2016

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Ruff, Chloe. " Finding Relevance, Competence, and Enjoyment: The Development of Domain Identification and Interest in First-Year Science Majors." International Journal of Teaching and Learning in Higher Education 28, no. 3 (2016). pp.335-346.

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Abstract
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Keywords
first-year students, science major, college education, study of science, student interest

Disciplines
Educational Assessment, Evaluation, and Research | Higher Education | Science and Mathematics Education

International Journal of Teaching and Learning in Higher Education 2016, Volume 28, Number 3, 335-346
http://www.isetl.org/ijtlhe/ ISSN 1812-9129

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First-year college students arrive with educational backgrounds that inform their initial choices in college and influence their perceptions of the academic experiences they will encounter (Astin, 1993; Thompson, 2007). Students entering college with pre-selected majors choose their majors based on a variety of academic and social experiences outside of the college context and already have developed knowledge and interest related to their major. These students may self-identify with their majors before attending their first college course. As colleges and universities explore methods to support and retain students, particularly students with a strong interest in science, technology, engineering, and mathematic (STEM) fields, motivation constructs such as domain identification and student interest are useful for examining how these first-year students perceive their initial experiences within their prospective major.

The constructs of domain identification and interest develop from an individual's educational and social experiences and influence later academic outcomes (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 encompasses both an individual's engagement with a domain and 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 (Renninger, 2010; Walker, Greene, & Mansell, 2006).

The initial courses that students take in their prospective major provide them with an opportunity to increase knowledge of, and value for, the domain. Ideally, these courses provide students with an opportunity to envision themselves within the domain of their major. Academic and social experiences students have in this first year may reinforce, negate, or cause them to re-evaluate their prior experiences and perceptions (Harackiewicz, Durik, Barron, Linnenbrink-Garcia, & Tauer, 2008). In each of these cases, students' identification and interest in the major may further develop or weaken. Prior studies in interest and domain identification have examined this period of transition in first-year college students through quantitative methodologies (Harackiewicz et al., 2008; Osborne, 1997). The present study was designed to qualitatively examine how students reflect on, and describe in their own words, their identification with, and interest in, their prospective science major.

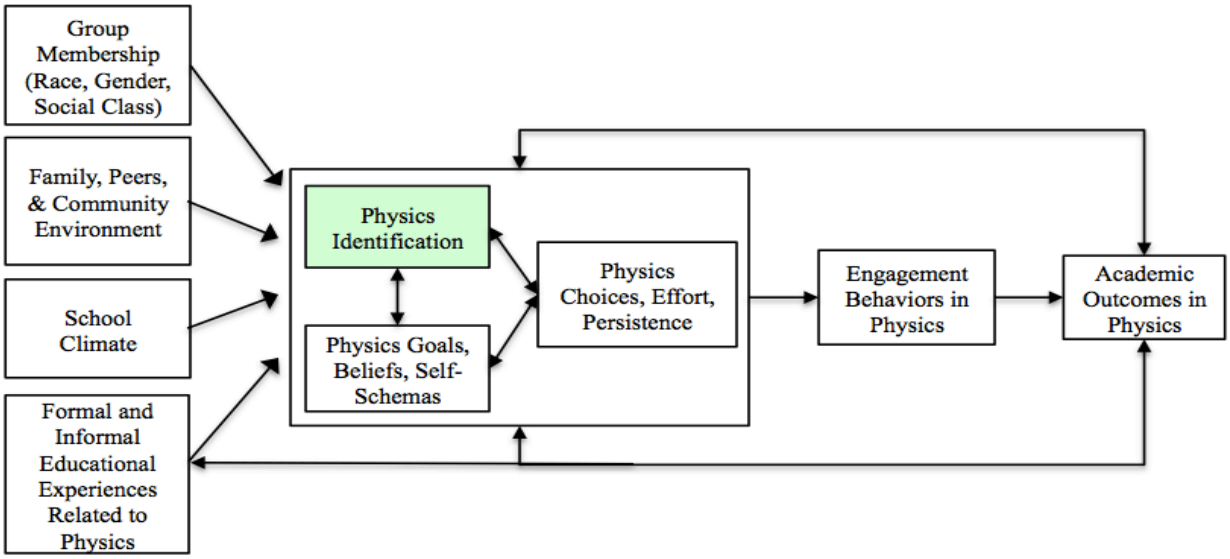
Theoretical Background

Domain Identification

Domain identification (DI) 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) filters through the individual's perceptions of the outcomes and evaluation of the importance of the domain to their self-esteem. 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 & Jones, 2011).

Academic DI upon entering high school is positively related to learning and performance goals, as well as to the intrinsic valuing of academics, perceived ability, self-regulation, and both deep and shallow cognitive processing, and it is negatively correlated with absenteeism and behavioral referrals (Osborne & Walker, 2006). At a college level, academic DI predicted GPA after one semester and again after two years, even when controlling for sex, race, and self-esteem (Osborne, 1997). Additionally, students at different levels of academic standing exhibited

Figure 1
. Model of a student's physics identification (adapted from Osborne & Jones, 2011)



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 the Dean's List, whereas a low level of academic identification was related to withdrawal or academic probation (Osborne, 1997).

Social and academic factors that influence the development of DI include: group membership (e.g., gender, race, class); family, peer, and community environment; school climate; and educational experiences (see Osborne & Jones, 2011 for more information). Through these background factors, DI is related to other motivation constructs (see Figure 1 for an example of a student's physics identification).

DI is likely cyclical, both influencing and influenced by academic engagement and performance. As such, identification with academics may be a stable concept, but it is not static and could be affected 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 increase students' identification with the academic domain (Osborne & Jones, 2011).

Existing research examines DI writ large in the form of academic identification (Osborne, 1997; Osborne & Walker, 2006) and more focused forms of DI such as math identification or engineering identification (Jones, Paretti, Hein, Knott, 2010; Jones, Ruff, & Paretti, 2013). Although theoretical models provide a description of how the development of DI should occur, further research is needed to understand how students develop different DIs (Osborne & Jones, 2011; Voelkl, 1997).

Researchers examining students' persistence in science also use 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" develops from their participation in various communities of practice (e.g., classroom, extracurricular; Aschbacher, Li, & Roth, 2010; Gee, 2000). Research on science identity is focused on the development of identity through the interplay between the individual and social support from teachers, parents, counselors, and peers. This research overlaps with the "group membership" background factor in Osborne and Jones' (2011) model of DI; however, DI focuses on the internal interplay between students' performance and perceptions of value for science. Science identity explores the influence of participation in a community on an individual's identity, whereas science DI explores how an individual internally evaluates this participation. The two frameworks likely work in concert; however, the present study focuses on students' internal perceptions and evaluation of their experiences.

Interest

Interest is used as a broad term both colloquially and theoretically to include a range of related concepts. The present study examines the development of individual

interest. Thus, Hidi and Renninger's (2006) description of interest is more appropriate than definitions limited to activity-based, situational interest. They defined 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. Hidi and Renninger (2006) suggested that 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) defined *affect* as the feelings that an individual connects with engagement with a subject matter. *Stored knowledge* is considered 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).

Hidi and Renninger (2006) proposed 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, individuals also begin to develop stored value for the content area and may come to have a well-developed individual interest (Hidi & Renninger, 2006).

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 and colleagues (2008) reported that interest development in introductory courses was related to both academic performance and later course selection. They used self-report measures and quantitative analysis of situational and individual interest in their study (Harackiewicz et al., 2008).

Research Question

This study examined how first-year college students perceive and experience the development of DI 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 DI and interest to complement the existing quantitative studies of these concepts in first-year students (e.g., Harackiewicz et al., 2008; Osborne, 1997). The research question is: 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. Students involved in the study participated in a set of two interviews during their first two semesters at the university, with one interview near the beginning of their first semester and a second interview at the beginning of their second semester.

Participants

Participants in this study were enrolled in "first year experience" (FYE) courses associated with their prospective major (biochemistry or physics). These courses were designed to help first-year students in the major to develop a more complex understanding of the role of scientists in their discipline. Participants were recruited through a brief in-class presentation and a recruitment email sent to the students by the course professor. Eight students volunteered to participate, including five women and three men. The 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 due to scheduling conflicts.

Data Collection

A set of in-depth individual interviews were used as a method for gaining information about the students' lived experiences related to identification with, and interest in, their major. The interviews were designed to elucidate the students' perspectives related to the constructs under study and generate rich descriptive data (Seidman, 2006). Each student was asked to participate in a sequence of two 60-minute interviews during their first year at the university. I used a semi-structured interview guide to keep the interviews focused on the constructs while also providing space to develop follow-up questions based on the student's responses to earlier questions. The interview protocol was pilot-tested on three undergraduate student volunteers, after which interview questions and the directions to the selective valuing activity were revised for clarity. The first set of interviews was scheduled

during the first five weeks of the students' first semester and occurred before students had taken their first set of exams in order to have students reflect on their prospective major prior to receiving feedback on their college performance. The second set of interviews was scheduled during the first six weeks of the second semester and occurred after students had completed and received grades for their first semester courses.

The first interview was focused on the experiences that led the student to have an interest in their major, including questions about 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 (i.e. "Tell me about how you came to choose biochemistry/physics as your major. What classes or activities did you participate in during high school or middle school related to your major?"). During this interview, the students also completed a selective valuing activity. Students were asked to list the personal aspects that they considered 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 the list. After listing their most important aspects, the students were asked to rank them from most 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. Following the activity, the students were asked to explain the relative importance of their major to other aspects on the pie graph.

The second interview was focused on the students' current experiences broadly within their major and more specifically within the FYE course. This interview occurred after students had completed and received grades for one semester of coursework. 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 in, and value for, their major had changed over the semester (i.e. " Now that you have finished one semester of coursework, how do you feel about your decision to major in biochemistry/physics"). Students completed a second selective valuing activity and were asked to explain the relative importance of their major to other aspects of the graph.

Data Analysis

I analyzed data from the interview transcripts and the selective valuing activity through a constant comparison method (Charmaz, 2006) by first using line-by-line coding of transcripts to develop a set of descriptive, open codes then consolidating the open codes into a set of focused codes that provided an initial description of the categories and subcategories emerging from the data. I used these focused codes to code the second round of interviews. All interviews were merged into one dataset during data analysis. Throughout this process, I used code mapping and analytical memos to develop the focused codes into themes and connect the themes to the participants' voices (Charmaz, 2006). Figure 2 provides an example of the process by which open codes were categorized into focused codes and then into themes.

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: Theme 1: *Self-definition in flux*, Theme 2: *Feeling competent*, Theme 3: *Expressing interest through enjoyment*, and Theme 4: *Relevant to me* describe how the students expressed the connection they felt with their prospective major during their first year at college. The themes are described in detail in the following sections.

Theme 1: 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 but changed to physics or biochemistry during the period of time between their acceptance to the university and the first interview (Table 1). The mutability in the students' self-definitions 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 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 (e.g., "as a Physics major, I want to make a difference in the world" [Kelley]).

Although students rarely identified directly with their major, they often described their interest in relation to the characteristics or values they felt defined themselves presently or those they wanted to define themselves with in the future. In part, by highlighting the values that they considered important, the students were also focusing on aspects of their major that were most important to them. For example, Max explained his connection with physics: "I guess just natural curiosity. That's why it's the most important. It's just a

Figure 2
Map of the Coding Process (to be read from the bottom up)

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

First Iteration: Initial open coding (sample of descriptive codes from interview transcripts)

1: Not a physicist	2: Math & science easier	3: Liked biology	4: Personal relevance
1: Being a Student	2: Think better in math & science	3: Fell in love with physics	4: Connections
1: Want to help people		3: Self-enriching	4: Best fit for career
1: Primary Interest	2: More challenging	3: Personal interest	4: Reasonable choice
1: As a Physics major	2: Desire to do well	3: Favorite subject	4: Many options
1: Going to be a scientist	2: Had to study	3: Most fun I had	4: Researched majors
1: Being a team-member	2: Studying really hard	3: Good use of time	4: Comparison with prior majors
1: Defines my personality	2: Doing well at	3: Readings are enjoyable	
	2: Likes challenge	3: Physics problems for fun	

Second Iteration of Analysis: Focused coding

1: Self-definition	2: Competence	3: Enjoyment	4: Usefulness
	2: Effort	3: Affective Response	4: Future Options
		3: Cognitive Response	4: Cost

Third Iteration of Analysis: Overarching Themes

Theme 1: Self-definition in flux	Theme 2: Feeling competent	Theme 3: Expressing interest through enjoyment	Theme 4: Relevant to me

Final Iteration of Analysis: Study Conclusions

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.

Table 1
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

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" (Interview 1). 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, Interview 1) and "to make an impact" (Kelley,

Interview 1). They also described having changed 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 (Interview 1).

The mutability of students' self-definitions is logical considering their positions as incoming college students. The students were taking their first college-level courses in their fields. In fact, for the biochemistry students, the FYE course was the first classroom exposure the students had to 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 concepts (Interview 1).

Theme 2: 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 self-confidence in their abilities (e.g., "math and science were always easy for me" Melissa, Interview 1) and 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 perceptions of their competence in high school courses or other related experiences to explain how they came to select and maintain interest in their prospective major. Feelings of lower competence were important also in how students described both their interest in 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.

As the students described their earlier educational experiences, five participants described long-term feelings of competence in areas related to their current major. 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 (e.g., "I always excelled in science and had to work really hard at everything else," Kelley).

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. For example, Kelley enrolled in Advanced Placement (AP) Physics even though she had a weaker math background than her classmates. She described initial confusion and lack of competence with the course, but she chose to remain in the class and developed a sense of competence through the support of her teacher and father: "[My father] helped me a lot and I needed his help less and less as I started doing really well" (Interview 1).

A number of students described an increased sense of competence associated with their college math and science courses. 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. Some students' feelings of competence were enhanced by the perception that the courses were less difficult than expected. Other students developed a greater sense of competence through the successful completion of their first courses.

Developing competence in a content area at times led students into the role of tutor. Cody described helping to prepare his high school classmates for tests by "re-teaching" material (Interview 1). 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 when many of her friends who were engineering majors were taking their first physics course (Interview 2). 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 professors (Interview 2).

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, Josh explained "[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 (Interview 1).

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 activities and his expectations for an introductory course. He defined his difficulties as more of a mismatch between the course description and the reality of the assignments

than a difference between his ability and the level of course work (Interview 1).

The end of semester grades also caused some students to examine their level of competence. Several students did not feel that they received grades representative of their competence, although they attributed the disparity in different ways. Similar to Cody, some students attributed their grades to a mismatch between their expectations and the course assignments and assessments, and others to initial attitudes and study habits.

Competence is a main element of how these students perceived their interest in, and identification with, their major; however, students did not develop or maintain interests solely in subjects where they felt successful. For example, Cody described his high school biology class as easy, but then he explained how he finished his work quickly and slept or read for the remainder of class (Interview 1). Often competence was a springboard encouraging students' connection with a discipline, particularly for students reporting long-term competence in a field. Although Cody slept through general biology, he described an ongoing interest in biology throughout high school, chose to take Anatomy and Marine Biology in addition to his required high school science courses, and entered college with a biochemistry major.

Theme 3: Expressing Interest Through Enjoyment

"Anatomy was my favorite subject" (Cody, Interview 1), and "I am enjoying all of my classes" (Melissa, Interview 1) are all descriptions that students related to the field of their major. As a reoccurring theme throughout the interviews, 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 positive feelings for a course or 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.

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 these general comparisons, the students were defining their area of interest: "I always liked the maths and sciences better since I was younger" (Melissa, Interview 1) or "[anatomy and marine biology were] the most fun classes I ever had in high school" (Cody, Interview 1). 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 chemistry a little bit, but I hadn't really enjoyed any of my science *classes* as much as I did until I took physics, which was my junior year. (Interview 1)

Several students described how their enjoyment of a subject impacted their selection of a major: either choosing or changing a major due to their excitement or lack of excitement for the major.

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 (biochemistry) contrasted her enjoyment of chemistry to other science courses. In biology, she enjoyed being able to understand the relationship between her work with horses (a personal interest) and course content, which encouraged Kate to look at her horses in a different way and begin to consider the role of chemical and biological interactions in her animals' behaviors (Interview 1).

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 sort of discovered 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" (Interview 2).

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?!" (Interview 1)

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 as students interacted with peers. Social experiences also occurred outside of the class structure through extra-curricular science and math activities (e.g., regional Physics Olympiad, summer science academies). These outside experiences allowed the students to engage with other high school or entering college students who shared their excitement for the subject.

Enjoyment did not appear spontaneously for all of the students in this sample. The courses and subjects that they described as fun, interesting, and enjoyable were ones in which they also felt competent and often described having put forth effort to develop competence. The courses and subjects that students described (e.g., Chemistry, Foundations of Physics) were courses that involved knowledge and skills considered foundational to the disciplines in which the students were majoring. Students used their enjoyment with courses and academic subjects to narrate the development of their interests and, by reflecting on particularly enjoyable activities and content areas, they emphasized the pivotal experiences in their developing interest and identification with their major.

Theme 4: Relevant to Me

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 courses related to their major, or how it was relevant to their future plans.

When reflecting on high school science courses, several students explained their developing connection with an academic subject in terms of course relevance 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" (Interview 1). 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, which helped to engage Kate with the courses.

Alternatively, Max 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 online outside of class, whereas his high school courses were focused on foundational understandings (Interview 1). 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 current interests.

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 course 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. They described choosing to take courses that they felt were most relevant to their future careers and using AP credits to exempt humanities courses that they perceived as less relevant to their major or future careers.

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

Many of these students understood that multiple paths were available but changed their major to a path perceived as more direct and relevant to future plans. For example, both Josh and Max described having early and strong interests in history, and they 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 (Interview 2). Similarly, although Kate referred to the time and effort she spent training horses throughout her interview, her career goals were related to biochemistry and medicine because "training horses would be a waste of college" (Interview 1).

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 explained that they would rather be learning something more personally engaging.

All of the students were participating in FYE 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 courses. When describing the FYE courses, the students spoke of course topics and assignments as helpful or important. Each of the students also evaluated some 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 will help me. I don't find it that enjoyable" (Max, Interview 2). 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, Interview 2).

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, no one expressed feeling their interest in, or identification with, the field was diminished by having to participate in the less personally engaging activities.

Discussion

The present study provides an opportunity to examine how well the Osborne and Jones (2011) and Hidi and Renninger (2006) models of DI and interest development align with the lived experiences of students. Osborne and Jones' (2011) model of DI is generally consistent with the findings of this study. The students did selectively value their major in comparison to other disciplines and related their current identification to prior educational experiences.

Hidi and Renninger (2006) 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 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. 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 relevance. By framing the definition of value as students' affective feelings and feelings of competence, Hidi and Renninger (2006) minimized the relevance of a developing interest to an individual's long-term goals and developing sense of self.

The findings of this study suggest several potential revisions to Hidi and Renninger's Four-Phase model that could be explored to develop a model to examine how academic interests develop into academic or professional DI. The stored knowledge component could be adapted to include the learners' feelings of competence, and the stored value component could be re-focused on students' perception of the importance or usefulness of the content or domain. Alternatively, other models of interest development, such as the Person-Object (POI) theory of interest development (Krapp, 2002), may provide a more applicable model for researchers examining the relationships between interest development and DI by removing the component of stored knowledge and framing value as the personal significance (e.g., relevance) of the content of interest.

Differentiating between Relevance, Selective Valuing, and Stored Value

All of the students interviewed expressed the practical nature of their choice of major by describing potential careers. These students had a perception of value that was based as much on their goals as it was on their past or current academic experiences within the field. The 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. Thus, these students may be articulating personal value for, and identification with, their major by explaining how their major fits into long-term career plans.

Theme 4: *Relevant to me* aligns with the definition of selective valuing in domain identification insomuch as students' perceptions of relevance connect their value for their major to personally significant future goals. Thus, in this case, 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 (2006) definition of stored value aligns minimally with the theme of Relevance through descriptions of instructors connecting a concept to students' personal interests. This aspect of relevance aligns with previous findings indicating that teachers can support students' situational, activity-based interest by making content and activities personally relevant to students (e.g. Hulleman, Durik, Schweigert, & Harackiewicz, 2008; Mitchell, 1993).

However, students frequently described the relevance of activities, courses, and their major in relation to their future goals, distinguishing Relevance from Hidi and Renninger's (2006) stored value component. Krapp (2002) described a more encompassing conceptualization of value within the POI model of interest development through which value is described as 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 within this sample and potentially provides a more fluid link between the development of interest and the development of DI.

Separating Individual Interest from Majors

Through the interviews and the selective valuing activity, students described 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 these activities 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. These students displayed the components of a developing individual interest (i.e., stored knowledge, value, and positive affect) but did not display high DI. They considered their interests to be personally relevant, but they 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 competence and enjoyment. They included these interests in their selective valuing graphs but explained that these activities were "for fun" and unrelated to career goals. This separation between level of interest and level of DI 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 as they continued to engage with it. However, they did not perceive the interest to be a viable career option, or they worried that pressure to perform would reduce their feelings of competence and enjoyment. Rather than dis-identify with the domain, the students chose to re-contextualize their identification as a "hobby" rather than potential career.

Conclusion

Theoretical Considerations

The descriptions of students' interest in, and identification with, their major in this study provides 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 *Relevant to Me* 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) are defined in current literature. Students may be evaluating the usefulness, value, or personal importance of their major through their perception of how relevant the activity or discipline will be to their future academic and career goals. This perception of value for the major is *future*-directed, whereas the value-related concepts in the current models of DI and interest (e.g., selective valuing, stored value, 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 these perceptions are also likely related to their understanding of the relationship between their major and future goals. 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 future (e.g., "How valuable is what you are learning in your first-year physics seminar to your future goals?") context.

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 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. 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 that emerged from this study in first-year students in other majors and in students who are entering into college without a declared major. Also, a longitudinal study is needed to follow students through college to examine how identification and interest in 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.

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