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Recruitment of Early STEM Majors into Possible Secondary Science Teaching Careers: The Role of Science Education Summer Internships

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A shortage of highly qualified math and science teachers pervades the U.S. public school system. Clearly, recruitment of talented STEM educators is critical. Previous literature offers many suggestions for how STEM teacher recruitment programs and participant selection should occur. This study investigates how early STEM majors who are not already considering teaching careers experienced a summer teaching recruitment internship and how it influenced their ideas about teaching and learning and interest in teaching high school as a possible future career. Using multiple qualitative data sources including interviews and daily internship reflections, a multi-case comparative case study was developed. The findings support that some interns substantially increased their interest in teaching careers, while other interns' interest did not change or decreased. The impact of the recruitment internship was related to extent to which interns (1) found teaching rewarding, (2) focused on student learning rather than behavior, and (3) developed close connections with students and appreciated their individuality. Implications for future recruitment efforts and research on teacher recruitment are provided.

Keywords: Recruitment, Secondary science teachers, summer internships

INTRODUCTION

According to a report on educator supply and demand in the United States (Bobbitt, Cunningham, & Gillespie, 2008), teaching job opportunities are relatively stable. This report explored teacher demand across educational fields (e.g. math, journalism, biology) by surveying career service representatives and teacher education deans and directors across geographical regions. Accordingly, 37 of 62 teaching fields reported some shortage of qualified teachers. Of these surveyed

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fields, 14 showed considerable shortage, and science (especially physics and chemistry) and mathematics were among the fields in greatest need of teachers.

Due to teacher retirements and increasing preretirement teacher attrition, the demand for qualified science teachers often outpaces supply, especially in schools with high teacher turnover (Ingersoll & Perda, 2010). Ingersoll and Perda (2010) found that 56% of U.S. secondary schools reported annual science job openings. Of these, 35% characterized their hiring difficulties as "serious" with respect to finding qualified science teachers (Ingersoll & Perda, 2010). According to the U.S. Department of Education's *Preparing and Credentialing the Nation's Teachers* (U.S. Department of Education Office of Post Secondary Education, 2013), 46 states reported shortages in science teachers in the year 2009-2010.

These shortages raise important questions about who is entering and leaving the science teaching profession. In terms of who enters the teaching profession generally, the most common demographics include females, Caucasians, and college students with lower academic ability (Guarino, Santibanez, & Daley, 2006). Other researchers (Westerlund, Julie, Radcliffe, Smith, Lemke, & West, 2011) explored what attracted and discouraged preservice science teachers at all grade levels with regard to teaching science. They found that those who wanted to teach science typically had positive science experiences with K-12 teachers and prior experience working with school age students. From this same study, secondary science preservice teachers often reported their preference to teach at the high school level because of the level of science content and perceptions of secondary students' higher thinking abilities. Eick (2002) examined the personal histories of those who entered and stayed in the profession of science teaching and found that individuals most likely to persist had intrinsic interests in science or teaching or experienced the personal rewards of teaching.

In terms of who leaves the teaching profession, Guarino (2006) found that most teachers exited the profession within their first years of teaching or near retirement. Demographically, Caucasian teachers, teachers with higher measured academic ability, females, and math and science teachers were most likely to leave the profession (Guarino, 2006).

Thus, in terms of supply and demand, this body of literature suggests that science and math teachers are in short supply, in large part because of the *attrition* of early career teachers. These studies also indicate that teachers who will most likely enter the profession and persist through the early years of teaching are those who had positive K-12 science learning experiences, previous experience working with K-12 aged children, intrinsic interest in science, and experienced personal rewards associated with teaching. A plausible solution to the shortage of science and math teachers would be to specifically recruit these likely "persisters" into the field of science and mathematics teaching.

RECRUITMENT

Clearly, recruitment is an important part of the solution to the science/math teacher shortage. Yet, even high school preservice teachers in great demand described *not* having been recruited and *not* being familiar with the promising employment market for science teachers (Westerlund, Radcliffe, Smith, Lemke, & West, 2011).

Luft, Wong, and Semken (2011) advocated taking a "Comprehensive and Strategic" recruitment strategy for attracting qualified potential science educators into the field. Their recruitment strategy highlighted how recruitment should (1) be aligned with the philosophy of the teacher education program and thus include opportunities for reflection on the enterprise of science teaching and learning, (2) include purposeful experiences that allow a candidate to engage in actual science

teaching, and (3) be situated in that selection and programming should be based on the prior experiences of the potential teacher. Well-intentioned but less effective recruitment efforts have been based primarily on incentives (explored later in this literature review) or represent "educational detours" (p. 467) that are only tangentially similar to actual classroom teaching such as tutoring or assisting college science professors. Furthermore, Luft, Wong, and Semken (2011) maintained that recruitment should be thought of as a preservice teaching experience itself. During these recruitment experiences, potential teachers can develop an orientation toward the teaching field and personally experience the challenges and rewards of actual science teaching. A key component of these recruitment experiences are opportunities to critically reflect on the potential teachers' effectiveness and ideas about science teaching. These authors also detailed research gaps with respect to science teacher recruitment and advocated research that explores how the recruitment process impacts potential teachers' beliefs and knowledge about science teaching (Luft, Wong, & Semken, 2011).

Because of the importance of recruitment of math and science teachers, many national and state policies and programs have been developed to serve this purpose (Clewell, 2001). At the national level, strategies have included federal loan forgiveness and development of NSF initiatives such as the Collaborative for Excellent in Teacher Preparation (CETP) program. These initiatives target curriculum development and reform, recruitment, early and consistent field experiences, and induction support for new teachers. At the state level, scholarships and loan forgiveness, websites for job postings, teacher recruitment grants, and alternative certification programs to streamline the certification process have all been attempted.

Several of the policies and programs provide incentives for promising science and math teacher candidates. Yet, recent studies have called into question the effectiveness of incentives. In a study of the NSF-funded Noyce Scholars program, researchers found that scholarships most influenced Noyce recipients to complete their teacher education program even more so than teaching in a high needs school as per requirement of scholarship. They also found that scholarships were even less influential for encouraging recipients to teach in high needs schools beyond their required two-year commitment (Liou, Kirchhoff, & Lawrenz, 2010). In a similar study of the Noyce program, it was found that scholarships may be going to those who would already become teachers rather than enticing those who had not considered teaching before (Liou & Lawrenz, 2011). Yet, financial incentives may be more important for career changers than undergraduates who had not yet committed to a particular career choice (Liou & Lawrenz, 2011). More than financial incentives, preservice teacher candidates' personal characteristics and perceptions (Liou & Lawrenz, 2011) and streamlined routes to credentialing (Guarino et al., 2006) may be more predictive of one's decision to become a teacher.

Several recruitment strategies have been employed. Taking a comprehensive and strategic recruitment approach requires addressing how people want to become teachers at different times in their lives (Hutchison, 2012). Previous research has focused on both early and mid-career recruitment efforts. In the next sections, I describe lessons learned from mid-career program recruitment and then early-career recruitment efforts, the subject of the present study.

Many mid-career change programs have been developed to address the increasing demand for math and science teachers: alternative certification programs, troops-to-teachers programs, and the afore-mentioned financial incentives (Ingersoll & Perda, 2010). These programs all offer possible entry-ways for mid-career or postundergraduate degree teacher candidates. Because these individuals already hold degrees and are also involved in other careers, recruitment for mid-career changers differs from early career candidates. Abell et al. (2006)

explored the effectiveness of different recruitment strategies to draw attention to an alternative certification program. They determined that personal contact with alternative certification program faculty, the internet, and distribution of program advertisements through school administrators were the best ways to target potential teacher candidates. Intentional gatekeepers (testing requirements and criteria to ensure high caliber candidates) and unintentional gatekeepers (certification officers, life stage, tenacity, internet savvy, and geography) served to deter potential candidates from these programs (Abell et al., 2006).

Early-career teacher candidates may be recruited in a number of ways, and these differ from efforts targeting mid-career changers because early-career teacher candidates can be more readily located within existing educational environments such as high schools and colleges. Various programs have targeted potential candidates while they are still in high school, while others target students who have already committed STEM majors. Literature about the recruitment of these two groups is relevant to the current project and described in detail below.

Some studies have investigated the recruitment of potential science and math teachers while they are still secondary students themselves. These recruitment efforts included science summer camps (Bischoff, Castendyk, Gallagher, Schaumloffel, & Labroo, 2008; Toolin, 2003), high school recruitment followed by college tuition waivers (Artzt & Curcio, 2008), middle school teaching practica for high school students (Toolin, 2003), inquiry learning experiences (Bischoff et al., 2008; Toolin, 2003), and cohort-approaches to advising and peer support (Artzt & Curcio, 2008). These programs ranged in success in terms of enticing these high school students to pursue science teaching careers from 6% (Bischoff et al., 2008) to 50% (Toolin, 2003) to 96% (Artzt & Curcio, 2008). The authors attribute program success to engagement in challenging science/engineering tasks (Bischoff, et al., 2008; Toolin, 2003), confidence built through autonomy via inquiry learning (Toolin, 2003), peer supports afforded by cohorts (Artzt & Curcio, 2008), and close association with college faculty (Artzt & Curcio, 2008).

Three studies specifically dealt with recruitment efforts of STEM undergraduates. Luft and colleagues (2005) examined the experiences of students taking a recruitment-oriented introduction to science teaching course in a secondary science math and computer science teacher education program. She categorized students' interest in teaching careers as primary or secondary. Students with primary interests wanted to work with children and share their love of science. Some had had prior experiences as tutors, coaches, or teachers. Students with secondary interests wanted to improve the instruction of particular topics such as evolution, found the teaching profession to be conducive to a desirable lifestyle, or planned to use teaching to fill time before entering another profession. She found that juniors and seniors showed more interest in and commitment to education careers than freshmen and sophomores. Additionally, students with primary interests in teaching were less likely to leave the program after this first course. Also, the field experiences were valued by all participants but did not necessarily impact students' decisions to continue within the teacher education program. Finally, relationships with instructors, advisors, and classmates were critically important to students in their recruitment course (Luft, Fletcher, & Fortney, 2005).

Other researchers (Worsham, Friedrichsen, Soucie, Barnett, & Akiba, 2014) examined the effectiveness of paid summer internships at sites of informal science education for freshman and sophomore STEM students as a recruitment pathway into science teacher education. Participants completed 10-week internships at science museums and nature centers while also participating in a support seminar. After examining application materials, exit surveys, and final reflective papers, the authors concluded that these internships were not effective for recruiting interns immediately into the program although several indicated that they would possibly

consider a science teaching career later in life. Participants' reasons not to become teachers included the rigidity of teacher education program requirements, concerns about teacher salaries and classroom management, and general career indecisiveness. A perceived lack of similarity between their informal teaching sites and actual high school science teaching settings as well as variable levels of job support at the internship sites may have also negatively impacted students' career decisions. The authors concluded that the paid summer internships attracted many students who later admitted to having only secondary interests in teaching. Based on their findings, this research team recommended that similar recruitment efforts screen applicants carefully with preference given to those with prior related educational experiences, support interns by making connections between internship work and teachers' work in actual high school science classrooms, build a community where interns support each other, prompt reflection, keep in contact with non-committed interns as they move through their undergraduate degrees, and improve science teacher education program requirement flexibility.

Tomanek and Cummings (2000) investigated the impact of formal science teaching internships on science teacher recruitment. In their program, undergraduate STEM majors spent ten hours per week assisting selected secondary science teachers for ten weeks in formal high school settings. They found that three of their fifteen participants became committed to secondary science teaching careers. The authors concluded that two factors positively impacted those three individuals. First, these participants' classroom experiences were very positive: they liked their cooperating teachers, enjoyed interactions with students, felt important and esteemed for their science knowledge, and, believed teaching was a legitimate career choice for them. Second, these three participants held particular prior beliefs about teaching; they viewed teaching as career with promising job availability, valued interpersonal aspects of good teaching, realized the importance of motivating students, and viewed teaching as a form of additional career preparation rather than a complete departure from their STEM major. For the participants who chose not to pursue teaching, the authors noted their concerns about classroom management and their perception of low prestige associated with a teaching career.

This literature review of previous recruitment efforts offers several insights with respect to both *program development* and *participant selection*. In terms of *program development*, optimal results would be expected from programs that:

- *Align with the philosophy of the teacher education program and embed opportunities for in-depth reflection on teaching and learning (Luft et al., 2011; Worsham et al., 2014);*
- *Allow the candidates to engage in authentic high school science teaching environments where they interact with secondary students (Luft et al., 2011; Tomanek & Cummings, 2000; Worsham et al., 2014);*
- *Offer peer supports (Artzt, 2008; Luft, 2005; Worsham et al., 2014);*
- *Offer teacher education advisory support (Artzt, 2008; Luft, 2005);*
- *Offer pedagogical support at the internship site (Worsham et al., 2014); and*
- *Allow the teacher education/certification process to be flexible so that participants can obtain their STEM degrees (Tomanek & Cummings, 2000; Worsham, et al., 2014).*

Similarly, optimal results would be expected from a selection process that gives preference to individuals:

- *With prior education-related experiences (Luft et al., 2011; Worsham et al., 2014);*
- *Who believe teaching is a legitimate career goal (Tomanek & Cummings, 2000); and*

- *Who hold primary interests in teaching such as wanting to work with children or share their love of science (Luft, 2005).*

As described more fully below, the recruitment internship program investigated within this study embodied several of these important literature-based features.

The present study is an attempt to add to this growing literature on the recruitment of science and math teachers and to answer calls for more research on this vital recruitment (Luft, et al., 2011). This particular recruitment effort incorporates many literature-based suggestions and may offer a promising avenue for alleviating the science/math teacher shortage. Specifically, this study investigates how early STEM majors who are not already considering teaching careers experience a recruitment internship and how it influences their ideas about teaching and learning and interest in teaching science as a future career.

METHODS

The present study utilized a qualitative approach for ascertaining how a summer internship experience influenced interns' future career decisions and ideas about teaching and learning. Two essential assumptions guided this work. First, interns have access to their own emic perspectives regarding their internship experiences. Second, these emic perspectives may influence interns' future career decisions. Given these assumptions, a qualitative research approach that sought interns' emic perspectives using various methods (interviews and written reflections) at various times throughout the internship experience was employed.

Context

The Noyce Interns Program at this Midwestern university is a three-to-five-week NSF-sponsored program offered to promising undergraduate students who are freshmen/sophomore math/science majors. Interns were encouraged to use these opportunities to explore teaching as a possible career and were guaranteed interviews for subsequent Noyce Scholarships if they chose to pursue science or math education careers. The Noyce Scholarships at this institution support masters students who enter an intense one-year Master of Arts in Teaching (MAT) program that requires an undergraduate degree in a content major. Thus, this teacher certification pathway allows individuals to both obtain their intended STEM major before obtaining teacher licensure. At this institution, interns were recruited in three ways: (1) fliers distributed throughout the science buildings, (2) email notifications through science academic advisors, and (3) announcements made by science faculty in introductory science courses.

In this study year, internships entailed working in an existing Upward Bound summer residential academy program teaching math/science to high school students from nearby urban high schools at the university. This particular Upward Bound program is a conglomeration of three federally-funded programs that offer academic-year mentoring programs and summer residential academies for first generation, low-income students from targeted high schools in the state. The interns were each assigned to assist an experienced science/math teacher as they taught daily hour-long classes within science or math disciplines. Interns were paid a stipend for their work, but research participants were not offered any additional compensation. The internships occurred within two types of Upward Bound programs, a three-week, five-day/week program and a second program which met four days/week for three weeks and two/days/week for two weeks. Interns worked half-days in these classrooms and were required to submit daily reflections guided by particular prompts (described below). Each intern's particular teaching context is described in the case studies that follow.

To prepare for their internships, interns were required to participate in a one-hour orientation with the author (internship supervisor). At this session, professional expectations, general pedagogical techniques, and descriptions of particular teaching assignments were discussed. Interns were also required to attend an Upward Bound orientation program during which the mission of Upward Bound was explained, instructors were introduced, and an overview of the summer academy was presented.

Sample

The sample consisted of five Noyce Interns who participated in the Noyce science education summer service learning program: Lora, Ben, Brittany, Ed, and Anita. All nine Noyce Interns were invited to participate, but only five returned the IRB-approved consent forms. These interns were all freshmen/sophomore STEM majors at a large Midwestern university and ranged in age from 18 to 20 years old. As noted in Table 1, the interns were all pursuing careers *not* related to science education, but they indicated in their selection interviews that they had had previous positive teaching experience and were eager to pursue this paid internship.

Data Collection & Analysis Procedures

Because this research project sought the "insider" perspectives and views of the STEM interns as they experienced their summer internships, qualitative methods were employed. Specifically, this study employed a multi-case study approach (Bogdan & Biklen, 1998) wherein detailed data are collected for a particular event.

Table 1. Participants

Intern	Age	Race/ Ethnicity	Major	Career Aspirations	Prior Teaching-Related Experience
Anita	18	Asian	Biology	Biology research or medicine	Tutored ESL high school freshmen in science & math
Ed	20	Caucasian	Conservation Biology	Conservation biologist	Dorm resistant assistant, golf instructor, taught environmental science at local elementary
Lora	19	Caucasian	Biochemistry	Dentist	Life guard, tutored math
Ben	19	Caucasian	Biochemistry	Medical Doctor	Taught 6th-graders in anti-drug program
Brittany	19	Caucasian	Pre-pharmacy	Pharmacist	Baby-sitting, teaching peers in band

Table 2. Data Collected by Participant

Intern	Lora	Brittany	Anita	Ed	Ben
Pre-Interview (field note lines)	11	11	9	16	13
Application Docs	complete	complete	complete	complete	complete
Daily Reflections	16	15	16	15	15
Author's Feedback on Reflections	6	6	6	6	8
Post-Interview (transcript pages)	6	5	2	4	4

The term "case study" may refer to both the unit of study as well as the means of reporting (Merriam, 1998). As a unit of study, the "case" examined within this investigation was the internship experience of STEM undergraduates teaching science and math to high school students at a university residential summer program.

Data collection entailed five sources of data: a pre-internship selection interview, documents, interns' daily email-written internship reflections, the author's emailed feedback for interns' reflections, and a post-internship interview (audio-taped and

transcribed). These five data sources are described briefly below and outlined by participant in Table 2

Pre-internship selection interview. This interview was not audio-taped but was recorded by detailed field notes. Interview questions centered upon interns' career interests, previous teaching and science experiences, and reasons for applying for this internship program.

Application documents. Documents included demographic information offered by the applicants in terms of intended major, prior coursework, age, and ethnicity as well as a two-page essay describing the interns' interest in science/math and experiences working with youth.

Daily reflections. The interns submitted daily written internship reflections via email. They were asked to address prompts about their daily tasks, what worked well or poorly, what they learned about teaching, students, and themselves, questions they have developed about teaching, among others. In total, Ed and Ben submitted 15 reflections for their 3-week internships. Lora, Anita, and Brittany submitted 16 reflections for their 4-week internships. These daily reflections were generally ½ to 1 page of text, single-spaced.

Author's feedback on reflections. As the interns submitted their daily reflections, the author (the project's internship supervisor) regularly emailed the participants with comments. These emails offered encouragement and pedagogical suggestions, and sometimes generated an email conversation between the author and interns. In two cases (Ed and Lora) the author sent the interns science teaching methods materials.

Post-internship interview. Within two weeks of the end of their experience, the interns were individually interviewed. These interviews lasted approximately 25 minutes each and were audiotaped and fully transcribed. Interns were asked questions about the nature of their internship experiences, their successes, their challenges, what they learned about science teaching, adolescents, and themselves through this experience, and their interest in pursuing a science teaching career.

Data analysis employed a grounded theory approach wherein data were open-coded to develop emergent themes (Strauss & Corbin, 1990). Because data collection was ongoing and iterative, the author had many opportunities to member-check with the participants. During the summer internship, participants submitted daily reflections, and the author regularly read, memoed, and responded to participants via email. This feedback on the reflections allowed the author to ask clarifying questions such as "I am wondering if you could narrow down the "problem" students to just 5 or 6?" (to Ben, 6/28) and "As for the one student who is not engaging, has anyone pulled him out to talk to him individually to find out what is going on with him? Does this happen in other classes too?" (to Lora, 6/27). This feedback served as a way to offer suggestions for interns as well as clarify their perceptions of their teaching contexts for research purposes. Participants often replied to these questions either in new emails or in their next daily reflection, and this data served to corroborate or challenge the author's initial memos. Because of the author's close association with interns, the post-interview questions served as a natural continuation of these conversations.

Following transcription of the post interviews, all data transcripts (pre-interview notes, application essays, daily reflections, author's feedback to daily reflections, and post-interview transcripts) were open-coded. This open-coding was guided by the focal research question – how do STEM majors experience a summer teaching internship? Thus, initial open codes pertained to perceptions of teaching, perceptions of students, perceptions of learning, classroom management, and connections to content. After coding all cases, the codes became more refined as shown in Table 3. These refined codes were then applied to all five cases again, and units of text embodying subcodes were highlighted. Using these refined codes, mini-

case studies were written for each individual case. Abbreviated versions of these mini-case studies are presented in the results section. A cross-case analysis (Table 4) compared the refined codes for each participant.

Table 3. Refined Codes and Sub-codes for Data Analysis

Code	Sub-codes	Description	Exemplars
Interest in teaching careers	Increasing	Increasing interest in teaching as career	"it wasn't my first option but now it's like higher up on the list." (Lora post)
	Decreasing	Decreasing interest in teaching as career	"it doesn't seem like something that I would willingly do." (Ben post)
Teaching difficulty	Easier	Easier than expected	"I thought it would be a lot harder." (Brittany post)
	Harder	Harder than expected	"surprised at how hard it was" (Anita post)
Teaching as rewarding	Rewarding	Teaching is rewarding	"I knew I would enjoy it but I did not know that I would look forward to it each day like I do!" (Brittany –W1,D4)
	Frustrating	Teaching is frustrating	"I honestly cannot wait for this class to be over." (Ben – W3,D4)
Focus of intern's attention	Behavior	Student behavior, respect, or task completion	"Also the students were much more talkative today." (Ben- W2, D1)
	Learning	Student under-standing/ learning	"They had a bit [of] a difficult time figuring out a climate's classification using the guide." (Ed – W3,D2)
	Motivation	Student motivation/ engagement	"I would like to know how to inspire students to want to work hard to help themselves." (Anita – W1,D1)
Perception of individuals	All	Speaks of students as all possessing particular traits	"One thing I noticed is that the students in that class don't respect the interns or the teacher." (Ben – W1,D2)
	Individual	Speaks of students as being individuals, not all alike	"Even though there were many students talking, some were working real hard on their math problems." (Anita – W5,D2)
Connection to content	Passion	Passion/interest in subject matter	"What I learned about science teaching today is how much I am passionate about teaching a topic I am interested in." (Ed – W1,D4)
	Learning	Described learning subject themselves	"I really didn't know most of the material because I didn't take half the classes, so I was learning with the students." (Ben – post)
Agency as intern	Agency	Intern taught, managed, or took leadership role	"I suggested to the teacher that we separate the students into the project groups" (Ben – W1,D4)
	Non-agency	Intern deferred to others when tasks needed to be	"Somebody needs to tell the class that the MATHTECH program will help them build their basic math skills" (Anita – W1,D3)
Relation to students	Likes students	Likes or is interested in students	"One student today told me that he is going to college for Culinary Arts and he is going to different parts of the world to study this. I thought that was really cool" (Brittany – W2,D2)
	Authority	Seeks to control/ exert power over students	"We didn't struggle with the students because in the past couple of weeks we have shown authority and they have not questioned it." (Ben – W2,D1)
	Students like	Students like intern	"many of them appreciate my help and they want me to come watch their talent show." (Ed – W3,D4)
	Care	Seems concerned about students & well-being/growth	"I hope the students feel as though they have improved and I hope that they feel less intimidated by math problems!" (Brittany – W2,D1)
Peer/ faculty collabora-tion	Collabora-tion	Mentions collaborating with intern, teacher, or using faculty feedback	"[non-study intern" and I led the class today" (Lora – W4,D1)
Perceptions of own growth	Growth	Describes own growth in teaching competence	"I am also picking up on which terms are best to use when explaining the steps to solving problems" (Brittany – W1,D3)

This analysis highlighted refined codes that co-occurred with interest in teaching and was used to develop three assertions about how internships impacted participants' interest in teaching.

Two validation strategies (Creswell, 2007) to enhance the credibility of findings were used: member-checking (previously described) and prolonged engagement. The prolonged engagement entailed a several-month working relationship with the internship supervisor, the author. The author interviewed participants for the selection of the program, attended all orientations, regularly engaged in email discussions about students' internship experiences based on their daily reflections, and conducted the post-interviews. Through this process, the author learned from the participants in many contexts, facilitating mutual trust.

RESULTS

This study investigated how early STEM majors who are not already considering teaching careers experience a recruitment internship and how it influences their ideas about teaching and learning and interest in teaching high school as a possible future career. Briefly, some students increased their interest in teaching substantially (Lora and Brittany), others increased their interest marginally (Anita and Erik), and one experienced reduced interest in teaching (Ben). In the sections that follow, brief mini-cases are developed that highlight participants' internship experiences emphasizing the refined codes. Following this presentation of mini-cases, a cross-case analysis (Table 4) highlights similarities and differences in the refined codes across participants. Finally, three evidence-based assertions about the impact of these internship experiences are presented. Throughout this section, data sources are labeled with interns' pseudonyms and timing of data production. For example, "Ben – W1,D1" indicates data obtained from Ben's Week 1, Day 1 reflection.

Cases

Lora. Lora assisted a Biomedical Science class specifically focused on neurochemistry. The course was taught by an experienced graduate assistant, and Lora was joined by another non-study Noyce intern. In her role, Lora initially circulated and helped students with activities but eventually co-led a class with the other intern, planned and taught her own lecture, and planned and taught her own lab.

Lora had a very positive relationship with her students. She memorized her students' names on the first day and frequently reflected on how interesting and talented her students were. When she referred to students collectively, she almost exclusively spoke in positive terms such as "my students are also very intelligent and are capable" (Lora – W1,D2). She became deeply invested in her students. In her post interview, Lora said that she "grew attached to them as their mentor" and "had no idea [she] was going to be so proud of their final projects." Yet, Lora also used her authority when she deemed it necessary. She felt it was important to let "the students know that you are the authoritative figure and not a friend" (Lora – W1,D1).

Lora's focus was largely on student learning, but she attended to behavior regularly in her reflections. In terms of learning, Lora had several insights about teaching. For example, she reflected that "instructors also need to ask the students questions to keep them interested and make the students think at a higher level" (Lora – W1,D2). Similarly, she concluded "keeping things interesting and changing up topics helps keep the attention of students" (Lora – W2,D2). Lora took an individual approach to teaching. She explained "As the instructor, I realize now that

it is my job to reassure these students that they are very smart and capable." She continued that she "can do this by having one-on-one time for a few minutes with each student to explain to them how easy a procedure actually is, give them an example, and show them how to do it" (Lora – W3,D2). When she reflected on behavior, Lora was often empathetic such as when her students seemed "bored and tired," she empathized that it was "a Monday morning" (Lora – W3,D1).

Lora reflected frequently on her collaboration with the course instructor, her fellow intern, and utilizing faculty feedback as she assumed more agency throughout her internship. She used this support to take an increasing leadership role in the classroom, eventually teaching whole lessons independently. After teaching her first lecture, Lora described how "it felt great teaching and I love leading a classroom!" (Lora – W2,D4). She said that her experience helped her realize "that not just anyone can be an educator, especially in the science field" (Lora – W2,D4).. Lora frequently mentioned her own passion for sharing this subject. In her post interview, she said "I love biology" and "the passion drove me to want to really get these students to understand" the material.

Lora reflected on her own growth as a teacher and found teaching to be rewarding. In her post-interview, Lora expressed that through her internship experience she "got to learn how to teach." She described how while she felt "shaky the first couple of days," she got more comfortable teaching throughout her internship. In her reflections, she often mentioned her own growth: "I would still like to get better at leading the group, but I find myself improving every day" (W1,D4). During her initial week as an intern, Lora was surprised by how much she liked it, saying "We are only three days in and I know this is an experience I could never forget" (Lora – W1,D3). When one of her students thanked her for teaching her every day, Lora said, "that kind of gratitude makes me love my job" as a teacher (Lora – W4,D2).

Lora's interest in the teaching profession increased throughout her internship. In her post-interview, she described how she thought high school teaching "would be much harder." In her responses, Lora described how she initially "thought teachers knew everything" but realized that a good teacher doesn't "need to have a Ph.D." in the subject. At the end of her experience, Lora described how a teaching career in science had moved "higher up on the list" of things she wanted to consider. She concluded, "I think I'd be happier with it than I ever thought I would be." Significantly, Lora applied to the summer internship program for a second year.

Brittany. Brittany assisted for five weeks in a math class using the MATHTECH (pseudonym) program, a series of self-paced computer math modules. Within this position, she circulated among students and assisted them one on one when they needed help. Brittany co-taught with another study intern, Anita.

Of all the interns, Brittany had the most personal relationship with students. Compared to Anita with whom she had the most contact, she described herself as a "softy" (Brittany – Post), and she seldom used any authoritative power with her students. Throughout her daily reflections, Brittany frequently described liking and being interested in her students, caring about them, and how the students liked and respected her. When referring to students in the collective, Brittany almost always used positive terms such as "I learned that my students are all very intelligent in their own way!" (Brittany - W1,D2). Although Brittany was very approachable, she maintained her professional role. When a student asked her for personal dating advice, Brittany reminded her that "I am supposed to be [in] a teacher role" (Brittany - W2,D4).

In her reflections, Brittany was much more focused on learning than behavior. She often described trying out new approaches to help students understand the material. For example, she described how she showed a student "how to use the FOIL method and he picked up very quickly" on his work (Brittany - W4,D2) and

how she "came up with a good teaching technique to help the students understand" subtracting negative numbers (Brittany – W2,D1). When she did reflect on classroom management, she often showed empathy for students, especially when she referred to them collectively. For example, she explained how "the students are getting more and more impatient with the program, and I think this just has to do with the fact that they are bored of it, which is understandable" (Brittany – W3,D2).

Brittany had agency in her role, even though the one-on-one computer lab environment precluded whole group instruction. For example, Brittany noticed that "sometimes the students are too shy to ask for help" so she began examining feedback on students' computer screens to determine if they were making progress on their modules and "would ask them if they needed any assistance" (Brittany - W1,D3).

Brittany described her own growth on many occasions. She frequently mentioned learning and re-learning math content as she helped students. Brittany often described getting better at helping students solve and approach math such as "picking up on which terms are best to use when explaining the steps to solving problems with a student" (Brittany – W1,D3). As such Brittany had many instances where she found teaching to be a rewarding activity. One day, she exclaimed that "I had quite a few 'ah-ha!' moments with them which was very rewarding and I was happy for them!" (Brittany – W2,D1).

By her post interview, Brittany showed an increased interest in becoming a science/math teacher. She thought teaching high school would be harder but "you kind of pick up on it and then you kind of get into this, like, teacher mode." Before this experience, she said she had "never really thought about being, like, a teacher. But now, if I ever ended up not wanting to do science, I think I would really like teaching obviously." Significantly, Brittany also applied to the summer internship program for a second year.

Anita. With Brittany, Anita assisted for five weeks in the MATHTECH math program classroom. She circulated among students and worked individually with students when they needed help. Anita showed less agency than Brittany within this context. Anita frequently noticed that particular teaching/motivating tasks should be done but did not think it was her role to actually perform those tasks. For example, she reflected "it seems that someone in charge should control the social behavior of students so all of them can be more productive" and "somebody needs to tell the class that the MATHTECH program will help them build their basic math skills" (Anita – W1,D3).

Anita did not have a very close personal relationship with the students. She seldom talked about liking or becoming interested in particular students, compared to Lora and Brittany. But, her reflections included many instances of her caring for and about her students collectively. As an illustration, she reflected "everything seems to be working; however I am concerned about students who are getting incorrect answer[s] and don't raise their hand for help" (Anita – W2,D1). Anita took a more authoritative stance in her relationship to students. When two students sat by each other despite their assigned seats, Anita "figured I would not be able to separate them so I said 'do not talk to each other'" (Anita – W3,D2). Similarly, when a student wanted to quit early she "went up to him and had him sit down, log in back to MATHTECH and do one more problem" (W4,D2).

Anita's focus was balanced between students' behavior and learning. For her, behavior and learning were related. On her last teaching day she noted how "some of the students were hard working and did their best, but what would help me most would be to know how to get students like [a girl mentioned previously] "to study and focus their attention on their academic work" (Anita- W5,D2). Anita was quite concerned about how to motivate students. She realized that "sometimes students do not even want to try" (Anita – W4,D2) and later said "I would like to know how to

make students realize how important their time in this class could be for their futures" (Anita – W5,D1). Anita seldom referred to students collectively and instead reflected frequently on their individual behavior and learning.

Anita seldom discussed growing in her teaching abilities, but she described a few instances of finding teaching personally rewarding. She mentioned "learning and re-learning" (Anita – W2,D4) math content several times. Less so than Brittany and Lora, Anita described how she felt satisfied when students showed learning gains. One day, she reflected that she "learned that teaching is fun. It feels good when students get what I am teaching and helping them with" (Anita – W3,D1).

By her post-interview, Anita described being "surprised at how hard" high school teaching was. In terms of her interest in teaching, Anita described no change, but indicated that she was "still interested in teaching" and "would like to do [the internship] again," although she chose not to reapply for the internship the following year.

Ed. Ed assisted in two sections of a Meteorology class. In this role, Ed circulated among students and offered assistance when students needed help. He often took leadership roles and enjoyed sharing his love of science. During the first week, Ed reflected "what I learned about science teaching today is how much I am passionate about teaching a topic I am interested in" (Ed - W1,D4). Because the instructor missed two days, Ed taught his own lectures to the whole class twice. Although this autonomy was "assigned" to Ed, he seized the opportunities readily. In one section, Ed was joined by Ben who assisted him on the days Ed was leading. Unlike the other interns, Ed seldom mentioned the role of collaboration (with the course instructor, his fellow interns, or the faculty supervisor) in his reflections.

Ed had a very positive relationship with his students. He liked and was interested in individual students in his class, making an effort learn his students' names and enjoying their "great sense of humor" (Ed - W2,D2). He explained how "it is important to get to know your students so that they open up to you when they have questions" and "getting to know your students also involves them in the learning process more" (Ed – W3,D1). His students clearly liked Ed too, as evidenced by how they invited him "to watch their talent show" (Ed- W3,D4). This positive relationship with students permitted Ed to take an authoritative stance occasionally, but Ed sought to use this authority for motivation rather than punitive purposes. He explained, "what I would like to know to better perform my job is how to better assert my authority to motivate students to work" (Ed – W3,D4).

Ed's focus was largely on student learning rather than student behavior. He described how "the true goal is to help students learn and not to simply cover a certain amount of material in a lecture" and "it is always okay to stop, slow down, or pause a moment to keep students engaged and to kindle their learning" (Ed - W2,D1). He attended to individuals in his attention to student learning and reflected that "not all students are going to be interested in all of the topics covered, and it is important to try and make topics relatable to the students to grab their interest" (Ed – W1,D5). Ed attended to motivation often in his reflections describing how "it is so important to teach students how to learn and how learning can be enjoyable, manageable, and rewarding" (W3,D2). When classroom management issues arose such as when some students "were having trouble focusing and some were do[z]ing off," Ed empathized with them saying "this may have been simply a function of the students being tired as it was late in the week" (Ed – W1,D4).

Ed did mention finding teaching rewarding but less so than Lora and Brittany. In his reflections, he periodically mentioned how helping students brought him satisfaction and how he was improving. For example, he reflected that he wanted to "better lead students to an answer instead of providing it for them" and described how "I have certainly gotten better at this, however, I have much room for growth" (Ed – W3,D2). By the post interview, Ed described how the internship "was

definitely rewarding. It was a great experience. For me, it helped me grow as a person, as a teacher, you know, social skills."

By the post-interview, Ed showed an increased but still very low interest in teaching as a profession. He described how high school teaching was harder than he had expected because "the age group" and "they still have other behavioral issues to deal with." When asked what he had learned about students, he said, "it's an interesting time in their lives" and then with a laugh "I would not want to teach high school." Before this experience, he described his interest in teaching as a career as "slightly below interested." After the internship, this interest had increased to "slightly higher than slightly below" interested.

Ben. For one class session, Ben assisted a Meteorology class co-taught with Ed. In this position, Ben circulated and answered questions during work time. For the next class session, Ben chose to assist with a Geology class, co-taught with non-study intern. This class was a more challenging class to teach as the course instructor struggled to manage the class. Ben explained that "it would have been easier to sit in another class but the teacher couldn't do it alone, even with the coach" (W3,D4). In this second class, Ben circulated and focused his efforts to keeping students on task during lectures and activities.

Ben's focus was very much on student behavior relative to student learning. Ben commented on behavior in all fifteen of his reflections. Some reflections contained few topics other than behavior. Even in the Meteorology class which had fewer behavioral challenges, Ben's reflections centered upon classroom management. For example, Ben described the Meteorology students in terms of positive behavior rather than learning: "The students in the first class are still very cooperative, and they almost always get all of their work done." Ben's idea of a successful classroom appeared to be an orderly one with clear hierarchical relationships between teachers and students. For example, on the first day, Ben wrote "the first class went by without any problems, and all of the students were well behaved" (Ben – W1,D1). Ben intentionally focused on behavior rather than learning. On the third day of class, he described how "the other intern and I are now focusing on keeping the students in check rather than helping them with their academics" (Ben – W1,D3).

Given his focus on behavior, when Ben asserted his agency, it was usually in terms of classroom management. For example, he described how "Before class started I personally talked to some of the students telling them to behave and stay awake" (Ben – W1,D2). Ben spoke of collaborating with the Geology instructor to brainstorm better ways to control the class. On the second day of class, he described how "one of the other interns and I met up with the teacher today before class and discussed ways we could keep the students-in check" (Ben – W1,D2). During the second week, he met "with the teacher to try to come up with ways to bring the class under control" again (Ben – W2,D2).

Ben's agency in this regard was very much tied to his desired authoritative relationship with students. He reflected frequently about this role. In one reflection, he described how the students "view us interns as their equals and don't recognize that we are partially in charge" (Ben – W1,D3). Similarly, Ben recommended that interns "should be given more authority to discipline the students" (Ben – Post). Ben mostly referred to his students collectively and often in negative terms. Near the end of the course, Ben surmised that "if we quizzed the students on the most basic knowledge of the course material, I do not think more than a handful would do well" and then explained "It's hard for me to blame anything besides the students; we all tried our best to implement the best plan but unfortunately, nothing worked" (Ben – W3,D4).

Although Ben experienced some rewards for his teaching, his experience was also quite frustrating. He described how "it's clearly visible that the teacher grows very frustrated and desperate which is upsetting for us interns who also feel a loss of

control when they all start talking" (Ben – W1,D2). By the third week, he said that he "honestly can't wait for this [Geology] class to be over" (Ben – W3,D4). Also, Ben never described getting better at his teaching role, even in terms of classroom management. Ben did describe learning science content himself during the internship and at the post-interview described his biggest success as "helping the students when they needed it" and "it seemed like they needed it a lot."

Table 4. Cross Case Analysis

Intern	Lora	Brittany	Anita	Ed	Ben
Interest in Teaching Career	Increased	Increased	Same (still interested)	Increased, but low	Decreased
Teaching Difficulty	Easier	Easier	Harder	Harder	Harder
Teaching as Rewarding	Very rewarding	Very rewarding	Mostly rewarding	Mostly rewarding	Mostly frustrating
Focus	Learning/ some behavior	Learning	Learning/ behavior/ Motivation	Learning/ motivation	Behavior
Perception of Individuals	Mostly individual	Mostly individual	Only individual	Mostly individual	Mostly collective
Connection to Content	Passion	Learning	Learning	Passion/ learning	Passion/ learning
Agency as Intern	Agency: taught	Agency: led	Non-agency	Agency: taught	Agency: management
Relationship to Students	Liked, cared about, some authority	Liked, cared about, was liked by students	Cared about, some authority	Liked, was liked, some authority	Authority
Collaboration	Important for teaching	Rarely mentioned	Rarely mentioned	Rarely mentioned	Important for management
Perceptions of Own Growth	Frequently mentioned	Frequently mentioned	Rarely mentioned	Rarely mentioned	Never mentioned

Ben's interest in teaching decreased throughout his internship. He considered the Geology class "a disaster" and explained that "It was total chaos from the moment they walked in until the moment they left" (Ben – W3,D5). By his post interview, he described how he thought high school teaching would be easier and "it doesn't seem like something I would willingly do." When specifically asked about his interest in high school teaching, he stated that "I don't think I would ever do it in high school" because "students in high school are a little less disciplined."

Cross Case Analysis

The cross-case analysis (presented in Table 4) highlights the different refined codes that co-occur with increased interest in teaching. The cases are presented from least interested in teaching (Ben) to most interested in teaching (Lora). From

this cross case analysis, three assertions were developed and are described and illustrated in the next section.

Assertions about How Internship Impacted Interest in Teaching

In this section, I make three assertions about how the internship experiences impacted these five participants' interest in teaching as a profession as revealed through the preceding cross case analysis. Each assertion is supported by evidence that connects the code "interest in teaching" with other codes developed through this study.

Assertion 1: Interns who found the internship experience more rewarding or perceived more growth were more interested in teaching. One line of evidence for this first assertion is the connection between "teaching as rewarding" and "perceptions of own growth" with the "interest in teaching" code. Lora and Brittany both had higher interest in teaching and had many mentions of teaching as rewarding and how they had grown as teachers. Often these constructs were linked together. For example, Lora described her growth that by the end of the internship, she "felt comfortable" and teaching "felt natural." She explained how "it makes more sense for me to do it [teach high school]. I think I'd be happier with it than I ever thought I would be" (Lora - Post). Similarly, Brittany explained how "I actually liked it a lot more than I thought I was going to" which was immediately followed by "I've never really, like, I've never even thought about going into education" until this time (Brittany - Post).

Ed also felt that teaching was rewarding and that he had improved as a teacher, but he was only slightly more interested in teaching as a profession. When I asked him "after this experience, how interested would you say you are in science teaching?" he replied "slightly higher than slightly below" which indicated a slight increase in teaching from "slightly below interested" prior to the internship. As previously mentioned, Ed found this internship rewarding for his own personal growth ("social skills" (Ed - Post) but not necessarily for his students' growth.

Of the interns, Ben found the experience to be least rewarding. Rather than gratitude or respect from students, he felt that the Geology students were disrespectful toward him, the other intern, and the instructor. In nine of his fifteen reflections, Ben described how "students in that class don't respect the interns or the teacher" (Ben – W1,D2) and there was a "lack of respect given to us by the students" (Ben – W1,D3). Sometimes this disrespect was confrontational as when a student "decided to confront me and then ignore me" when he tried to encourage him to get to work (Ben – W1,D4). Often, Ben felt ignored as when he stated that "the students have not been listening to us" (Ben -W2,D4) and "I tried to tell the ones that were not contributing to get to work but they ignored me, as usual" (Ben - W2,D4). Although "there was little respect shown for the teacher, the coach, or us" (Ben - W3,D5), Ben still concluded "the overall experience was rewarding for me. I felt like [I] helped some students along the way which is always a good feeling" (Ben -W3,D5). Yet, the frustration with classroom management was one of the reasons Ben offered for not wanting to become a high school teacher in his post-interview.

Thus, this connection between finding their teaching role during the internship rewarding and interest in teaching may be related to actually enjoying teaching (Lora and Brittany), perceptions of personal and professional growth (Ed), or classroom management frustration and interpersonal relationships (Ben). Some causality can be inferred for Lora and Brittany who directly linked their teaching satisfaction with teaching interest, but that may not be the case for Ben. Perhaps his initial decreased interest in teaching as a profession mitigated the extent to which he invested in the experience and found it personally or professionally rewarding.

Assertion 2: Participants focusing on student learning rather than student behavior were more interested in teaching. The evidence for this assertion stems from the connections between the "interest in teaching" code and the balance of the interns' focus on "behavior" relative "learning" sub-codes. Sometimes, participants directly linked behavior/learning with their interest in teaching, but the link was more subtle for other cases.

When students understood the content, the interns felt good. This feeling of *reward when students learned* seems to be related to interest in teaching as described in Assertion 1. For example, Anita described how "when they got it, it feels like so good" (Anita – Post) and Ed explained that "it was very rewarding to be able to offer my knowledge to help students learn" (Ed – W1,D1). Although all interns experienced this satisfaction when students were learning, Brittany and Lora described this reward several times a week, much more often than their peers. For example, Lora reflected "it seems that they have retained quite a bit of information. Knowing this made me extremely happy! It felt rewarding, and I can now relate to teachers who talk about that rewarding feeling they get when they know they helped a student understand a concept" (Lora – W1,D4). Interestingly, the classes that included the most assessment (the MATHTECH math program and Biomedical classes) were those for which the interns most frequently reflected on the *rewards* associated with student learning. Those classes made both interns and students aware of student progress: "There are a lot of students that seem to be feeling very proud of themselves for completing a large portion of their pie, which is great to see!" (Brittany- W3,D3).

More than their peers, Lora and Brittany dismissed some behavioral issues that occurred in their classrooms by *empathizing with students*, *not taking disrespectful behavior personally*, and rationalizing that this *behavior comes with this age*. When Brittany described how "students were rowdy and did not want to do their work," she rationalized that "it was most likely because they are nearing the end of the MATHTECH program" (Brittany – W5,D1). Similarly, Lora described how her "students were having a hard time focusing today, but it was understandable because action potentials can be quite boring to learn about" (Lora – W2,D1)," showing empathy for her students. Brittany actively chose not to take poor student behavior personally. In her post interview, she described how some students would say "rude things" but she did not "want to take it personally" (Brittany – post). For example, when a student declined her help in the math lab requesting "someone who knows what they're doing," Brittany reflected "This was a little hurtful because she has never allowed me to help her so she is assuming that I am incompetent. I let it go though as usual" (Brittany, W3,D1). Lora often dismissed poor student behavior as merely behavior that comes with this age. In her post interview, she described how "they definitely have maturity issues which is a natural. They're at that stage" (Lora – Post). She continued, "so they weren't all bad. It was, like, angst-y freshmen" (Lora – Post). Thus, Lora and Brittany dismissed classroom management problems with these three strategies.

Ed, who focused extensively on student learning and experienced teaching as rewarding, offered nature of adolescence and behavior-related reasons for his relatively *low* interest in teaching. When asked in the post-interview about what he learned about students, he said, "they are adolescents, and it's just a really interesting time in everyone's life and so, uh, I would not want to teach high school (laughing)." Similarly, he later described how teaching high school was harder than he had expected because "just the age group" in that "they still have other behavioral issues to deal with. You still have to, sometimes, give some punishment."

In Ben's case, his decreased interest in teaching was directly linked to his concerns about classroom management. When asked about his interest in high school teaching after the internship, Ben explained why high school teaching was

not a career he would "would willingly do…because the students in high school are a little less disciplined" (Ben Post). When Ben described classroom management issues, his reflections did not include the empathy, nature of adolescents, or not taking it personally subcodes present in other interns' reflections. Rather than being empathetic toward students, Ben blamed them: "It's hard for me to blame anything besides the students" (Ben – W3,D4).

Assertion 3: Participants who developed close connections with students and appreciated their individuality were more interested in teaching. Evidence for this assertion comes from the association of the "interest in teaching" codes with "relationship to students" and "perception of individuals." Although the "interest in teaching" code seldom directly occurred with these latter codes, some distinct patterns emerge from Table 4.

Liking and caring about students was associated with greater interest in teaching, and Lora's and Brittany's reflections contained the majority of these codes. Lora became very attached to her students, reflecting even in the first week, "I know when this program is over, I am going to miss these students quite a bit!" (Lora – W1,D3). Similarly, Brittany formed close relationships with her students. When her students began to refer to her as "Miss [Brittany]," she said it "warmed my heart because it was endearing and sweet!" (Brittany – W1,D4). Brittany was deeply interested in her students, often noting how impressed she was by their individual talents. Like Lora, Brittany grew attached to her students, reflecting at the end that she was "sad that [the internship] is over" (Brittany –W5,D2). Both Lora and Brittany also cared deeply about individual students' well-being. When one of Lora's very talented students seemed disengaged, she described how her "personal project now is to try to help him realize that 'school is cool' and being the best you can be is the best trait a person can possess" (Lora – W2,D2). However, both Ed and Anita also had positive, if not close, relationships with students. Ed most often described liking and being interested in students ("I would like to get to know my students better" (Ed- W1,D1)) while Anita most often demonstrated that she cared for students ("I would like to know how to inspire students to work hard and be inwardly motivated" (Anita – W3,D3)). In contrast, Ben seldom demonstrated how he liked or cared for individual students in his reflections.

The perception of students as individuals rather than a collective was associated with increased interest in teaching. Interns' tendencies toward perceiving students as individuals or as a collective were immediately evident in daily reflections indicating that this tendency possibly reflected a pre-internship disposition of the interns rather than a disposition learned during the internship. For example, on the first day of the internship, Lora described how "there are twelve students, and about half of them are truly interested in the subject matter and are very respectful in the classroom. The other students have good intentions and are great people, they just get easily distracted and can be a bit disrespectful" (Lora – W1,D1). Whereas, Ben immediately focused on the collective group: "They all have high hopes and they can achieve their goals but they need to apply themselves and these classes can really help. It just doesn't seem like they know this yet" (Ben – W1,D1).

The appreciation of individuality seemed to moderate classroom management concerns while viewing students as a collective seemed to exacerbate these concerns. In these cases, the intern approached dealing with behavioral issues case by case rather than imposing authority over the collective group. For example, Anita described how "there is one student that quits working five minutes early every day. He sits in his place and talks with his friends, which gets other students off task." To address this individual problem, Anita employed individual proximity: "I learned that just standing beside a student helps to keep them on task" (Anita – W4,D1). The converse was also evident in Ben's tendency to perceive students as a whole rather than as individuals in terms of classroom management. As such, Ben described a

field trip day to the wetlands and lamented that "Nobody was staying on task " He explained how "if I were the teacher, I would have cancelled the field trip knowing the students wouldn't be able to handle it" (Ben - W2,D5). Ben's authoritative relationship with students entailed having (or desiring to have) power over *all* the students, and he tended to view classroom disruptions in the collective, even reflecting that "there were a few students that instigated the disruptions, but most of the students went along with it" (Ben - W3,D5).

DISCUSSION AND IMPLICATIONS

The internship recruitment project described herein was informed by and aligned with previous literature. In terms of the program itself, the experience required regular reflection (Luft et al., 2011; Worsham et al., 2014), engaged participants in relatively authentic high school teaching environments where they interacted with secondary students (Luft et al., 2011; Tomanek & Cummings, 2000; Worsham et al., 2014), and offered peer and teacher education advisory support (Artzt, 2008; Luft, 2005; Worsham et al., 2014). In terms of the selection of promising interns, the program participants all had prior education-related experiences (Luft et al., 2011; Worsham et al., 2014) and at least initially indicated that they had primary interests in teaching such as wanting to work with children or share their love of science (Luft, 2005). Thus, the project seemed well-poised to serve as an effective science/math teacher recruitment. The main contributions of this paper come from the three assertions warranted from the data as described in the results section. In this section, these assertions are first discussed in light of current literature to indicate how the study's findings advance knowledge about recruitment. Implications for future research and recruitment efforts are highlighted for each assertion and summarized in Table 5. Finally, a discussion of the limitations of this study is presented.

The first assertion *(Interns who found the internship experience more rewarding or perceived more growth were more interested in teaching)* is not surprising on the surface, but the specifics of the five cases are suggestive of how to promote both rewarding experiences and growth. Eick (2002) found that science teachers who stay in the profession have experienced the rewards associated with teaching, and clearly finding teaching as a rewarding profession was important for this study's participants as well. Specifically, perceptions of interns' own growth (personal and professional) and frustration associated with classroom management were important for interns finding these internships rewarding.

Perceptions of interns' own growth and teaching as rewarding were aligned with interns' change in interest in teaching. Interns' perception of growth was manifest in daily reflections and post-interviews. That reflection on ideas about teaching and learning is an important part of recruitment activities is documented within the literature (Luft, 2015; Worsham, 2014), but these interns seemed to specifically benefit from reflecting on their own growth and successes in their teaching contexts (e.g. increased comfort for Lora or improved personal social skills for Ed). This study advances this literature about the role of reflection in recruitment by indicating the importance of prompting interns to *reflect on their own growth*. As such, recruitment efforts can invite interns to make goals and regularly assess their growth toward them.

Ben's frustration with classroom management mitigated how rewarding he found his internship. Other research studies have cited classroom management as a reason STEM majors choose not to enter the science teaching profession (Tomanek & Cummings, 2000; Worsham et al., 2014). While the focus on behavior will be discussed with the second assertion, classroom management frustration in Ben's case was also connected to his perception of ineffectiveness and lack of professional

growth. Ben simply did not experience personal or professional success related to classroom management, which was his primary focus. This finding yields a new implication for future recruitment efforts: recruitment internship orientation must more fully address classroom management *strategies* that interns can continue to try until some success is experienced. In this regard, describing the kinds of classroom management strategies and situations in which teachers typically intervene (Battalio et al., 2013) may be useful. Similarly, practitioner articles that address classroom management strategies (Brown, 2005; Jones, Jones, & Vermette, 2013) can be used as resources.

The second assertion *(Participants focusing on student learning rather than student behavior were more interested in teaching)* advances current literature about recruitment. From this study, a focus on learning, especially *student growth in learning*, and the ability to dismiss/minimize classroom management concerns by *empathizing with students, not taking student behavior personally,* and acknowledging how *behavior comes with this age* were all associated with increased interest in teaching. As noted previously, this concern about classroom management has been a deterrent for other possible teacher recruits (Tomanek & Cummings, 2000; Worsham et al., 2014). This study's findings indicate that this concern with classroom management may represent a continuum of interns' relative focus on behavior at one end and learning at the other.

The present study clearly connects "teaching as rewarding," a sentiment demonstrated in previous literature (Eick, 2002) as important for recruitment and retention to *student growth in learning.* When interns' perceived student growth, especially as a result of their own teaching efforts, they felt the reward of teaching. Not surprisingly, interns whose internship sites included more formal and informal assessment opportunities such as in the computer lab environment noted this growth most often, probably because it was so much more visible through these assessments. Some logical implications for future recruitment efforts would be to (1) select internship sites that include many assessment opportunities and (2) better support interns before and throughout internships to focus on student assessment and feedback to further orient interns toward a focus on student learning.

Some of the interns minimized classroom management concerns by *empathizing with students, not taking student behavior personally,* and rationalizing how adolescent *behavior comes with this age.* When interns employed these strategies, they experienced less frustration with classroom management. Thus, these findings yield possible implications for future recruitment endeavors. First, internship orientation should address the nature of adolescents in terms of their cognitive and emotional development, and several classroom management strategy "handbooks" such as the *Discipline Survival Guide for Secondary Teachers* may serve this aim (Thompson, 2010). Second, internship orientation and support should invite interns to reflect on their own high school and adolescence experiences, encouraging interns to adopt an empathetic approach to classroom management. Third, more peer support should be invited so that interns are less inclined to take classroom management issues personally. Although interns all had at least one partner intern in this study, having opportunities for all interns to debrief *collectively* would allow interns to realize that much of the student behaviors they are witnessing occur across contexts and across interns.

Previous literature has emphasized how recruitment experiences should be similar to actual secondary science and math contexts (Luft et al., 2011; Worsham et al., 2014). The present project allowed interns to gain experience in authentic, non-idealized settings with real classroom management issues at times. Yet, the findings of this study (particularly in the case of Ben) are suggestive of some parameters regarding these recruitment experiences in authentic settings. Some classroom

contexts are particularly challenging and prospective science/math teacher frustration in these settings may be difficult to counter. Ben struggled with (1) a cooperating teacher who had little success with classroom management herself and (2) a classroom with multiple disruptive students. His case highlights how there needs to be a balance between challenging and authentic, especially for programs seeking to prepare students for teaching at high needs schools. Certainly, more research regarding the suitability of various authentic contexts would better inform these recruitment efforts.

The third assertion *(Participants who developed close connections with students and appreciated their individuality were more interested in teaching)* also advances literature about recruitment. Luft (2005) found that candidates with primary interests in teaching such as wanting to work with children were more likely to be retained in a teacher education pathway. Similarly, Tomanek and Cummings (2000) found that interns who enjoyed their classroom interactions and valued the interpersonal aspects of teaching were more committed to teaching careers. The results of this study support these findings but also indicate particular aspects of interns' relationships with students that seemed to support interns' ultimate consideration of teaching as a career. Specifically, liking and caring about students and perceptions of students as individuals were important constructs for these five interns.

When interns like Brittany, Lora, and Ed came to personally interact and learn about their students, these relationships were meaningful for the interns. Liking and caring about students may have helped interns better recognize their learners as individuals (described below). One important implication for future internships is to provide interns with strategies and encouragement to get to know their students early during their internships. Strategies for learning students' names and better understanding students' lives inside and outside of the learning environment can be shared at an orientation event. This orientation can prompt conversations about having relational as opposed to custodial or behavioral approaches to classroom interactions in order to support the development of student-teacher trusting relationships (Gregory & Ripski, 2008). Additionally, encouraging interns to attend "out-of-class" student functions may also be helpful. Finally, prompting reflection about what interns learned about students (as was used in this study) can be extended by asking interns to reflect on individual students' interests and backgrounds. Future iterations of this internship will include such prompts and invite attention to different students across reflections.

Consideration of students as individuals rather than as a collective was also associated with interest in teaching. Related to interns liking and caring about students, the perception of students as individuals helped interns consider behavioral problems on an individual basis. The structure of the different internships may have helped or hindered interns' abilities to perceive students as individuals. In the MATHTECH classes, interns exclusively worked with students individually, while the other internship classrooms included whole group, small group, and individual interactions. An obvious implication from this finding is to include many opportunities for small group and individual interactions within an internship. Specific discourse strategies for asking inquiry-supportive questions, facilitating small group discussion, and enhancing student comfort can be shared with interns in an orientation event.

Interns' attention to individual students as opposed to the collective was immediately evident in daily reflections. Although this orientation can hopefully be fostered through the previously described activities, attention to individuality may simply vary across interns. Future research in this area may be warranted. Given its connection to interest in teaching and ability to downplay classroom management concerns, attention to individual students as opposed to attention to the collective

may be used for selection into recruitment programs. Future iterations of this study's internship program will invite applicants to think through various classroom management scenarios to ascertain the extent to which they may employ individual/collective approaches to teaching.

This study has three important limitations that should be noted for readers who hope to apply findings to additional settings. First, the nature of an in-depth qualitative case study does not permit generalizability in the same way that a large quantitative study could. The onus is upon the reader to determine the extent to

Table 5. Implications for Future Recruitment Efforts

Assertion	Implication
Interns who found the internship experience more rewarding or perceived more growth were more interested in teaching	• Invite interns to make personal and professional goals for their internships and reflect on them regularly • At orientation, address classroom management strategies
Participants focusing on student learning rather than student behavior were more interested in teaching	• Select internship sites that include many assessment opportunities • Better support interns before and throughout internship to focus on student assessment and learning • At orientation, address the nature of adolescents in terms of cognitive and emotional development • At orientation, invite interns to reflect on their own high school experience to promote empathy • Offer more opportunities to collectively debrief teaching experiences so that interns do not take classroom management issues personally
Participants who developed close connections with students and appreciated their individuality were more interested in teaching	• At orientation, address strategies for learning student names and getting to know students as individuals • Prompt regular internship reflections about what interns have learned about students as individuals • Select internship sites that include opportunities for small group and one-on-one interactions

which the research assertions fit within other specific contexts in order to ascertain this transferability. To facilitate this process, a thick description of each participant's context and experiences was provided.

Second, this study thus far has not been longitudinal. Changes in interns' interest in teaching as a profession have only been documented through the length of the brief summer internship, and participants' views and inclinations will likely change further as they gain additional experiences in college. That being said, the fact that two study interns at the time of this writing applied for a second year of the internship suggests that some changes documented herein may have been sustained through the next academic year.

Finally, data collection was entirely based on participant responses (application materials, interviews, and written reflections) and did not include classroom observations of interns at their teaching site. Because of this, readers should be cautioned that participants may have portrayed their ideas and experiences in socially-desirable ways. Yet, this threat to the credibility of this qualitative multi-case study's findings was hopefully moderated by prolonged engagement and triangulation using several data sources.

CONCLUSIONS

Research about this Noyce Internship Program contributes to the literature on the role of STEM major internships for teacher recruitment. As called for by Luft et al. (2011), the present project illustrated potential teachers' experiences with a comprehensive and strategic recruitment process, highlighting the ways interns'

perceptions of teaching, learning, students, and their own interests and abilities change over time. Specifically, this study highlighted how summer internships for early STEM majors can begin to influence their interest in teaching as a profession. Particular aspects of the internships (requirement for reflection, opportunities for teacher agency, and the balance between emphasis on classroom management and student learning) were connected with interns' positive or negative teaching experiences. Similarly, particular aspects of the interns themselves (expectations for classroom management, desire for authority, and interest/care for students) were also connected with the impact of these internships for recruitment. The findings from this study can be used to inform future recruitment efforts and highlight fruitful avenues for future research about teacher recruitment.

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