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Early Recruitment of Science Teachers: Promising or Problematic Strategy

This study examines the experiences and knowledge of students who are participating in a recruitment course in a secondary science, mathematics, and computer science teacher education program.

The United States currently faces a shortage of mathematics and science teachers, and the problem is getting worse. In response to this concern, several reports have been issued discussing the shortage of teachers and suggesting potential reform and policy measures (e.g., National Commission on Mathematics and Science Teaching for the 21st Century, 2000; National Commission on Teaching & America's Future, 1996). Among the recommendations that have been made, several pertain to the preparation of science and mathematics teachers at universities and colleges. As a result, institutions preparing teachers now offer different pathways for certification, such as one-year programs that offer certification and a graduate degree, or programs that allow a content expert to receive on-the-job pedagogical training. Another effort, which has not been discussed much in the literature, involves the recruitment of students into the educational pipeline. Recruitment programs precede formal teacher education programs as a means of increasing the pool of applicants.

This study looks at students who are participating in a recruitment course in a secondary science, mathematics, and computer science teacher education program at a large university. By examining the experiences and knowledge of students in such a program, it is possible to understand the disposition of students who elect to participate in these courses, and the curricular and instructional aspects that impact students who are considering the teaching profession. The findings provide an additional data source from which to draw conclusions, and thus have direct implications for those affiliated with similar courses. In addition, our findings can assist those who are contemplating the development of such courses to consider course goals, the content and process of the course, and the means by which students are recruited into the course. While our intent is to inform other science teacher educators about our examination of this unique period in teacher development, we also hope to demonstrate the importance of examining the recruitment phase of the teacher education process, and to purposefully contribute to the limited literature in this area.

Ideally, by understanding how teachers develop and why they remain in the profession, we can design recruitment programs to target students with potential for longevity and impact in the educational environment.

Background

Research regarding recruitment courses is notably absent in the teacher education literature. However, studies pertaining to teacher persistence and teacher development exist, and can inform those seeking to understand issues related to recruitment. Ideally, by understanding how teachers develop and why they remain in the profession, we can design recruitment programs to target students with potential for longevity and impact in the educational environment.

The literature about teacher persistence suggests that a com-

mitment to teaching and positive field experiences may contribute to one's decision to have a career in education. In a study of graduates from a secondary science teaching program, Eick (2002) compared their autobiographies that were written over time in order to determine trends related to persistence. Teachers still in the classroom (more than three years since graduation) expressed interest in science and teaching and/or recognition about the rewards of working with students. A study conducted by Marso and Pigge (1997) followed potential K-12 teachers in order to explore factors that led to persistence in the field. After seven years only 51% of the population had made the transition to the teaching profession. Those making the transition at the secondary level were very or almost certain about becoming teachers early in their teacher preparation program and they decided to pursue teaching prior to graduating from high school. Neither their academic aptitude nor their perceived effectiveness as a teacher was related to their transition to teaching. An earlier study by Chapman (1984), which collected data from teacher education graduates, sought to determine how administrators could deter the attrition of new teachers. While the data revealed a limited impact by administrators in terms of retaining teachers, it was found that persistence was linked with an early commitment towards teaching and positive field experiences during the preservice program.

The research literature is rich with discussions of the many aspects of the professional development of teachers, including the knowledge base and beliefs of teachers. For secondary science teachers, the knowledge base that one holds is important in terms of learning to implement reform-based practices. This knowledge base should consist of an understanding of the prominent concepts in one's discipline (Carlsen, 1993; Hashweh, 1987) and an understanding of the processes and nature of science (Duschl, 1987). Furthermore, this knowledge should be connected and accessible to the science teacher (Gess-Newsome, 1999).

Beliefs guide instructional decisions, influence classroom management, and provide a lens through which to understand classroom events.

Ultimately, science teachers need to understand both the structure and the nature of their discipline, as well as have the ability to select and translate content into learning activities. But a sound knowledge base is not enough; the beliefs that a teacher holds directly impact his/her classroom practices (Pajares, 1992). Beliefs guide instructional decisions, influence classroom management, and provide a lens through which to understand classroom events. In fact, beliefs may be more important than knowledge when considering a teacher's classroom practice (Pajares). For example, Ernest (1989) found that two teachers with similar knowledge but different beliefs taught in different ways. Ultimately, he suggested that an understanding of teaching beliefs rather than knowledge was more useful in predicting teachers' classroom decisions.

The UTeach Program

The UTeach program at the University of Texas is a joint effort of faculty and staff from the Colleges of Education (COE) and Natural Sciences (CNS), along with local teachers, to prepare secondary science, mathematics and computer science teachers for the state of Texas. As a program that draws upon different knowledge bases, the program coursework consists of content and pedagogical courses at the University of Texas and field experiences in surrounding school districts. Collectively, the different components of the program provide students with content courses that support their degree majors, classroom and field experiences in various forms of instruction, and opportunities to learn about different knowledge bases in teaching. During each of these experiences students explore issues related to equity, technology, inquiry, and translating theory into practice.

The recruitment courses, which are referred to as *Step 1* and *Step 2*, are unique parts of the UTeach program. These one-credit courses focus primarily on recruitment, but they also provide field experiences in which students teach science in a reform-based manner. In *Step 1*, students learn how to teach three different elementary science lessons from a popular kit. In *Step 2*, students again draw upon the lessons in a science kit and learn to teach three different reform-based middle school science lessons. During their field experiences, the cooperating teacher gives feedback to the students on their instruction.

Freshmen, sophomores, juniors, seniors, and post-baccalaureate students are informed about these courses though written invitations, orientation booths, announcements, brochures, and COE and CNS advisors. Students who complete *Step 1* or *Step 2* can be reimbursed for the tuition associated with these courses, and they can apply these credits to their degree plan. Typically, more than half of the students who complete *Step 1* and *Step 2* continue in the UTeach program.

Study Context

The findings that are reported here represent one aspect of a larger study, which is being conducted at the University of Texas. The larger study looks at the development of beliefs, practices, and various knowledge bases of secondary science teachers throughout their teacher preparation program and during their first years in the classroom. This study is following 17 students in the UTeach program from *Step 1* through their second year in the classroom.

This first examination of the study data specifically explores the first semester of the UTeach students, focusing on 1) the circumstance of their recruitment, 2) their belief and knowledge profiles as related to teaching, and 3) their salient experiences in a UTeach recruitment course.

Methods

Participants

Randomly selected students in *Step 1* courses, who indicated that they were science majors, were contacted through e-mail about participating in the longitudinal study of secondary science teachers at the University of Texas. Of the students who were contacted, 17 indicated a willingness to participate in the study. Table 1 gives a brief overview of the students who comprise this study.

In addition to the typical presentation of demographic data, information is also provided that pertains to the student's reason for considering a career in education. Students who indicated in their first interview that the teaching profession was a primary interest are noted as "primary." Students who are participating in the *Step 1* courses for reasons other than being a teacher are listed as "secondary." This will be discussed further in the Findings section.

Data Collection and Analysis

Interviews – To collect background and experiential information from the students participating in this study, semi-standardized interviews were conducted twice. The first interview occurred during *Step 1* and the second interview took place in the following semester. Berg (1998) states that a semi-standardized interview involves a number of predetermined questions that address the research goals and

Table 1.
Students in Step 1

Student	Gender	Year in school	Major	Current status after Step 1 course	Reason for teaching
1.	Male	Junior	Biology	Dropped	Secondary
2.	Female	Senior	Physics		Primary
3.	Male	Freshman	Biology		Secondary
4.	Female	Junior	Chemistry		Primary
5.	Male	Junior	Biology		Secondary
6.	Male	Sophomore	Bio/Pre-med.	Dropped	Secondary
7.	Female	Sophomore	Biology		Secondary
8.	Male	Junior	Chemistry		Primary
9.	Female	Sophomore	Biology		Primary
10.	Female	Junior	Biology		Primary
11.	Male	Freshman	Biology		Primary
12.	Female	Senior	Biology	Moved to elementary program	Primary
13.	Male	Junior	Geology		Secondary
14.	Female	Senior	Chemistry		Primary
15.	Female	Junior	Biology		Secondary
16.	Male	Junior	Chemistry		Primary
17.	Male	Senior	Chemistry		Primary

that are presented in an order and language appropriate for the people in the study. The interviewer can digress or probe beyond the predeveloped questions in order to gain a further understanding of the topic discussed. We included questions beyond typical demographic data. For example: How did you decide to enroll in the UTeach program? How is the UTeach program helping you become a secondary science teacher? What has led you to believe that you may want to be a teacher?

The students' reasons for considering the education profession ranged from finding a degree that allowed them to work with people and science, to dissatisfaction with the courses and instructors in their current science or engineering program.

The responses of the students were examined and categorized in order to determine trends that existed among the participants. Points in the data that represented salient findings are shared in the Findings section.

Belief interviews – Teacher beliefs were captured using an interview with eight open-ended questions. Students were interviewed during the *Step 1* semester and the following semester. The wording of the interview protocol sought to elicit how the students participating in this study viewed teaching and learning in a secondary classroom, as well as what underlying beliefs impacted their instructional decisions. Questions used to capture the UTeach students' beliefs, for example, included: How do you think your students will learn best? How do you think you will know when your students understand? How will you adapt your teaching to best represent the discipline of science? All of the interviews lasted 45 to 90 minutes, were audiotaped, and were conducted by one of the authors of this paper.

The audiotaped interviews were coded by faculty and graduate students familiar with the coding process (see Luft & Roehrig, accepted). Each coded interview resulted in the eight questions being categorized as traditional, instructive, transitional, responsive, or reform-based. Traditional and instructive responses represent teacher-centered beliefs, while responsive and reform-based responses represent student-centered beliefs. Transitional responses indicate beliefs that are teacher or student-centered, as they can be focused on conceptual knowledge or aspects of relationships between a teacher and his/her students.

Views of the nature of science interviews – During the *Step 1* semester, participants in the study completed the Views on the Nature of Science—version C questionnaire (VNOS-C) (Abd-El-Khalick, Bell, & Lederman, 1998). Questions in the VNOS-C were designed to elicit views about the tentative and subjective nature of science, the role of society and culture in science, the difference between observation and inference, the role of theories and laws in science, and the role of creativity and imagination in science. The VNOS-C responses were examined by one of the authors and coded to depict the participating students' views of the nature of science as contemporary (i.e., science as tentative and a human construct) or traditional (i.e., science as procedure that accurately depicts the natural world). We added a third category called naïve, which means that the views of students straddle both or neither domains. Details about the coding process for contemporary and traditional views of science can be found in Abd-El-Khalick, Bell, & Lederman.

Artifacts – Artifacts were collected from the UTeach students to capture their experiences during *Step 1*. The students were specifically asked to share documents that best represented their development as a teacher. The documents were copied and placed in the student's file, while the originals were returned to the student. These documents were integrated appropriately and accordingly into the findings.

Findings

The findings from this initial analysis of the data address three areas, which ultimately provide some insight into the recruitment of students into teacher preparation programs.

Recruitment circumstances

Students looking for alternatives enrolled in Step 1. The UTeach program uses a variety of methods to inform students about the *Step 1* courses. Students receive letters or brochures, are referred by academic advisors, are contacted in high school, or find out about the program through the web or a fellow student (Dodson, 2002). The students in this study elected to participate in the program after talking to a friend, seeing an

advertisement, or talking to an advisor. These recruitment events came at a time when the student was interested in looking at other career options, which takes us to our second point regarding recruitment.

Students were more advanced in their coursework. The *Step 1* course was developed with the goal of providing freshmen or sophomores with classroom experiences. However, the program is configured so that students can participate in *Step 1* at any in time in their university career. In our study, most of the students were more advanced in their coursework and were actively considering another major. They did not plan to pursue a degree in education initially, but it was now an option for a variety of reasons. The students' reasons for considering the education profession ranged from finding a degree that allowed them to work with people and science, to dissatisfaction with the courses and instructors in their current science or engineering program.

Participants in the program

Students were involved in education for different reasons. The students in our study were categorized as either having a primary or secondary interest in education (Table 1), and there was clearly a mix of both. Students who were classified as having a primary interest in education wanted a career in education in order to work with children and to share their understanding and enjoyment of science. Some of these students had prior experiences as tutors, coaches or teachers, which sparked their interest in education. Students who were classified as having a secondary interest in education were interested in teaching in order to improve the instruction of evolution, live in a town with family members, have a flexible career, or fill the period of time before their entry into another professional program.

Students held primarily teacher-centered and transitional beliefs. The beliefs held by the students were typically teacher-centered and transitional. Based upon the examples provided by students, these beliefs related to their prior experiences in education. For example, when students were asked to discuss their role as a teacher, they spoke about their high school or university instructors and the special attributes of these teachers. This is not surprising, as the UTeach students had not typically experienced or explored student-centered instruction in-depth, nor had their beliefs about teaching been actively and purposefully challenged with the intent of forming student-centered beliefs. Table 2 shows the beliefs data for each student and the overall percentages in each category.

Students expressed limited views of the nature of science. The students in this study revealed traditional views about the nature of science on their VNOS-C and belief interviews. Even though the students enjoyed

Table 2.
Students' beliefs

Student	Traditional	Instructive	Transitional	Responsive	Reform-based
1.		•	••••••		
2.		•••	••••		
3.	•	•••	••	•	
4.	•	••	••••		
5.	•	•••	•••		
6.		•	•••••	•	
7.		•••••	••		
8.	•	•••	•••		
9.	••	••	•••		
10.	•	•••	•••		
11.	•••	••	••		
12		••	•	••	••
13.	•	••	••••		
14.	••	••	••	•	
15.		•••	••••		
16.		•••	••••		
17.	•	•••	•	•	•
Percentage	12%	36%	45%	5%	2%

science, it was clear that their prior experiences in science had not initiated a consideration for a more progressive view of science. Most notably, most students did not view science as tentative, considered science and society to be interactive, nor did they describe scientists as bringing creativity and biases to their research. Table 3 provides an overview of each student's views of selected areas in the nature of science (agreement with a statement aligns with a contemporary view of science).

Experiences related to *Step 1*

Field experiences were a positive feature in the early recruitment course. Each student in Step 1 valued the opportunity to teach different lessons from a science kit in an elementary classroom. In fact, when asked to share an artifact that best represented their development as a teacher, each student provided the evaluation form filled out by his/her cooperating teacher. As students elaborated on these documents, they indicated that the teaching experience was important because it allowed them to experience the enjoyment of helping students learn about an idea in science, share their knowledge with students, and see that younger students were easy to manage. Most of the students considered their initial teaching experiences to be successful and based these conclusions on their own observations and the feedback provided by the cooperating teacher.

Relationships were important to students in their recruitment course. Students in the Step 1 courses valued relationships as they pertained to their educational experience. Some students spoke about the relationships that they found in the program, which consisted of support and encouragement offered by the *Step 1* instructors as well as the advisors of the UTeach program. Others spoke about their relationships with classmates, which allowed them to have peers with whom to discuss their experiences in teaching and in the UTeach program. The relationships the students experienced allowed them to feel connected to the program and to other students. For most of the students this was an important experience.

Discussion & Conclusion

This initial look at the recruitment aspect of a teacher education program provides a unique glimpse at the students who participate in such courses, and the experiences that may be built into such courses. Even though this study is limited in duration and focused on students in one type of program, several points will be useful to those who are contemplating the development of recruitment courses.

Three important topics stand out from our data. First, the students who were juniors and seniors in our

Table 3.
Students' views of the nature of science

Student	Science as tentative and empirical	Experiments are not the only way that scientists build new knowledge	Science as culturally and socially impacted	In following a process, scientists not always have accurate conclusions
1.	N	N	D	D
2.	N	D	A	N
3.	N	A	D	N
4.	N	D	N	N
5.	N	D	N	D
6.	A	D	A	D
7.	N	D	D	N
8.	A	D	D	D
9.	N	D	D	D
10.	N	D	A	D
11.	N	D	D	D
12.	N	N	A	D
13.	N	D	A	D
14.	N	D	N	D
15.	A	D	D	D
16.	N	D	D	D
17.	N	N	D	N

A-Agrees with statement; D-Disagrees with statement; N-Naïve answer

program indicated more interest in education as a career and a greater level of commitment than did the freshmen and sophomores in our study. It may be that freshman and sophomores graduated too recently from high school and were not yet ready to consider a career in secondary education, or they may not have had the kind of educational experiences that might influence their interest in the field. This is not to say that freshmen and sophomores should be excluded from recruitment courses. They should be included, but for reasons other than fostering an interest in education. Second, there are clearly two groups of students who were considering a career in science education. At this time it is difficult to describe how either the primary or secondary groups will persist in terms of becoming teachers. However, of these student groups, those with primary interests talked about how prior experiences in education influenced their decision to consider education, while only those with secondary interests in education left after the first course. Third, the field experiences were valued by all students and did not appear to be a factor in their decisions to leave or continue with the program. Students who enjoyed the teaching experiences felt it confirmed their decision to enter education, while those who had a less than satisfying experience were still committed to staying in the program.

In light of these observations, we might place more emphasis on a student's commitment to education, and his/her prior educational experiences, when determining who participates in a recruitment course. Several authors have discussed students' level of commitment as important in terms of persisting as a teacher (Chapman, 1984; Eick, 2002; Marso & Pigge, 1997). Students in our study with a higher level of commitment tended to have prior experiences in education that were sustained over time and that occurred in a variety of settings. Thus, it may be a better approach to recruit certain students early in their academic career, rather than inviting all students to participate in the courses. With more deliberate recruitment measures, those who are currently involved in some form of teaching (e.g., tutoring, coaching) or who had positive educational experiences, can be sought out. Students who are considering education early or later in their educational career will find the program in time.

Clearly, teacher preparation programs—from the first courses to student teaching—need to consider the beliefs and knowledge that students hold.

A more complex issue surrounding recruitment courses pertains to the knowledge and beliefs of entering students. Most of the students in this study held beliefs and knowledge that were not conducive to reform-based teaching. While *Step 1* provided an experience in teaching that was reform-based, the course itself was not designed to impact student knowledge or beliefs. All of the students in this study valued the teaching experience, but none described how it altered their beliefs about teaching or their knowledge in the field. In fact, students felt affirmed as teachers and as part of a community, and were not challenged to consider their current educational ideologies. Studies suggest that beliefs and knowledge are important in learning to teach, and that they are difficult to change (Gess-Newsome, 1999; Pajares, 1992). Clearly, teacher preparation programs—from the first courses to student teaching—need to consider the beliefs and knowledge that students hold. Such programs should be crafted to help the student develop a way of thinking and teaching that reflects current reform-based efforts in science education.

In terms of influencing student beliefs and knowledge, the *Step 1* course described in this study may not have lived up to its potential. Ideally, the *Step 1* course could serve as an initiation point for examining beliefs about teaching and the nature of knowledge. However, those who design recruitment programs should consider whether they have a mission to educate students about the reforms. If this is an objective, then recruitment programs need to stress reform-based instruction by targeting the beliefs and knowledge of these potential teachers. Failure to address these areas may reinforce the traditional and didactic beliefs and knowledge that students bring to the program. Juniors and seniors in the program will have limited time to confront or develop their beliefs or knowledge in regard to reform-based instruction.

Final Comments

As the title of this paper implies, recruitment can be a promising strategy for increasing the pool of teachers in mathematics and science. However, when teachers do not enter or persist in the profession, or when the beliefs and knowledge levels of the students are not fully considered,

recruitment can be problematic. Given the financial and personal cost involved in recruitment programs, it is important to consider the population at hand. Recruitment program administrators must strategically recruit teachers and develop programs in a manner that addresses the teachers' entering beliefs and knowledge level. Ultimately, well-designed recruitment programs alone will not solve the shortage, but they do hold out the promise of a bright start in the teacher education process.

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Both Steven Fletcher and Brian Fortney are science education doctoral students at the University of Texas, Austin. Steve continues to follow the students in this study, while Brian completed this research as part of an internship.