefulness, interest) • Required students to find and begin to read scientific literature (usefulness, success, interest; stored knowledge) • Challenged students' beliefs about the authority of the scientist and scientific data (usefulness) • Included guest speakers and a lab tour to help students understand the purpose of biochemistry beyond preparation for medical school (usefulness, interest) • Provided opportunities to successfully find and begin to read biochemistry research articles	• Focused on ill-structured problems with multiple solutions and multiple paths to a solution (empowerment) • Provided ill-structured problems to challenge students' understanding of problem-solving in physics (empowerment, success, interest; stored knowledge) • Provided multiple opportunities to practice flexible problem solving skills (success; stored knowledge) • Required a large-scale group project about an energy crisis to provide challenge and autonomy to develop solutions and work in group (empowerment, success, caring, stored

	(success; stored knowledge)	knowledge, stored value) • Taught flexible problem solving to support success in higher level physics courses (success) • Provided support for developing self-efficacy for beginning and solving complex problems (success) • Structured activities and discussions to challenge students' beliefs about physics and the authority of physicists (usefulness; stored knowledge)
Making Connections	• Used a course-of-study planner to connect the biochemistry major to students' long-term goals (usefulness; stored knowledge) • Had guest speakers discuss practical contributions of their own research (usefulness; affect) • Allowed peer mentors to lead small discussion groups giving tips and answering questions about biochemistry courses (success, caring, interest; affect) • Set-up small group discussions led by upper-class biochemistry majors (caring, success, interest; affect)	• Encouraged students to make connections between physics and their long-term goals (usefulness) • Invited researchers from the physics department to discuss their research and introduce students to undergraduate research opportunities (usefulness) • Engaged with individual students and small groups during in-class group-work sessions to create a more personal learning space within a large class (caring)

Discussion

To examine how professors' beliefs and instructional strategies can affect the development of students' interest in and identification with their prospective science major, we relate our findings to theories of interest and domain identification.

Interest

Professors' beliefs. The examples and language used by the professors to describe their students' selection of a major in physics or biochemistry in the theme Building On Prior Experiences and Significant Others emphasize the experience-based nature of interest (see Table 6; Hidi & Renninger, 2006; Schraw & Lehman, 2001). The examples described in this theme highlight the connection between the students' current interest in their major and their prior educational experiences, particularly their prior experiences in related high school courses.

The different levels of knowledge, value, and external support described by the professors (in the sub-themes of Biochemistry and Physics Student Profiles) demonstrate a difference between how the two professors perceive their first year students' connection or level of interest in their major. The characteristics of the incoming biochemistry students illustrate the situational phases of interest, in which students are exposed to the field of biochemistry for the first time (although they had completed high school courses in related fields such as chemistry and biology). These students likely have knowledge of and positive feelings and value for related domains, but do not have detailed knowledge of biochemistry, they do not know what it means to be a biochemist, and they have not internalized a value for biochemistry. Hidi and Renninger (2006) and Mitchell (1993) explain that, during the situational phases of interest, individuals need external support as they engage and re-engage with the domain and develop affective or emotional connections with specific content or tasks.

The characteristics of incoming physics students connect with elements of both situational and individual phases of interest development and provide a deeper level of understanding of students at the emerging individual phase. These students are re-engaging with a domain in which they have some knowledge and exhibit curiosity to learn more. However, the professor describes students who may know about physics, but have not yet internalized value for the domain; they do not view the domain as being personally or societally important.

Supporting interest through course design. The aspects of the course designs described in the themes Thinking Like a Scientist and Making Connections illustrate methods that the professors used to support their students' interest (see Table 7). Both professors designed their courses to support students' development of domain knowledge and skills. For example, the professors used activities and guest speakers to help introduce students to several forms of

domain knowledge, including a "big picture" understanding of the purpose for the field and practice with critical thinking skills necessary for success in the domain.

In addition, these findings coincide with research showing that different methods of support are needed for different levels of student interest (Hidi & Renninger, 2006). The biochemistry professor described activities that can be viewed as supporting students in the situational phases on interest by using novelty, helping students find personal relevance, and creating space for social involvement (Alexander et al., 1994; Hidi & Renninger, 2006; Mitchell, 1993; Palmer 2009; Renninger et al., 2002; Schraw & Lehman, 2001). The physics professor described how he incorporated activities that supported students with emerging individual interests, such as by supporting students' autonomy in how they developed and solved ill-structured problems presented in class and providing students with challenge, time, freedom, and resources needed for learning (Barron, 2006; Renninger, 2000; Tsai et al., 2008).

Differences from theory and other interest research. The findings of this study go beyond the prior studies of social support as defined by interest researchers by examining both the professors' beliefs about their students' interest and the methods they used in their course to support the development of this interest. Although, the findings do align with the Hidi and Renninger (2006) model of interest development, we suggest that these findings also show that faculty are doing more than supporting positive affective connections, domain knowledge, and value. For example, the professors also encourage students to re-examine their misconceptions about the domain, find connections between the domain and their future goals, and begin to participate in the undergraduate research opportunities within the department. The role of teachers in helping students to make these connections and rework misconceptions is broadly described as "external support" in Hidi and Renninger's model of interest development. Yet this

type of external support provided at the point when students are developing an interest within a college major, may be integral for students to successfully access the domain knowledge and experiences.

Hidi and Renninger's (2006) categorization of "external support" is so broad that it can minimize the importance of different types of support in the early and later stages of interest development. Moreover, Hidi and Renninger (2006), as well as other interest researchers (Alexander et al., 1994; Hulleman et al., 2008; Mitchell, 1993; Renninger et al., 2002), describe specific methods for providing external support in the early phases of interest development, but describe support in more general terms when suggesting methods of supporting students in the later phases of interest. Providing students with challenging activities and supporting their autonomy may help the students to develop stored knowledge and value, but will not necessarily have the same benefit as scaffolding students' access and participation in activities that are important in the academic community or professions related to the students' interest. By helping the physics and biochemistry students to make connections with researchers in the disciplines and helping them to successfully access and participate in research activities related to their discipline, the strategies described by the professors in this study highlight a weakness in the current model of interest development.

Domain Identification

Professors' beliefs. The professors did not talk about domain identification explicitly. For example, neither professor described their students as valuing the domain as an important part of themselves, nor did they describe students as defining or identifying themselves with their major. However, the professors' descriptions of their students and their descriptions of the activities that they integrated into the course do illustrate aspects of the antecedents of domain

identification described in Osborne and Jones' (2011) model of domain identification. In particular, the professors' descriptions stress the importance of prior educational experiences and significant others in the students' developing domain identification.

The professors described (in the theme, Building on Prior Experiences and Significant Others) students who are entering their prospective majors with two different levels of experience in the disciplines. In biochemistry, Dr. B described students who were entering a new domain; they may have had a strong background in science, biology, or chemistry, but had not participated in educational experiences related to biochemistry. In contrast, the physics students that Dr. P described had a large set of experience in physics related to their high school coursework and likely had developed some level of identification with physics; however, their experiences were within the context of high school physics. We propose that the students' level of experience in the programs shaped the context of their domain identification. Thus, Dr. P supported students' physics identification by helping students' transition from their identification with high school physics to their identification with undergraduate and upper-level physics. In contrast, Dr. B worked with students who were entering a new domain; and thus, although they may have had a strong identification with science, biology, or chemistry, they had not developed a biochemistry identification.

Supporting identification through course design. As discussed previously, the strategies that professors can use to promote students' domain identification (consistent with the MUSIC model) include: empowering students by providing control over their learning environment, ensuring that students understand what they're learning, believe that they can succeed in the course activities, are interested in the course activities, and believe that the professor cares about their success in the course. Examining the findings, we found that the

professors were doing all of these things, indicating that they were supporting students' development of domain identification.

The following examples show how the professors included the MUSIC model (Jones, 2009) components into their instruction. Both professors provided students with some level of choice and control (i.e., they provided eMpowerment) within the course activities and assignments by providing students with activities that had multiple solution paths and assignments that encouraged students to choose from a selection of the articles to read or labs to visit. They actively encouraged students to understand how the domain was connected to their short- and long-term goals (i.e., it demonstrates Usefulness) through guest speakers and class discussions about the role of the scientist in their discipline. Similarly, the professors structured their courses to help students develop the skills they would need to believe that they could be successful in upper level courses within the major (i.e., it promotes beliefs about Success); which included challenging students misconceptions about the discipline through lecture and class discussion, as well as providing students with opportunities to develop skills such as flexible problem solving, reading scientific research, and interpreting scientific data. Both professors integrated activities that were designed to be engaging and provide situational interest for the students (i.e., it is Interesting), including guest speakers and lab tours. In addition, the professors provided students with the opportunity to develop relationships with other students and faculty in the department (i.e., it promotes Caring) by including upper class students as peer mentors and group discussion leaders, as well as through researchers in the departments providing presentations of their research.

Comparing Faculty Perceptions with Student Beliefs

The present study is part of a larger study in which some of the students in the biochemistry and physics courses were interviewed. In this section, we compare the faculty perceptions of students' interest in and identification with their majors in the present study with those of the students' perceptions reported in the other study. We found that the professors' and students' perceptions were mostly consistent, with one exception: professors did not seem to address the broader reasons that students chose their major.

Relevance to future goals. Both the professors and their students drew connections between the students' current interest in and identification with their major and their prior educational experiences. The students' also described how past experiences had helped to shape their choice of major. However, all of the students were also evaluating the relevance of their major in relation to their future schooling and career goals and aspirations. Some students had more definite plans than others, but all of the students made a connection between their chosen major and careers or potential areas of graduate study. This perception is partially consistent with Dr. B's description of a subset of biochemistry students who chose to major in biochemistry as preparation for medical school. This perception is not consistent with Dr. P's description of physics students who had not connected their major to their plans for the future. However, the students described a range of goals for school, career, and life that included both practical goals (e.g., attending medical school or a graduate program) and aspirations (e.g., choosing a career that made them happy, helping people, making a difference in the world). Although both professors explained how they tried to help students understand the usefulness of the major in relation to long-term goals, neither professor addressed the broader aspirational reasons students might have had for selecting the major. Dr. B used her understanding that some students chose a

biochemistry major as preparation for medical school helped her to incorporate activities and guest speakers to help students understand both the big picture of biochemistry and how biochemistry could be useful for a number of different future goals. Giving students a short survey to elicit their future goals and aspirations in relation to a major may be one way to help professors to better understand their students' knowledge of the role of the scientists in the discipline and the breadth of academic, research, or career opportunities related to a discipline.

Understanding the relevance of coursework. When explaining the relevance of their current course-work, students in both biochemistry and physics described key elements of their first year experience courses as "important, but not interesting." They acknowledged the future relevance of the activities, but did not consider them "interesting" in the present. These activities included the flexible problem solving assignments in physics and the scientific literature assignments in biochemistry. Both sets of activities were described by the professors as challenging student misconceptions and encouraging conceptual change in the students' thinking about the domain. Dr. B acknowledged that students struggled with the process of reading and analyzing scientific literature, thus having students understand the importance, even if they were not excited by the activity aligned with the professor's expectations. However, the ability to "think flexibly" when solving problems was a key component of Dr. P's physics seminar and was designed to encourage students to change how they approached problem solving in the present. The physics students acknowledged the future usefulness of understanding this concept, but they did not describe the style of problem solving as being useful or "interesting" in the present. These students may not have understood or accepted the rationale for changing their thinking. This difference in understanding highlights the difficulty of providing a first year experience that is not coupled with the introductory courses for the major: the physics majors

used flexible problem solving strategies to solve ill-structured problems in Dr. P's course, but were given well-defined problems with specific answers and solution paths in their Foundations of Physics courses. Thus students' high school-level problem solving strategies were reinforced in their Foundations course (a three-hour per week course) while these same strategies were challenged in their First Year Experience course (a one-hour per week course).

Implications and Conclusions

Professors in the biochemistry and physics courses perceived their students' interest in and identification with their prospective major somewhat differently. The biochemistry professor described students who had a situational interest in biochemistry, but generally low identification with the domain of biochemistry. The physics professor described students who had an emerging individual interest in physics and a physics identification that developed through their high school science experiences.

Although neither professor was familiar with the academic research in the fields of interest or domain identification, both used instructional strategies that supported students' interest in and domain identification with their major. It is possible that with an understanding of interest and domain identification theories, professors could more intentionally design instruction to develop students' interest in and domain identification with their major. We found several examples of how the professors in this study did that; however, with a better understanding of the theories, maybe they could have done more. For example, the biochemistry professor made efforts to help students develop a "big picture understanding" of the knowledge and purpose of the field and to make research in biochemistry personally relevant to the students (to make the activities seem useful to students), but could have done more to scaffold students' understanding of the initial scientific research articles to foster their success. The physics professor tried to

encourage students to develop the problem solving strategies they would need to access higher levels of domain knowledge and to provide students with activities that incorporated both challenge and empowerment, but could have done more to help students connect problem solving abilities with their future education and career goals.

The professors' perceptions of students' interest and identification were similar to, but different from those of the students. For example, students in *both* programs evaluated their major in relation to their current long-term goals and aspirations. The student perceptions also provide evidence for some of the methods the professors used to encourage the development of interest and domain identification. Particularly, students were willing to engage in activities that they deemed "important, but not interesting" if they perceived the activity as relevant to their future goals in the domain. To address students' perceptions, these professors could help students to develop a broad understanding of potential future careers and academic programs associated with the domain. The professors could invite alumni as well as other faculty to discuss how their physics degree is relevant to their current academic program or career. In addition, the professors could address students' perceptions by emphasizing the purpose of learning activities and helping students to understand how the activities are important both for current learning and to help students to be successful in later classes.

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Chapter 6
Summary, Conclusions, and Future Research

Summary

The impetus for this dissertation grew from my desire to understand the overlap and contrasts of two apparently similar concepts from different theoretical traditions. A more nuanced understanding of these concepts helps researchers and teachers to better support student engagement and persistence (Harackiewicz et al., 2008; Osborne & Jones, 2011; Renninger, 2010; Renninger & Hidi, 2011; Walker et al., 2006)**.** This understanding is particularly useful for researchers and educators working to increase the number of students graduating with science degrees by nurturing and supporting students' interest and identification with science. This dissertation examined how first year college students and their professors experienced interest in and identification with a prospective science major within the context of first year experience courses designed to introduce students to their prospective science major. I engaged in a theoretical examination of the concepts and two exploratory qualitative studies in order to study: (a) how first year college students perceived their interest in and identification with their prospective major, (b) how professors of first year college students perceived and supported their students' interest in and identification with their prospective science major, and (c) the similarities and differences between these perceptions.

The first manuscript examined the theoretical and practical intersections between domain identification and interest through a review of the theory and research supporting Osborne and Jones' (2011) model of domain identification, as well as Hidi and Renninger's (2006) and Krapp's (1999, 2002) models of interest development. These three models associate the development of domain identification or interest to the increase in learners' value for the domain and suggest that learners develop value for the domain through engagement in educational

experiences related to the content of the domain. However, the definition and theoretical framing of the *value* differentiate the models. Researchers studying domain identification and interest have called for more study in the process of development of these concepts (Hidi & Renninger, 2006; Jones, Ruff, & Osborne, in press; Osborne & Jones, 2011); this manuscript provides researchers with points of overlap and differentiation between the models of domain identification and interest where future research could be focused.

The second manuscript focused on first year college students' perceptions of their domain identification and interest in their prospective science major during their first year of college. The first year physics and biochemistry students interviewed in this study enjoyed (for the most part) their high school and college science classes, felt they were growing more competent in their coursework, and viewed their academic major as relevant to their future personal and career goals. These perceptions align with aspects of Osborne and Jones' (2011) model of domain identification and Hidi and Renninger's (2006) Four Phase Model of Interest that provided a theoretical framework for the study. This study also illuminates differences between first year college students' perceptions of the relevance of their major and how concepts related to relevance (i.e., stored value, selective valuing, usefulness) have been defined by current models of domain identification and interest.

The third and final manuscript examined how professors of first year students perceived and supported the development of their students' interest in and identification with their prospective science major and compared the professors' and first year college students' perceptions of these concepts. The participating professors provided different descriptions of their students' levels of interest and domain identification suggesting that students who major in biochemistry enter college with a potentially lower level of interest in and identification with

their major than students who major in physics. In each discipline, the professor related the students' interest in and identification with their major to their prior experiences in related subjects in high school. Although neither professor was familiar with the academic research in interest or domain identification, both used instructional strategies that aligned with research on supporting student interest and domain identification. It is possible that with an understanding of interest and domain identification theories, professors could more intentionally design instruction to develop students' interest in and domain identification with their major. The professors' perceptions of students' interest and identification were similar to, but did not fully align with those of the students. The main difference being that students in both majors evaluated the major in relation to their current long-term goals and aspirations. The comparison of student and faculty perceptions provided support for some of the methods the professors used to encourage the development of interest and domain identification.

Conclusion

Taken as a whole, these three manuscripts expand our current understanding of the areas of theoretical and practical alignment of domain identification and interest in the lived experiences of first year college students. The first manuscript (Chapter 3) highlights the theoretical similarities and differences between the concepts. Whereas, the second (Chapter 4) and third (Chapter 5) manuscripts show the connections between Osborne and Jones' (2011) and Hidi and Renninger's (2006) models of domain identification and interest and the lived experiences of first year college students and their professors. The second and third manuscripts provide empirical support for the background factors described by Osborne and Jones' (2011) as essential to the development and maintenance of domain identification. In particular, these studies show how elements of the MUSIC Model of Academic Motivation (Jones, 2009) are

integrated into both the student and faculty perceptions of the development of domain identification. These studies also highlight the perception of competence and domain knowledge, aspects of Hidi and Renninger's (2009) model of interest development, as an integral parts of both the student perceptions of interest and faculty support of student interest.

Despite the consistencies I documented among the theories and empirical data, all three studies highlight the concept of value or relevance as a point of divergence between the models of domain identification and interest. The theoretical differences noted in manuscript one are also apparent in the perceptions of students and faculty in manuscripts two and three. In manuscript one (Chapter 3), I noted a difference in the conceptualization of selective valuing (Osborne & Jones, 2011) and stored value (Hidi & Renninger, 2006). The difference between defining value as the centrality of a domain to an individual's concept of self (selective valuing) and value as the combination of feelings of competence and emotions related to engaging with content (stored value) emphasizes the theoretical distinctions between the models of domain identification and interest. In manuscript two (Chapter 4), I documented the consistency between how students perceived the *relevance* of their academic experiences and the selective valuing (Osborne & Jones, 2011) and usefulness (Jones, 2009) components related to domain identification. I noted in this manuscript that the students' perception of competence was more closely aligned with Hidi and Renninger's description of value than their perception of relevance. Finally, in manuscript three (Chapter 5), I showed that although the professors' beliefs and strategies were generally consistent with both models, Hidi and Renninger's (2006) categorization of "external support" (from teachers, parents, peers, etc.) for interest development is so broad that it minimized the important role that supportive others may play in helping students to develop knowledge and value for a domain. Researchers integrating the two concepts

into future studies, particularly future quantitative studies, should be cognizant of this divergence in the definitions of value in the current models of domain and interest and clearly define how they are interpreting this concept. Other models of interest development, such as Krapp's (2002, 2007) Person Object Theory of Interest, may be more applicable for researchers designing studies to examine the relationship between domain identification and interest.

Future Research

Future research on domain identification and interest could address questions related to the recursive nature of both concepts. In particular, research is needed to examine the impact of the ebb and flow of interest in content on the learner's domain identification. The current studies provided a snapshot of how students perceived their domain identification and interest at two points during their first year in college. However, even in this study, students pointed to times when they found course activities relevant (and thus, related to their identification with their major) but not interesting. This finding raises the question of how much situational interest, or lack thereof, plays a role in domain identification. A longitudinal mixed methods study examining trends in college students' interest and domain identification in their academic major for the duration of two or more (ideally all eight) semesters could address this question by integrating periodic surveys of interest related to content and assignments in courses related to the major with open-ended surveys or interviews of students. The periodic surveys would measure the students' more fleeting sense of situational interest in content and activities, while the open-ended surveys or interviews would provide insight into how students viewed their coursework over the long term, as well as how they described their current identification with and individual interest in their major.

Research is also needed that explicitly examines the influence of significant others in guiding students' perceptions of the relevance of a domain through empirical studies and targeted, course-based interventions. The study described in Chapter 5 is one of the first studies to qualitatively examine how faculty both perceive and support their students' domain identification and interest; however, this study was based on a small and purposeful sample of professors teaching courses designed to support students' who were entering their major. The results of this study could be expanded in at least three ways. First, this study could be expanded by surveying a large sample of professors or teachers (for example, all of the physics professors that are members of the American Physics Society or all of the teachers that are members of the American Association of Physics Teachers) to measure how they integrate the components of the MUSIC model (Jones, 2009) into their courses and to solicit examples of course activities or content they feel are related to the MUSIC components.

Second, this study could be expanded through a targeted intervention in which researchers worked with a group of professors or high school teachers to purposefully integrate components related to the development of domain identification and interest into course curriculum. The students in these courses could then be compared to students in similar courses in relation to their level of individual interest and domain identification before, during, and after the completion of the courses. This study could provide further insight into effective methods of supporting domain identification and how students perceive and respond to differing levels of support.

Finally, further study is needed to fully examine how students' domain identification and interest changes over time during the transition in context from high school into college or a vocational setting. The students interviewed for the study in Chapter 4 spent much of their first

interview reflecting on how their experiences in high school had influenced their identification with and interest in their major and frequently they described changing their academic interests during their transition from high school to college. However, all of the data gathered in these interviews were retrospective as students reflected on their experiences in high school. A longitudinal mixed methods study beginning with participants who were high school juniors would provide researchers with the opportunity to examine how the students' academic interest and domain identification (in relation to high school subjects and potential college majors) changes over time. Data collected for this study could include teacher and parent surveys, as well as high school grades and SAT scores to provide a more complex understanding of the variables that influence students' interest in and identification with a college major. In addition, beginning the data collection period during the junior year of high school would provide a benchmark for students' domain identification and interests prior to their college application process or their transition into a vocational setting.

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Appendix A: Interview Guides

The questions within these interview guides were designed to keep the conversation focused on the research purpose without overtly using terms for components of interest or identification to avoid biasing the language students or professors used (Seidman, 2006). The questions were also designed to be fairly open-ended to allow the participants to share their perceptions and experiences (Patton, 2002).

First Student Interview (Fall Semester):

Thank you for meeting with me. Like I described in class and in my email, our conversation is going to focus on how you came to choose biochemistry/physics as a major, how you feel about your major, and how you feel about your biochemistry/physics first year seminar. Your responses are going to be kept confidential. I will give you a pseudonym, or you can choose one, so that after our interview your name won't be attached to your comments.

- Decision process for choosing major
    - What type of decision process did you go through when you chose to major in biochemistry/physics?
    - Who influenced your decisions?
- Experiences with major before coming to VT
- High School courses related to major?
    - What were those courses like for you?
- Outside of school experiences related to major?
    - Tell me about those experiences?
        - How did these experiences influence how you feel about to your major?
- How do you feel about your decision to major in biochemistry/physics?

I have been asking you some pretty broad questions about how you feel about biochemistry/physics, my for my next few questions I would like for you to think specifically about your Biochemistry/Physics First Year Seminar.

- How does what you are learning about biochemistry/ physics from this class match what you thought about biochemistry/physics before the semester started?
- I know that all courses have their ups and downs. What would you consider the ups for this class?
    - (If clarification is needed) What makes you excited about coming to this class?
    - What do you feel are the key things you have learned about so far in the class?
- What are the downs? (Clarification) What do you find less interesting about this course?

Visual Question: The student will be shown a sheet of paper on which a circle is drawn.

- Hand student set of blank index cards (one pre-populated with "Major". Have them write on the cards the most important parts of themselves.
- Order the cards in by how important the topic is to you (how much of yourself is represented by the topic)
- Look at this circle and imagine that this circle contains all of the parts of who you are. I would like for you to draw in lines to show me the piece of this circle that represents biochemistry/physics for you, and all of the other pieces of you.
- Looking at the chart – what percentages would you give to each piece?
- Tell me about how important this piece of the circle is compared to all of the other pieces?

We are coming to the end of the first interview, so now I would like to know – if you were doing this interview, what question would you have asked that I have missed?

Second Student Interview (Spring Semester):

Thank you for meeting with me again. Thinking back to the last interview, we talked about some of your past experiences in biochemistry/physics and how you were feeling about biochemistry/physics at the beginning of the semester. In this interview, we are going to be focusing on the course and how you are feeling about biochemistry/physics now that you are finished with the Fall semester.

I want to start our conversation, like last time, by talking with you about you general feelings about your major.

- First, now that you have finished a semester, how do you feel about your decision to major in biochemistry/physics?

I have been asking you some pretty broad questions about how you feel about biochemistry/physics, my for my next few questions I would like for you to think specifically about your biochemistry/physics first year seminar.

- What stands out when you think on your experiences in the course over the Fall semester?
- How have your experiences in your seminar affected you personally?
    - What changes do you see in yourself because of your experiences in this course?
- Imagine that I am Dr. B/ Dr. P, tell me what you think are the key parts of the course that I need to keep in the course for students next year?
        - Explain to me how these parts of the course are important to you.
    - What do you think are some parts of the course that should be left out?
        - Explain to me how these parts of the course are not important to you?

Show circle map from first interview. In our last meeting, you drew in these lines to represent how you felt about biochemistry/physics: how much of *you* was represented by your major. Looking at it now, what changes would you make in the size of the piece?

- Tell me about how this piece is compared to the other parts of the circle now.

Before we wrap up our interview, I would like to ask you one last set of questions. All of these questions are going to relate to the biochem/physics seminar course that you completed during Fall semester. (*These questions are adapted from Evans, Jones, & Akalin, 2012)*

- How much control did you have over what you worked on in your biochemistry/physics seminar? (How much do you feel like you were doing what you want to be doing during the assignments and class activities?)
    - What things did you have control over?
- How useful was your seminar course for your goals this year or in the future?
    - In what ways is it useful?
- How successful were you in completing your seminar?
    - For Physics students: How successful do you feel you will be in your course this semester?
- How interested were you in working on the course? (How much did you enjoy the seminar?)
    - What about it interested you?
- How important was and is your seminar course to you?
    - Why was/is it important?
- How much did your <u>teacher</u> want you to succeed in this course? (How much did/does your <u>teacher</u> like to help you on this activity?)

    - How did you know?
- How much did your teacher care about you?
    - How did/ you know?
- How much did other students want you to succeed in your seminar course (this could apply to your peer mentors or your classmates)?
    - How do you know?
- How much did other students care about you?
- How much effort did you putting into your seminar? (How hard did you try in this course?)

Faculty Interview Guide:

Thank you for meeting with me! I know that you have a busy schedule, so the questions that I will ask you in this interview will be focused on your perceptions of your first year students reasons for choosing your major, how they feel about the major as incoming students, and the aspects of your course that you feel influence how they feel about their major. The interview will include some questions as well as an activity. I want to remind you that I am here as a doctoral student, not as part of the Office of First Year Experiences. This interview will be confidential.

- First, what are some reasons that you feel students choose to enter this university as a biochemistry/physics major?
- Who or what do you feel influences your students' decision to choose this major?

Before we go further with the questions, I would like for you to jot down some thoughts for me:

- On this half sheet of paper would you list or describe:
    - How would your students describe the field of biochemistry/physics?
    - What do your students think are the key aspects of biochemistry/physics?

        - How do your students feel that biochemistry/physics is important (to themselves and to society)?

- Now I would like for you to flip the paper over and list or describe:
    - How do you describe the field of biochemistry/physics?
    - What are the key aspects of biochemistry/physics in your view?
    - How do you feel that biochemistry/physics is important (to you as an individual and to society)?

Now unfold the paper so that the two lists are both visible.

- Of the lists you have here, what do you feel are the greatest areas of difference between how you and how your students view biochemistry/physics?
    - What do you feel are the greatest misconceptions that students have related to their beliefs about biochemistry/physics?
- Now I would like for you to think about the different aspects of your biochemistry/physics FYE seminar. Which aspects of the seminar do you feel help to address the differences between your view of biochemistry/physics and your students view? Think about the activities, lessons, assignments and anything else that you do in the course.

Note down the aspects on post it notes as the professor answers and move the post it notes on to the activity sheet.

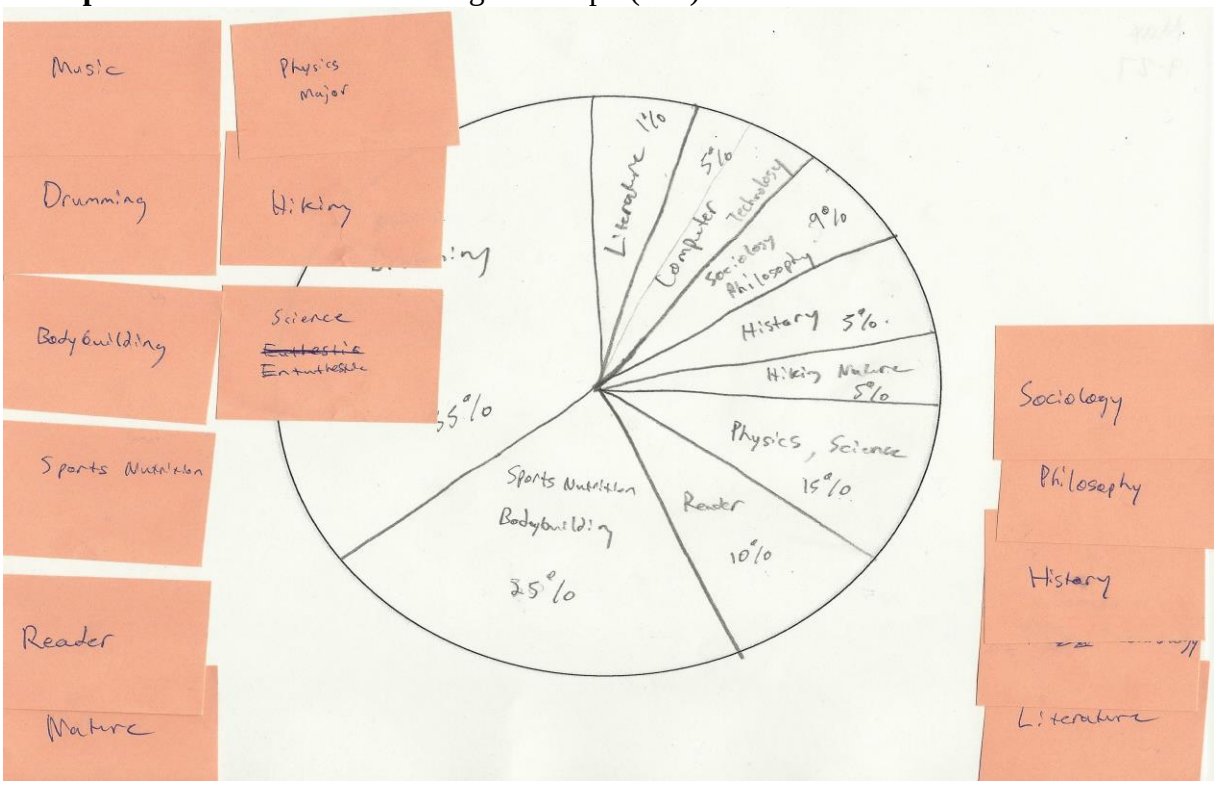
For the next set of questions I am going to refer to the course as a whole, but I would like for you to keep the course aspects that you have highlighted in mind as you answer.

- What choices do students have in how they participate or complete activities or assignments during the course?

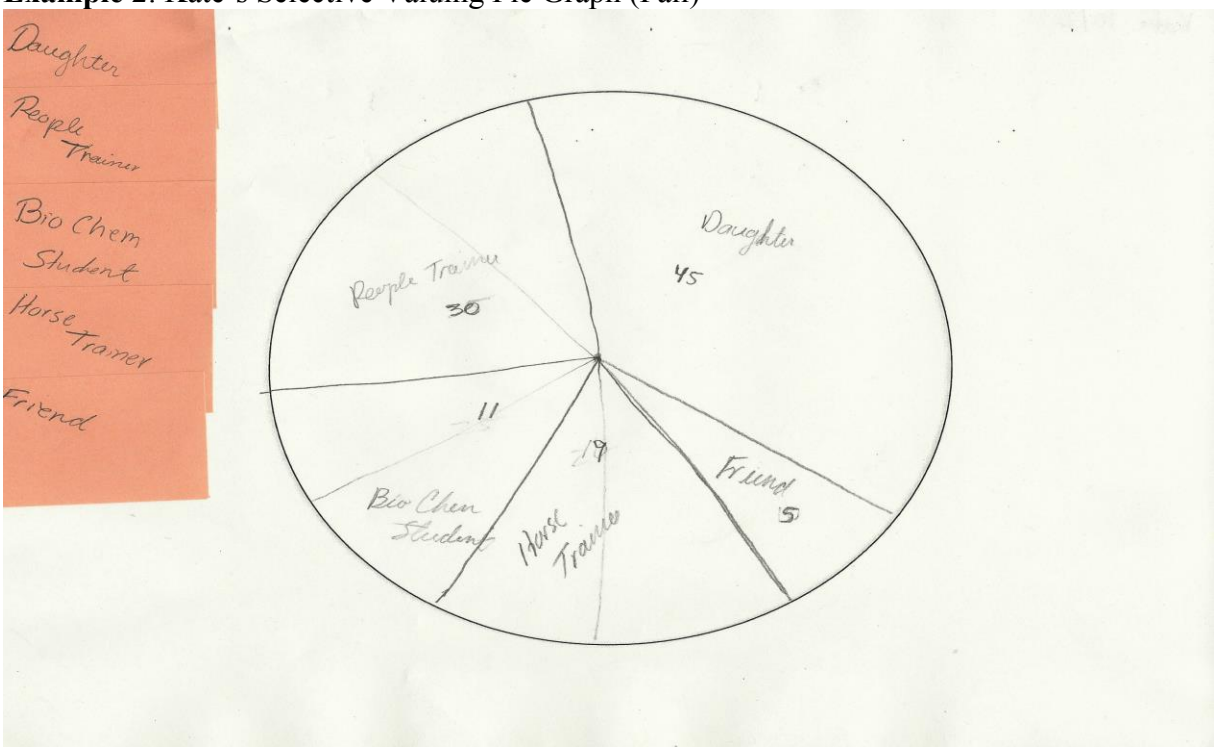
    - What do they have control over?
- How useful or important is the seminar to students' lives, either now or in the future?
- With which aspects of the course were students successful?
    - Which aspects did they find difficult?
- What did students seem to find most interesting and enjoyable about the course?
    - What did students find least interesting and least enjoyable about the course?
- How did you show students that you cared about their academic success?
- How much effort did students put into the course?
- Which parts of the course do you feel are the most necessary for your students to be successful biochemists/physicists?
- Finally, coming back to students' beliefs about biochemistry/physics, what do you feel is the main way that students change how they view biochemistry over the course of the seminar?

Appendix B: Selective Valuing Activity Examples

Example 1: Max's Selective Valuing Pie Graph (Fall)



Example 2: Kate's Selective Valuing Pie Graph (Fall)



Appendix C: Code Mapping Tables

Chapter 4 108Code Mapping: Interactions of Analysis (to be read from the bottom up)

Code Mapping for
RQ 1: How do first college year students perceive their interest in and identification with their prospective science major?

(Final Iteration: Application of Themes to Data Set)
First year college students in biochemistry and physics perceive interest and identification with their prospective major in terms of Competence, Enjoyment, and Relevance; however, their self-definition with their major continues to be in flux.

(Third Iteration: categories)

Category 1: Self-Definition in Flux	Category 2: Feeling Competent	Category 3: Expressing interest through Enjoyment	Category 4: Keeping things Relevant

(Second Iteration: Focused coding)

C1: Self-definition	C2: Competence C2: Effort	C3: Enjoyment C3: Affective Response C3: Cognitive Response	C4: Usefulness C4: Future Options C4: Cost

(First Iteration: Initial open coding – sample of codes)

C1: Not a physicist	C2:Math & science easier	C3: Liked biology	C4: Personal relevance
C1: Being a Student	C2: Think better in math & science	C3: Fell in love with physics	C4: Connections
C1: Want to help people	C2: More challenging	C3: Self-enriching	C4: Best fit for career
C1: Primary Interest	C2: Desire to do well	C3: Personal interest	C4:Reasonable choice
C1: As a Physics major	C2: Had to study	C3:Favorite subject	C4: Many options
C1: Going to be a scientist	C2:Studying really hard	C3: Most fun I had	C4: Researched majors
C1: Being a team-member	C2: Doing well at	C3: Good use of time	C4:Comparison with prior majors
C1: Defines my personality	C2: Likes challenge	C3: Readings are enjoyable	
		C3: Physics problems for fun	

Chapter 5 Code Mapping: Interactions of Analysis (to be read from the bottom up)

Code Mapping for
RQ 2: How do professors of first year students perceive their students' interest in and identification with their prospective science major?

(Final Iteration: Application of Themes to Data Set)
The professors perceived that their students interest in and identification with their perspective science major developed from their prior experiences in high school and was influenced by significant others. Although there were some similarities, the two professors had different perceptions of the key aspects of their students' interest and identification with their major.

(Third Iteration: categories)
Category 1:
Building on Prior Experiences and Significant Others

(Second Iteration: Focused coding)

C1: Past Learning
C1: Guidance in Choice of Major
C1: Liking Science
C1: Planning for Future
C1: Curiosity
C1: Characteristics of the Department

(First Iteration: Initial open coding – sample of codes)
C1: Did well in high school science ((Dr. P, Dr. B)
C1: Teacher encouragement (Dr. B)
C1: Parent influence (Dr. B)
C1: Liked physics, chemistry, biology in high school (Dr. P, Dr. B)
C1: Training potential (Dr. B)
C1: Pragmatic choice (Dr. B)
C1: Planning ahead (Dr. B)
C1: "What can you do with a physics degree?" (Dr. P)
C1: Drawn to physics/science early (Dr. P)
C1: Personal interest rather than societal value (Dr. P)
C1: Trying to find out how things work (Dr. P)

Chapter 5 Code Mapping: Interactions of Analysis (to be read from the bottom up)

Code Mapping for
RQ 3: How do professors support first year students' interest in and identification with a prospective science major?

(Final Iteration: Application of Themes to Data Set)
The professors supported their students' interest in and identification with their prospective science major by helping them to develop the critical thinking skills needed to be successful in the discipline and by helping the students to make connections with peers, faculty and researchers in the discipline. The professors supported both student development of content knowledge and their access to researchers and research opportunities in the discipline.

(Third Iteration: categories)

Category 1:	Category 2:
Thinking Like a Scientist	Making Connections With Research and Researchers

(Second Iteration: Focused coding)

C1: Big Picture Understanding.	C2: Informal mentoring.
C1: Critical Thinking Skills	C2: Access to research opportunities.
C1: Understanding Scientific Literature	
C1: Correcting Misconceptions	
C1: Developing Self-Confidence	
C1: Flexibility	

(First Iteration: Initial open coding – sample of codes)

C1: Scientific knowledge	C2: Peer mentors source of tips
C1: Authority of scientist	C2: Networking with peers and researchers
C1: Supporting critical thinking	C2: Personal interaction with students
C1: Guest speakers show bigger picture	C2: Faculty describe research
C1: Introducing students to interpretation of data	C2: Meeting faculty in the department
	C2: Students choose lab tour
C1: Introducing domain knowledge	C2: Exploring undergraduate research opportunities
C1: Helping students understand the value of knowledge	
C1: Getting students feet wet	
C1: Need different skills in college physics	
C1: Changing student perceptions of physics	
C1: Use Fermi problems for flexible thinking	
C1: Need confidence to approach difficult problems	