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CLASSROOM REALITIES: TEACHING STUDENTS WITH DISABILITIES AS A  
TRADITIONALLY OR ALTERNATIVELY CERTIFIED SECONDARY  
SCIENCE TEACHER IN MAINE

by

Haley A. Richardson

A Thesis Submitted in Partial Fulfillment  
of the Requirements for a Degree with Honors  
(Secondary Education)

The Honors College

University of Maine

May 2012

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## **Abstract**

This study aimed to determine the characteristics of effective pre-service instruction and in-service professional development based on certification route that affect Maine secondary science teachers' preparedness to accommodate students with disabilities. Traditional and alternative certification routes differ in fundamental elements such as length, course requirements, and format, leading to teachers who have different strengths and weaknesses, and consequently, different professional development needs. Effective preparation for instructing students with disabilities is an important issue because the trend toward full educational inclusion increasingly will require that classroom teachers have the skills to make appropriate accommodations. A survey sent to Maine secondary science teachers gathered information about their pre-service training, professional development needs and experiences, and current situations teaching students with disabilities. The results show that alternatively trained teachers feel more prepared than traditionally trained teachers to make accommodations, but that most teachers, regardless of certification route, were not confident in their special needs skills during their first year of teaching. To improve secondary science teachers' skills for including students with disabilities, they should have more extensive pre-service training that includes special education field experiences. Professional development should be science-related and based on the needs within a school.

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## Chapter 1

### INTRODUCTION

#### **What are Traditional and Alternative Teacher Certification Programs?**

Traditional certification programs are also called university approved programs. They are operated by colleges and universities granting bachelor's and master's degrees in the field of education. Students enroll in a four-year undergraduate program or a one-year graduate program which includes instruction in content area knowledge and pedagogical methods, as well as opportunities for field experience and student teaching. The curriculum integrates mandatory testing and certification procedures so students are able to apply for state certification upon graduation.

Alternative certification programs are broadly defined as programs that supplement an aspiring teacher's prior education or experience with the necessary courses for state certification standards. They culminate in teacher certification, but not necessarily in a post-secondary degree. Like traditional certification requirements, there is no national framework for alternative certification programs; teacher certification authority lies with the state governments (United States Department of Education [USDOE], 2000). Programs may be facilitated by universities, school districts, or private organizations and, therefore, exhibit great variety in structure, duration, and content. However, four features appear in most definitions of alternative certification programs. First, they have practice-intensive (versus theory-intensive) curricula which often place students in teaching positions while they complete abbreviated coursework. Second, they aim to recruit atypical teacher candidates, such as males, racial minorities, and midcareer professionals. Third, they cater to candidates who wish to teach subjects in which there

are teacher shortages, such as science, mathematics, and special education. Finally, alternative programs prepare students to teach in high-need urban and rural areas (see Feistritzer, 2010; Humphrey, Wechsler, and Hough, 2008; Walsh and Jacobs, 2007). Alternative teacher certification programs differ fundamentally in purpose from education programs in that “alternative routes are a means to gain certification eligibility while regular teacher education programs are generally a way to earn an education degree” (USDOE, 2000).

New Jersey, Texas, and California implemented the first alternative certification programs in the 1980s. These programs were originally intended to decrease the number of emergency certificates issued to offset teacher shortages, a procedure which hastily put untrained teachers into classrooms while requiring them to independently take courses toward certification (National Center for Education Information, 2010). As more states have begun offering non-four-year university routes to teacher certification, the role and construction of these programs have diversified. While rapid teacher preparation remains a central feature, it has become common for aspiring teachers with bachelor’s degrees to teach while enrolled in a structured program that provides pedagogical courses and mentoring. This structure has been successful in terms of its rising popularity.

Alternative certification programs quickly spread beyond the three states in which they originated. More teachers graduated every year until 1990. After leveling off for eight years, they again saw rapid growth. One-third of the existing alternative certification programs were created between 2000 and 2009. The National Center for Education Information reported that a total of 500,000 teachers in the United States have entered the profession through these routes since 1985; 2009 alone saw 59,000 new

alternatively certified teachers. In 2010, 48 states and the District of Columbia reported having alternative routes to teacher certification (National Center for Education Information, 2010).

Diversification of these programs has been not just geographic, but manifestational. States have flexibly applied the core features of alternative certification programs to institute attractive paths to teaching. New York, for example, invested a portion of its \$700 million federal Race to the Top grant in a new alternative Master of Arts in Teaching program at the American Museum of Natural History. The 15 month program will be free to the 50 applicants with science backgrounds who are selected to become middle and high school science teachers. Upon graduation, the teachers will be given four-year assignments at high-needs schools around the state (Quenqua, 2012). While New York's innovative high-profile plan to increase its supply of STEM educators may produce effective teachers, the quality of alternative certification programs varies as widely as their form.

### **Controversy**

Teacher quality is one of the most frequent subjects of media headlines at the national, state, and local levels. Supporters of alternative certification routes assert that qualified professionals who desire to become teachers are too valuable to turn away simply because they do not hold an education degree. States need fast options to entice those who would not complete the comparatively arduous traditional route to become teachers. Alternative routes also draw more teachers from minority populations than do traditional routes. In a primarily white, female occupation, diversity is highly sought. Critics of alternative route programs denounce the abbreviated pedagogical instruction as

insufficient for preparing a new teacher to manage his or her classroom well enough to effectively teach. Allowing unprepared teachers into classrooms will make issues in education worse, not better, they argue. There is research that upholds both of these views, as well as alternative programs to serve as examples. However, there is no question that states are continuing to implement them.

One of the most well-known – and most controversial – alternative programs is Teach For America (TFA). Founded in 1990, the highly competitive program places people with at least a bachelor's degree as two-year teachers in high-need schools after a five-week summer training session. TFA's website ([www.teachforamerica.org](http://www.teachforamerica.org)) prominently displays statistics about its recruits and the organization's growth; an estimated 9,000 TFA-prepared teachers with diverse backgrounds have been in classrooms during the 2011-2012 school year, counting among their ranks many Ivy League graduates. These teacher-hopefuls take a content knowledge test before entering the classroom and work toward their host states' certification standards while teaching. Teachers come from every state, but Maine is not one of the 34 states to which TFA members have been dispatched.

The criticism directed at TFA has come from both large organizations, such as the National Education Association, and the general public, and ranges from alleged ineffective teachers to charges of elitism. In a policy brief on the program, Heilig and Jez (2010) examined the first of these concerns. The organization's two-year model perpetuates a chief problem in many high-need schools: teacher attrition. As Heilig and Jez note in their executive summary, more than half of TFA recruits leave the profession once their two-year contract expires; 80% are gone within three years. Critics question

whether virtually untrained – albeit highly motivated – people can really raise student achievement in the time when most teachers are just beginning to find their footing in the classroom. Heilig and Jez examined several studies on the subject and determined that claims of achievement gains are inconclusive. They ultimately recommended that TFA recruits should commit to five years of service and should be a last resort for filling teaching vacancies. Further, attention should shift from “market dynamics” to “improved in-service training, mentoring, and professionalization of teaching” (p. 12).

Former U.S. Assistant Secretary of Education Diane Ravitch (2012) condemned TFA as one of the programs following a corporate model of education reform which seeks to save schools (and money) by replacing veteran teachers with “a steady infusion of smart but barely trained novices.” Such models, she writes, aim to raise test scores with such unethical tactics as “excluding students with disabilities or students learning English as a second language.” Like Heilig and Jez, Ravitch believes that the focus should be on improving training and standards for career teachers and pre-service teachers. She posits that the high-caliber individuals who currently turn to TFA would instead choose to enter a traditional teacher education program because teaching would no longer be seen as “a stepping stone to graduate school or another more remunerative line of work.”

Measuring the efficacy of teacher education programs is a controversial issue in itself, but it is one that also drives the conflict over program legitimacy. Here, the concern is with the scope of certification requirements, specifically whether alternative programs should be held to the same standards as traditional programs. The National Council for Accreditation of Teacher Education ([NCATE], 2012) accredits traditional and

alternative certification programs through the same process. Institutions under review are held to the NCATE standards and must provide statistics about their completion rates and state licensure exam results. Interviews with people at all levels of the program, from administrators to students, also factor into the review. NCATE maintains that the duration and format do not affect a program's quality if the accreditation standards are met.

The federal government has clearly established its position on alternative route issues. Millions of dollars of federal funding has been given to Teach For America. Programs and grants, such as Troops to Teachers and Transition to Teaching, encourage the formation of alternative routes to certification. Transition to Teaching funds state programs which recruit professionals from other fields to become teachers through alternative programs. Troops to Teachers compensates veterans who wish to obtain certification. Both programs require beneficiaries to commit to teaching in high-need schools. The U.S. Department of Education has emphasized the value it places on alternative routes by including incentives for establishing programs in its most prominent education legislation. Title II of No Child Left Behind provides for Improving Teacher Quality State Formula Grants which states must use to increase their numbers of highly qualified teachers. The Race to the Top Fund lists alternative certification programs as one of its scoring priorities, directly affecting the amount of funding given to a state. The government's willingness to subsidize such initiatives indicates that alternative certification programs will persist, as will the debate over who produces the most effective teachers.

## **Teacher Certification in Maine**

The Maine Department of Education (MDOE) defines a university approved program as:

A professional education program developed and offered by a unit that includes a Maine college or university that has been assessed by a review team utilizing the standards contained within Chapter 114 and authorized by the Maine State Board of Education to prepare P-12 educators. (Rule 05-071 CMR Ch. 114 § 1.2)

Initial full teacher certification in Maine through a university approved program requires a recommendation for certification from the university. During the course of studies, the applicant will have passed at least 24 credit hours of content courses, a methods course and a “teaching exceptional students in the regular classroom” course, and the Praxis I and Praxis II (content) exams; completed fifteen weeks of student teaching; and demonstrated proficiency in Maine’s ten beginning teacher standards. Each university approved program has individual requirements for pedagogical classes. Maine also recognizes teachers certified in other states through an interstate compact.

Teachers who have not fulfilled all of the requirements for full teacher certification may obtain a temporary certificate from the Maine State Board of Education (MBOE). Maine offers three certificates: transitional, conditional, and targeted needs (USDOE, 2009). Teaching for one year with any of these certificates waives the student teaching requirement. Each certificate lasts for one year and may be renewed twice, although there will most likely be an expectation that the candidate fulfills some of the unmet requirements prior to each renewal. Transitional certificates are only available to teachers who are certified in another content area. Six credit hours of classes in the

transitional certificate content area is the minimum to qualify for this option. Conditional certificates are granted to candidates who have completed the requirements for a full certificate except passing the Praxis exams or education coursework. Targeted needs certificates are an option when candidates do not qualify for a transitional or conditional certificate, but these certificates only apply to candidates who wish to teach subjects that qualify as shortage areas. As of 2009, those subjects included secondary physical science, life science, and math, as well as foreign languages, special education, and industrial arts/technology for all grades. One further option for teaching is a waiver. In the case that a potential teacher does not qualify for any certificate, the superintendent and potential teacher must justify the need for the potential teacher's employment. This situation may occur when a community member wants to offer classes in a specialized skill.

MDOE defines an alternate route program broadly as “an organized, performance-and-standards-based professional preparation and support program leading to initial teacher certification. A participant in such a program has an appropriate undergraduate degree” (Rule 05-071 CMR Ch. 114 § 1.2). Although Maine does not offer any such program, an independent route to alternative teacher certification is possible through MBOE and consists of a transcript review. This route was approved in 1996 (USDOE, 2010a). MBOE officials ensure that applicants hold at least a bachelor's degree, have sufficiently passed the required education courses (i.e. methods course and “teaching exceptional students in the regular classroom” course), 24 credit hours of content courses, and the Praxis I and Praxis II (content area and Principles of Learning and Teaching) exams. The 15-week student teaching requirement may be fulfilled through a formal field experience facilitated by a traditional program, one year of



teaching with a conditional or targeted needs certificate, or one year of comparable teaching experience.

Unfortunately, the transcript review route did not support Maine's Race to the Top application, in which the state earned just five out of a possible 21 points for "providing high-quality pathways for aspiring teachers and principals" (USDOE, 2010c). But in the near future, Maine will recognize several routes to alternative teacher certification. A review and rewrite of Code of Maine Rule Chapter 114: *Purpose, Standards and Procedures for the Review and Approval of Preparation Programs for Education Personnel* is scheduled for completion by June 2012. Although the state is not creating formal programs like those described by Feistritz; Humphrey, Wechsler, and Hough; and Walsh and Jacobs; would-be teachers should find the certification process more navigable than in the past. The stakeholders committee entrusted with the task designed the routes to accommodate individuals who have content knowledge but lack teacher training. Under the guidance of a school district and an alternative route institution, teacher candidates will work within a school system while completing pedagogical classes. A mentor will help implement a unique plan for the candidate's induction into the profession which will be tailored to his or her strengths and weaknesses. The bachelor's degree, testing, and student teaching requirements of a transcript review will still apply to these new alternative routes. The state has seen a 312% increase in the number of alternative route completers between 2000 and 2006, as well as a 34% increase in the number of teachers with temporary certificates from 2003 to 2007 (USDOE, 2010d, Tables 3, 14). The new alternative routes will aid this deluge of aspiring educators while benefitting the students who will have certified teachers.

## **Students with Disabilities in Maine**

The national trend in education is moving toward full inclusion of students with special needs in regular classes. At the same time, the percentage of students qualifying for services has been growing. Maine presents a particularly critical case due to its high incidence of students with disabilities. During the 2008-2009 school year, 17.3% of Maine's public school students ages three to 21 were served under the *Individuals with Disabilities Education Act* (IDEA). In contrast, the United States served 13.2% of students under IDEA. Maine ranks third in the nation for the percentage of students qualifying under IDEA, falling just behind Rhode Island at 19.0% and Massachusetts at 17.6% (National Center for Education Statistics, 2010). Maine teachers may have varied reactions to this status. In actuality, a teacher's experience depends on the district in which he or she is employed since the incidence of students with disabilities ranges from 6% to 27% across the state (Harris & Pushpam, 2002, p. 1). Maine teachers must be trained to work in a school that falls anywhere along this broad spectrum.

In Maine in 1986, the special education enrollment of students ages three to 21 was 12.68% of the regular education enrollment. That value rose steadily to a peak of 18.35% in 2004, and dropped slightly to 17.72% in 2007 (MDOE, 2007a). Of those 34,425 students receiving special education services in 2007, 15,250 were between the ages of 12 and 17. The most commonly identified disability among that age range was a specific learning disability, affecting 40.0%. Second most frequent were the 19.7% with disabilities falling under the category of "other health impairments." Emotional disabilities (11.7%), multiple disabilities (11.0%), and speech and language impairments (9.4%) were also relatively prevalent. Autism and mental retardation affected 3.9% and

2.9% of students, respectively, and six other categories falling below 1% composed the remaining students between the ages of 12 and 17 (MDOE, 2007b).

Despite the rising number of students receiving special education services, a greater effort is underway to help them participate with their peers as often as possible. In 2005, 52.1% of special education students ages 12 to 17 were placed in a regular classroom, 31.0% received extra academic help in a resource room, and 12.4% spent the school day in a self-contained classroom. The remaining students were educated in separate facilities (MDOE, 2005). Between 1987 and 2002, the percentage of students with disabilities taking science courses rose from 50% to 83% (USDOE, 2003, p. 46). These statistics indicate that, on average, regular high school classroom teachers have primary responsibility for the immediate needs of more than half of Maine's high school students with disabilities, and that number rises when students in resource rooms join their peers for subjects such as science. Inclusive trends are positive, but they entail more responsibility and specialized knowledge on the part of the classroom teacher.

Teachers' accommodation skills may vary based on the route through which they were trained. Proponents of traditional certification programs believe that pre-service teachers receive the best instruction about students with disabilities at traditional institutions (see Levine, 2006). The series of pedagogical classes required in an education program may have exposed the pre-service teachers to that subject indirectly, providing them with knowledge about students with disabilities in courses dealing with educational assessment, psychology, and diversity. Though they may only have theoretical knowledge, they are prepared across several contexts.

In one scenario for alternatively certified teachers, they may bring years of hands-on experience working with people with disabilities to their responsibilities as teachers. Conversely, a teacher with no previous experience who has only received the bare minimum instruction on teaching students with disabilities – a course that fulfills Maine’s “teaching exceptional students in the regular classroom” class requirement – may be ineffective at teaching his or her students. Even worse, that teacher could cognitively or affectively harm students whose educational or emotional stability depends upon accurate assessment and commitment to individualized interactions. Identifying the most effective method of training teachers in principles of inclusion is important so that students with disabilities will receive the full benefit of being included in the general education classroom.

### **Professional Development**

Maine promotes professional development (PD) through programs subsidized at both the state and the federal level. As specified in the *Maine State Teacher Quality Action Plan 2008-2009*, a \$3,000 stipend is paid to any teacher who successfully completes the National Board Certification process. The No Child Left Behind Act of 2001 has influenced professional development through federal funding and recommendations. For example, schools meeting the Local Education Agency (LEA) low-income requirements of Title I Section A and failing to make Adequate Yearly Progress (AYP) for at least two consecutive years must spend at least 10% of the money received from Title IA funding on professional development. Title II Section B of the No Child Left Behind Act requires Maine to award grants from an annual allocation of \$843,000 designated for mathematics and science teacher professional development. To

guide disbursement of these funds, the state has drawn on the USDOE definition of “high quality professional development” as events that

1. Improve and increase teachers’ knowledge of academic subjects and enable teachers to become highly qualified;
2. Are an integral part of broad school-wide and district-wide educational improvement plans;
3. Give teachers and principals the knowledge and skills to help students meet challenging State academic standards;
4. Improve classroom management skills;
5. Are sustained, intensive, and classroom-focused and are not one-day or short-term workshops;
6. Advance teacher understanding of effective instruction strategies that are based on scientifically based research; and
7. Are developed with extensive participation of teachers, principals, parents, and administrators. (USDOE, 2006, p.1)

Supplying high quality professional development to all teachers can be challenging in a rural state such as Maine. Indeed, the Department of Education Training and Events Calendar (<http://www.maine.gov/education/calendar/training.shtml>) rarely lists professional development events farther north than Bangor. MDOE (2010) suggests reaching isolated teachers through distance learning programs “that are innovative, content-based, and based on scientifically based research.” MDOE has attempted to offer wide-reaching PD through occasional webinars which are accessible to teachers statewide.

**Statement of the Problem**

The controversy over the efficacy of the increasing number of alternative teacher certification programs, the growing trend toward classroom inclusion, and Maine's high population of students with disabilities compound to form a new issue which is important for our state's science teachers: how to ensure that students with disabilities receive effective education while teacher and classroom demographics are shifting. It is appropriate to address this issue before teachers enter the profession and to maintain teachers' proficiency at teaching students with disabilities throughout their careers. Therefore, the purpose of this study is to investigate differences in the preparation and professional development needs of traditionally versus alternatively trained Maine secondary science teachers and make recommendations for improvement in each of these experiences.

## Chapter 2

### LITERATURE REVIEW

#### Traditional Route Program and Teacher Characteristics

Traditional teacher certification programs are often regarded as if they provide identical learning experiences. The reality is that an education student's experience will vary greatly by institution and depending on contemporary trends, even though he or she may be attending one of the many colleges and universities recognized by the National Council for Accreditation of Teacher Education (NCATE) or the Teacher Education Accreditation Council (TEAC). These varying experiences produce teachers with different ranges of pedagogical and content knowledge and skills who are then further influenced by the circumstances of their first teaching jobs. Nevertheless, there are common characteristics among university approved teacher education programs and in the profiles of students who choose this route. The following discussion of the literature will highlight both the differences and similarities of teachers referred to as "traditional route teachers" and the programs from which they graduated.

Demographics for traditionally certified teachers in the United States are largely consistent throughout the literature examined. The gender trend has shown increasing disparity between the proportion of traditionally trained male and female teachers each year since 1986, the intensity of which is shown by Feistritz's (2011) report that 87% of these teachers are female. Constantine et al. (2009) found an even greater amount, 93%, to be female. However, the proportion of males and females who chose traditional undergraduate and graduate teacher certification programs over other routes shows less variation. Sixty-three percent of all current female teachers and 48% of all current male

teachers went through a traditional undergraduate program, and another 15% of all females and 18% of all males became certified through a university graduate program (Feistritzer, 2011).

Statistics are also consistent in regard to ethnicity. Traditionally trained teachers most often identify themselves as White, with either Black or Hispanic/Latino qualifying as the distant second most common response, depending on the source. Constantine et al. (2009), Feistritzer (2011), and the National Comprehensive Center for Teacher Quality ([NCCTQ], 2008) found that about 72%, 87%, and 84% of their sample populations were White, respectively. Constantine et al. reported that 16% were Hispanic/Latino and 13% were Black, Feistritzer found 4% to be Hispanic/Latino and 5% to be Black, and the NCCTQ described its sample as 7% Hispanic/Latino and 5% Black. Like gender, the ethnicity statistics show that one group predominates in traditional teacher preparation programs.

The number of teachers choosing to pursue a certificate through a traditional program has dropped over the last three decades. Prior to 1980, 97% of all teachers took the university route, but the same can be said for only 83% of those teaching in 2011 (Feistritzer, 2011). The United States Department of Education ([USDOE], 2010d) reported that in the 2005 to 2006 academic year just 544 of Maine's 1,129 teacher certificate recipients, or 48%, graduated from a traditional route program (Table 1). Although the number of traditional program graduates in Maine who took a licensure test fell by 3% between 2000 and 2006, the number of initial teaching licenses granted has risen by 25% in the same time period (Table 1, Table 10). This phenomenon is the opposite of the national trend, which has shown a 28% increase in the number of



traditional program graduates who took a licensure test during those years but only a 14% increase in the number of initial licenses (Table 1, Table 10). These statistics demonstrate that Maine students who intend to become teachers are seeking routes other than traditional preparation programs.

Traditional certification programs are still the dominant route to becoming a teacher. Nationally, today's traditionally prepared teachers are split nearly evenly between teaching in a town or rural area versus a city or suburb. Twenty-four percent teach grades 9-12. Twenty percent of traditional program alumni teach at least one class in life, physical, or general science (Feistritzer, 2011). Since traditional education schools have incorporated highly qualified teacher status into their preparation programs, the percentage of science classes in Maine taught by highly qualified teachers has risen consistently throughout recent years from 88% in 2003 to 96% in 2008 (Maine Department of Education [MDOE], 2009).

Nationwide reports of how much class time these teachers completed for their traditional programs vary. Constantine et al. (2009) found that the amount of required instruction fell between 240 and 1,380 hours, or between about five and 31 courses if each course requires 45 instructional hours (p. 35). Feistritzer's (2011) data showed that 41% of students, a plurality, took at least 50 semester hours (Chart 32). Assuming that each class counts as three semester hours and applying Constantine et al.'s estimate of 45 instructional hours per course works out to about 17 courses and 750 instructional hours. However, these results do not account for the 34% of respondents who indicated that they did not remember the number of hours required in their program. According to the NCCTQ (2008) survey, pre-service teachers study many of the same topics no matter

what institution they attended. Ninety-two percent reported studying childhood development, which was the most common factor among the teachers polled. Eighty-two percent received instruction in teaching children with special needs, and 76% learned about diversity in the classroom. The topic least often taught was how to interact with parents and the community, in which only half of the teachers had been educated.

Although certain topics are common across programs, the emphasis placed on each topic may not be standard. Seventy-three percent of traditional route teachers surveyed by NCCTQ (2008) reported that they had learned about “the history, philosophy, and policy debates in public education” (p. 9), and 45% said that their preparation program was too focused on education theory and philosophy. Darling-Hammond (2009) clarified this point of view by explaining that it “usually mean[s] that [university work] is too abstract and general, in ways that leave teachers bereft of specific tools to use in the classroom” (p. 40). The teachers’ analysis of the excess instruction in theory is similar to Wenglinsky’s (2000) findings. His research on the effectiveness of teacher education programs determined that traditional university teacher preparation programs largely focus on pedagogy at the expense of content knowledge, and further, that students at schools in which the two areas are more closely balanced perform better on standardized tests. Nevertheless, Wenglinsky concluded that universities are the most appropriate places for teacher training programs.

Test scores have been a controversial tool for determining the effectiveness of traditional certification programs and their students. Wenglinsky (2000) drew on Praxis I and II data to show that large, private universities with primarily traditional students are the best milieus for education students. However, SAT scores showed that the students

attending those universities had been academically successful in the past. Levine (2006), who researched the appropriateness of various higher education institutions for training teachers, referred to a study done by the Educational Testing Service (ETS) and the American College Testing Program (ACT) which compared the SAT and Praxis II scores of secondary education majors with non-education majors. In both cases, the two groups of majors displayed similar ability. Graduate Record Examination (GRE) scores of secondary education majors were also comparable to the larger population, scoring slightly higher than average on the verbal and analytical sections and just below average in math.

Maine's traditional education students had a pass rate of 98% on the Praxis II academic content knowledge exams in the 2005-2006 academic year compared to a national average of 96%. This would seem to be a good sign according to Wenglinsky (2000) and Levine (2006), but Darling-Hammond (2009) debates the use of test scores to assess effective teacher preparation. She asserts that most certification examinations "are multiple choice tests of basic skills or subject matter knowledge that measure little of what candidates learn in teacher education and provide no evidence of whether they can actually teach" (p. 44). Still, Darling-Hammond, like Wenglinsky, is a proponent of traditional university preparation programs.

### **Alternative Route Program and Teacher Characteristics**

Alternative route teacher certification programs are notable for their greater spread of demographics. They are proportionally more popular among prospective male teachers than female teachers, as Feistritzer (2011) showed with the statistics that 22% of all female teachers and 32% of all male teachers graduated from an alternative

certification program. Reports still show a majority of female teachers, with Feistritzer finding 78%, Constantine et al. (2009) finding 88%, and Feistritzer (2005) finding 63%. However, alternative program ratios are more balanced than the overall teacher population in the United States, which is 84% female and 16% male (Feistritzer, 2011).

The ethnicity of alternative route program teachers also differs from the 84% White, 7% Black, and 6% Hispanic/Latino population of all teachers (Feistritzer, 2011). Feistritzer found 70% of alternative program participants were White, 11% were Black, and 15% were Hispanic/Latino; Feistritzer (2005) found 68% White, 12% Black, and 14% Hispanic/Latino; and Constantine et al. (2009) found the largest divergence from the norm with 45% White, 36% Black, and 20% Hispanic/Latino. Fifty-three percent of Hispanic/Latino teachers and 39% of Black teachers chose an alternative program over a traditional program. Clearly, alternative routes to certification have been particularly attractive to minority teacher candidates.

The age at which candidates began their programs differs from the average education school student who has entered after high school. According to Feistritzer (2005), 11% of alternative certification program participants were age 50 or older, and more than one-quarter, 27%, were between age 40 and 49. Although 53% had less than two years of teaching experience, they may have acquired personal experience working with children in other professions. Seventy-eight percent had at least a bachelor's degree in a field other than education (Table 1).

Although alternative certification programs are known for their variety, Walsh and Jacobs (2007) attempted to find commonalities in order to compare current program features with the original intentions of alternative route programs. They identified several

common characteristics: academically-competitive participants who teach while earning certification, courses in education but not academic content, and duration of one to two years. The variability not only in the components of alternative route programs, but in how those components are implemented, means that these characteristics are closer to guidelines than rules. For example, one of Walsh and Jacobs' findings was that 26% of alternative programs accept upwards of 90% of their applicants. Of those that require a minimum GPA, which Constantine et al. (2009) reported was 93%, Feistritzer (2005) found to be 71%, and Walsh and Jacobs (2007) noted as 79%, it was rarely above 2.5. The study listed other common considerations for entry as a basic skills test, an interview, and previous coursework. About half of the alternative route programs required at least a bachelor's degree in a major related to the subject which a candidate wishes to teach.

The content of alternative route programs is consistent in some cases, but the length required for each component varies. Ninety percent of alternative route teacher candidates teach while simultaneously earning their certification (Feistritzer, 2011). Each candidate generally has a mentor teacher to guide him or her through the program, and it has been found that 83% of candidates attend seminars with others who are at the same point in the program (Feistritzer, 2005). But the number of education course credit hours required for completion is one of the most variable factors from program to program. Constantine et al. (2009) found that teacher candidates took a range of five credit hours to 53 credit hours with an average of 20 credit hours, or between 1.7 and 17.7 courses with an average of 6.6 courses, assuming each course is 45 total hours. Feistritzer (2011) similarly found a large range, reporting that 12% of participants did not take any education courses and that 20% took more than 50 credit hours. Feistritzer (2005, 2011)

and Walsh and Jacobs (2007) all found that about a quarter of alternative route teachers took more than 30 credit hours of education courses. Although Walsh and Jacobs determined that 67% of candidates received instruction in classroom management, Constantine et al. (2009) reported that just 2.4 credit hours were allotted for this topic on average.

Some variation in alternative route certification programs may be due to location. Slightly more than half of alternate route teachers have gone through an alternative certification program that was facilitated by a college or university, and 18% went through a school district program. Taking online classes is a popular option; 20% of alternatively certified teachers completed all of their coursework online, and 18% of programs include at least one online class in their curricula (Feistritzer, 2005, 2011). Three-quarters of alternative certification programs require instruction in educational theory (Walsh and Jacobs, 2007). Participants are nearly equally split on their opinions of this aspect of their schooling, with 45% agreeing with the statement that their program put “too much emphasis on theory and philosophy” and half stating that their program “struck the right balance between [theory/philosophy and handling the practical challenges of teaching]” (NCCTQ, 2008, p. 31). Only 3% believed that they received too much practical instruction. These findings support Humphrey, Wechsler, and Hough’s (2008) experience in their study of alternative certification program components that “alternative certification participants spoke most highly about practical courses focused on specific ideas for teaching a curriculum or handling classroom management. . . . Participants were much less enthusiastic about theoretical, historical, or foundational classes” (p. 10).

Some significant details of alternative certification programs differ depending on who is surveyed. Walsh and Jacobs (2007) asked alternative certification programs how long their process of obtaining certification takes the average participant, from entering to graduating, and found that 81% of programs claimed to graduate their students in less than two years. Participants, on the other hand, reported just 68% of the time that they graduated within two years (Feistritzer, 2005). There was also disagreement about the type of certification earned upon program completion. Eighty percent of programs asserted that their graduates were fully certified under their state's definition, but just 48% of program completers said that they obtained full state certification. Programs reported a wide range of total costs paid by their participants; a plurality of 35% said they received between \$1,000 and \$5,000, but 6% were free, and 8% charged more than \$20,000. The free certification programs were run by school districts (Walsh and Jacobs, 2007).

Many alternatively certified teachers entered the profession later in life. They may have decided to become a teacher after working in another area of the education field or even in a completely different industry. Feistritzer (2005) reported that a year before entering a certification program, 22% of future teachers fell into the former group and 47% were in the latter. Twelve percent had been students, and 9% entered directly from military service. A third of teachers surveyed said this was their first career change, and nearly as many reported that it was their second. Despite Feistritzer's (2011) finding that alternatively certified educators were more likely than the overall teacher population to teach high demand subjects such as math and science, Humphrey et al. (2008) determined that just 5% of alternative route program entrants transitioned from math or science

careers. Not many of these candidates would have chosen a teaching career if they did not have the option of an alternative certification program. Just 22% said they would have entered a traditional education school, 6% would have sought a job in a setting in which certification was not required, and 47% would not have become educators. Just 3% of Feistritzer's (2011) survey sample would not recommend an alternative certification program to other aspiring teachers.

Alternatively certified teachers in Maine have a high success rate on their certification examinations. Of the 1,129 Maine education certificate recipients in the 2005-2006 academic year, 585 did so through an alternative route (United States Department of Education [USDOE], 2010d, Table 1). Each of the 585 alternative route certificate recipients who took a basic skills or academic content certification test during the 2005-2006 academic year passed the test, compared to a 95% pass rate nationwide (Table 7a)

Whether they transitioned from a science career or not, 34% of alternatively certified teachers specialize in a science field. Feistritzer (2011) found that 13% teach general science, 6% teach biology, 5% teach physical science, 4% teach earth science, and 3% teach each chemistry and physics. Thirty percent of alternative route educators teach in grades nine to 12. They prefer metropolitan areas over rural and town locations, which draw 63% and 37%, respectfully.

Nationally, the number of candidates choosing alternative route programs has been growing (Feistritzer, 2011). In the 1985-1986 academic year, only 285 teachers earned teacher certification through this method. Just over two decades later in the 2007-2008 academic year, 62,000 teachers accomplished this same feat. Sixteen percent of all



current teachers and one-third of teachers who have earned certification since 2005 graduated from an alternative route program. The USDOE (2010d) similarly reported that 15% of education program completers were from alternative route programs between 2004 and 2006 (Table 1). Feistritz (2005) asserted that these programs “are attracting large numbers of highly qualified, talented and enthusiastic individuals” (p. 3). Certainly they offer an option for aspiring teachers with diverse skill sets; for example, Troops to Teachers has assisted former military service people obtain certification through alternative routes, more than 4,800 of whom are currently teaching (Missouri Veterans’ Education and Training Section, 2005).

Maine has seen its numbers of alternatively certified teachers rise even more quickly than the nation. According to the USDOE (2010d), between the 2000-2001 and 2005-2006 academic years, the number of these candidates who took a certification test in Maine rose 312%, while the number nationally rose 136% (Table 3). This increase has coincided with an overall increase in the number of first-time teachers certified by the state government. During that same time span, initial certifications rose 25% compared to a national increase of 14% (Table 10). While this may suggest that the percentage of highly qualified teachers in Maine schools is rising, another significant factor has also shown change: the number of Maine teachers with conditional, transitional, or targeted needs certification. Teachers utilizing any of these temporary certificates, categorized as waivers by the USDOE, increased by 34% between the 2003-2004 and 2006-2007 academic years compared to a decrease of 11% nationally (Table 14). In the 2006-2007 academic year, 1,189 of Maine’s total 17,743 teachers, or 6.70%, fell into that category. High school science teachers were teaching under temporary certificates at a rate of

9.65%, much higher than the national statistic of 1.86%, and greater than the 6.86% of Maine high school mathematics teachers in this situation (Table 15).

### **Traditional Route Teacher Preparedness**

Traditionally trained teachers largely feel positive about their schooling experience. According to Feistritzer (2011), ninety percent rate their program *excellent*, *very good*, or *good*, and 89% would recommend their program to others. High effectual and value ratings were given to conversations with other teachers (75% rated this *very effective*, and 77% felt this was *very valuable* for developing competency) and authentic teaching experiences (71% and 87%, respectively), indicating that these aspects contributed to feelings of preparedness when graduates entered the profession; however, *very effective* or *very valuable* program components do not imply that traditionally trained teachers felt prepared to teach.

Feistritzer's (2011) survey of teachers with experience ranging from one year to more than 25 years found substantial differences between the teachers' perceived preparedness in their first year of teaching and 2011. They initially felt most competent in teaching content material and interacting with superiors, but both of these received responses of *very competent* from just 44% of the teachers. Additionally, teachers rated their competency negatively in these categories at a rate of 9% and 23%, respectively. Traditionally trained teachers indicated that they were *very competent* in classroom discipline least often, with an initial report of 25%. This category was also given the most negative rankings, with 28% of teachers feeling *not very competent* or *not at all competent*.

Interestingly, self-reported proficiency in classroom discipline more than tripled when teachers were surveyed about their preparedness in 2011. Eighty percent felt *very competent* and only 1% felt *not very competent*. Preparedness to teach content material and interact with superiors also jumped, with 94% and 73% reporting competency, respectively. The contrast in initial and subsequent teacher preparedness indicates that teachers became considerably more confident in their abilities through experiences that they did not receive, or did not receive enough of, in their education programs.

Principals and education school deans, faculty, and alumni expressed a range of opinions on how well education schools prepare teachers for various competencies in Levine's (2006) survey. Of the four groups, alumni rated themselves as *very well* prepared or *moderately well* prepared most often, with an average of 58%, and principals gave that rating least often, just 40% of the time. The only category in which principals rated teachers more prepared than the teachers rated themselves was in the teachers' abilities to incorporate technology into the classroom. Education school deans and faculty both believed alumni were more prepared to integrate technology and implement educational standards than the alumni recognized. Evaluations of teachers' content knowledge were consistent across the four groups; ratings ranged from 69% of faculty that felt teachers were prepared *very well* or *moderately well* to 79% of deans. Notably, only 68% of education school deans responded that traditional education schools are the most appropriate location for future teachers to learn their subject material. Learning subject material was the competency chosen least often by deans as appropriate for education schools.

Few positive ratings of teachers' preparedness were given in categories pertaining to working with students who differ from the norm culturally, linguistically, or in ability, nor did the respondents feel that teachers knew how to work with parents. Alumni were twice as likely as principals to report that they were prepared to teach students with disabilities. The domain which ranked lowest was handling English Language Learners (ELL), in which principals rated education schools favorably just 16% of the time. Deans felt just slightly more positive at 22%, but 83% believed education schools are the most appropriate venue for learning this skill. In fact, deans rated more than 80% of nearly every competency as best taught in traditional schools despite their discouraging beliefs about how well those schools prepare teachers. The most popular proposal for improving teachers' competency was to provide mentoring for new teachers, which more than half of each of the four survey groups agreed with.

The inconsistency between the views of efficiency and appropriateness of traditional education schools is summed up in Levine's (2006) observation that "the fundamental weakness in the teacher education curriculum is the lack of agreement about what it should produce" (p. 35). He speculates that principals, deans, faculty, and alumni realize that some of these skills can only be learned with experience in the classroom, and therefore, they still feel that education schools are a suitable venue for training.

### **Alternative Route Teacher Preparedness**

Alternatively certified teachers are satisfied overall with the programs they have chosen to complete. In Feistritzer's (2011) survey, 25% rated their program *excellent*, 39% thought it was *very good*, and just 3% had a *poor* experience (Chart 18). Two studies by Feistritzer (2005, 2011) found that more than 80% of alternative program

graduates would recommend their program to others. Since alternative certification programs offer a variety of experiences, Feistritz attempted to determine which program components were the most effective. Real classroom experience was the most highly rated program component for learning how to teach; about 80% of alternatively certified teachers deemed this fieldwork both *very valuable* and *very helpful*. Conversing with other teachers also received much credit for developing classroom competency from 73% of teachers. Courses in education topics were not as highly valued for their role in improving alternative program teachers' skills; only about 30% of the survey samples rated pedagogical classes favorably. Interestingly, mentors were seen as *very helpful* and *very effective* by between 40% and 50% of program participants – less than half – and mentoring is a cornerstone of many alternative route certification programs. Building portfolios and attending seminars were viewed as *very effective* in only about 20% of cases.

Beginning alternatively certified teachers were most confident in their interpersonal skills and subject matter (Feistritz, 2005, Table 11). This is predictable when considering the older average age at which alternative route candidates begin their programs. Their previous job experiences most likely provided them with transferable skills. Since 65% of alternatively trained teachers reported having less than five years of teaching experience, they would not be as expected to express confidence with classroom management topics.

Feistritz's (2005, 2011) two surveys presented similar results in many cases. They both found that alternatively certified teachers initially felt *very competent* cooperating with fellow teachers more than they did in any other area surveyed, at a rate

of 56% and 46%, respectively. Forty-nine percent of the first sample and 39% of the second felt *very competent* in their subject matter. The survey areas receiving the fewest claims of confidence, classroom management and discipline, were also the areas with the most *not very competent* and *not at all competent* ratings at about 40%.

In a study by Humphrey et al. (2008) which asked alternative certification program participants about their self-efficacy in the fall of their first academic year teaching, 79% of those with classroom experience and 67% of those without classroom experience felt confident in their classroom management skills. Teachers with prior classroom experience were more confident in each domain surveyed, which corresponds with Feistritzer's finding discussed earlier that a majority highly valued their field experience. Humphrey et al. also found that 58% of teachers with classroom experience felt generally prepared to be effective at their jobs, while just one-third of teachers without classroom experience made the same assertion.

Classroom experience seemed to have a positive effect on Feistritzer's samples, as well. Estimations of competency significantly increased when alternatively certified teachers considered their abilities at the time of being surveyed. The teachers' expertise at teaching subject matter and their interpersonal skills again topped the list, but the percentage reporting they felt *very competent* in these domains rose considerably in Feistritzer's (2005) study to 80% and 78%, respectively, and in Feistritzer's (2011) study to 93% and 84%, respectively. No category in the first study was given a competency rating of less than 63%, nor was any area rated lower than 70% in the second study (both in classroom discipline). Time and classroom management, skill at motivating students,

planning instruction, and interacting with superiors were ranked in the middle in each survey.

Humphrey et al. (2008) similarly found that reports of alternatively certified teachers' self-efficacy increased over time, and moreover that this effect occurs after just one semester. In the spring of their second year, beginning alternative route teachers with previous classroom experience felt confident in their classroom management and discipline at a rate of 88%, and even 78% of teachers without previous experience reported feeling confident (Exhibit 11). In terms of their overall content knowledge and pedagogical abilities, teachers with and without previous classroom experience identified with statements of self-efficacy 87% and 68% of the time, respectively. An area in which teachers were less self-assured of their abilities after the first semester of teaching was instructing ELL students. Teachers with previous classroom experience still described themselves as more confident than those without, at a rate of 63% versus 48%, but this actually represents a decrease in confidence from the fall of the first year. Teachers' efficacy at teaching students with special needs was not surveyed in the fall, but they felt least confident in this area in the spring.

Curiously, teachers who did not take college education courses during their alternative route programs experienced increased feelings of preparedness similar to those expressed by teachers who had previous classroom experience. The 39% of teachers in Feistritzer's (2005) survey sample who did not take college education courses consistently rated their competency higher than did their counterparts. They also had higher job satisfaction ratings. Sixty-six percent of alternatively certified teachers were *very satisfied* with their interactions with fellow teachers, 59% with their student

interactions, and 45% with their principals. Despite just 7% of teachers who were *very satisfied* with their salary and 16% with their community status, 45% felt overall satisfied with their jobs.

### **Professional Development Experiences**

Professional development (PD) is not unique to either traditionally or alternatively trained teachers. All educators participate in a variety of professional development activities that focus on pedagogy and content-specific topics.

Reading discipline- and education-based publications is one of the most popular ways teachers seek to improve their practice. In a study examining science and math teachers' PD experiences, Chval, Abell, Pareja, Musikul, and Ritzka (2008) reported that 87% of science and math teachers had read professional literature in the three years prior to being surveyed. Lustick (2011) found in a study of National Board Certification (NBC) candidates' perceptions of PD that 98% of the participants had read literature while pursuing that credential. Workshops and conferences were also common choices. All of Lustick's participants and 74% of Chval et al.'s group attended such events, and 45% of the latter had led science, math, or pedagogical PD activities. Enrolling in a university-level science course was the least common activity among the NBC candidates, with 79% claiming participation, yet this is still greater than the 43% of Chval et al.'s sample that took a content-specific course and the 35% that took a teaching course in the past three years. The NBC cohort completed more PD in every area except reading professional publications during its candidacy period than did Chval et al.'s sample of science and math teachers in three years.



Constantine et al. (2009) found that PD most often focuses on content and performance standards. This was the most common topic reported by traditional (91%) and alternative (85%) route teachers when they were surveyed about their first three years teaching. Of the eight activities that were considered, alternatively certified educators participated more often than traditionally certified educators in five areas. The greatest disparity between the two groups was in PD that focused on pedagogical skills. Eighty percent of alternative route teachers attended this type of event – a full 20% more than the number of traditional route teachers. During their first three years, alternative route teachers experienced technological PD at a rate of 64% to traditional teachers' 58%, assessment PD at 79% versus 70%, and classroom management and discipline PD at 71% versus 54%.

### **Preferred Professional Development**

Professional development for teachers has traditionally consisted of one-day events that include lectures or workshops. During these events, teachers are fed information which will supposedly improve their practice. Lustick (2011) described such experiences as “isolated, extrinsically motivated, undisciplined, and leav[ing] little room to assess the accountability of results” (p. 223). Yet rural teachers have difficulty obtaining even traditional forms of PD. Chval et al. (2008) investigated the factors that hindered rural teachers' ability to participate. In order, the three most frequently named factors were insufficient financial subsidies from the school, personal cost, and low ranking of importance to the school. Other constraints ranged from a lack of interest in the topics to unawareness of existing PD opportunities. Clearly, extending effective PD experiences to all teachers can be challenging.

Teachers' needs and wishes must also be taken into account. Perceptions of professional development satisfaction and needs do not vary significantly between teachers with differing years of experience according to the survey results of Chval et al. (2008), Feistritzer (2011), and Lustick (2011). One divergence noted by Chval et al. was that teachers with less than two years of experience more frequently reported wanting PD relating to ELL and minority students. A second difference noted was the transition from desiring an equal amount of content- and pedagogy-related PD in the first five years of teaching to a slight favoring of pedagogical instruction in later years, particularly in the use of technology. However, the suggestions for components of effective PD were consistent across teachers regardless of years of experience. Feistritzer's (2011) participants expressed strong similarities in all teachers' value and satisfaction of their PD experiences for contributing to their development as proficient teachers. Lustick's (2011) NBC candidates would all be expected to show similar PD rankings without divergence due to years of experience because teachers must have a minimum of three years of teaching experience in order to apply for the NBC process.

Just as Feistritzer (2011) found only inconsequential variation in PD perceptions between teachers of different age ranges, the data also demonstrated consistency between traditionally and alternatively certified teachers. When responding to whether PD has been a valuable resource for their teaching abilities, 90% of traditional route teachers and 89% of alternative route teachers responded *very valuable* or *somewhat valuable*. This same level of satisfaction with PD opportunities differed by just five percentage points between traditional and alternative route teachers, at 71% and 76%, respectively. Ratings of actual PD experiences were even more similar with 69% of traditionally certified

teachers and 71% of alternatively certified teachers responding that they were *very satisfied* or *somewhat satisfied*.

All of Lustick's (2011) survey respondents had two PD experiences in common: attempting National Board Certification and participating in in-service days. The first experience was rated as having a *strong* or *moderate* effect on science teaching and learning by 80% of teachers, while in-service activities were only rated as significant by 38% of teachers. Lustick (2011) hypothesized that the lack of choice in attending these events was to blame for "the consistent and clear low respect" (p. 232) given to school workshops. Other less popular activities were enrolling in an education course and sitting on a committee. The highest percentage of *strong* ratings given to a PD activity was 67% which indicated that creating a science curriculum was important for science teaching and learning. Working with other teachers was also rated highly. Interestingly, 81% of respondents rated reading scientific literature as having a *strong* or *moderate* effect, but just 64% said the same of reading educational literature.

Lustick (2011) noted that the most highly valued PD activities were content-centered while the least valued have a general focus. Chval et al. (2008) also found content-centered PD to be desirable when teachers were asked about their ideal PD experience. Also mentioned were technology integration, classroom management, and instructional methods. Teachers indicated that the most important factor for each of these topics was that they had to be practical for use in the teacher's grade level, subject, and teaching method; in other words, teachers desired PD that is relevant. In Chval et al.'s (2008) survey of science teachers' perceived needs for PD, the most frequently desired pedagogical skill was *developing critical thinking in science* which was reported by 68%

of the sample population (Table 6). Learning how to integrate technology was also highly desired by 63%, and making connections between science and real life received a positive response from 56%. Classroom management was named by just 28% of respondents, and adapting instruction for ELL students was an issue for 23%. The most common desires for PD related to facilitating students' understanding of science, and the less common desires focused more heavily on instructional and classroom supports. This sentiment was echoed in Lustick's (2011) findings in which it was determined that teachers prefer PD that has specific goals and is aimed at enhancing student learning (p. 224).

Chval et al. (2008) reported PD needs in specific science topics most frequently for physics and chemistry, followed by earth science, and finally biology (Table 9). Fifty-six percent of science teachers felt they needed PD in electricity and magnetism (physics) and 51% wanted PD relating to energy and chemical change (chemistry). Climate and weather topped the earth science PD needs list at 49%. Genetics and evolution were the only biology topics in the top five perceived PD needs with 46% of science teachers needing instruction.

Chval et al. (2008) concluded that teachers' perceived PD needs did not align with actual PD opportunities. It was suggested that teachers should have input as to the type of PD, that PD instructors should receive more training, and that teachers without regular PD opportunities should be given special consideration (pp. 41-42). Lustick (2011) listed three possible formats for an improved model of professional development: "interdisciplinary planning, content-based research opportunities, and intra-disciplinary discussions of effective standards-based pedagogy" (p. 220). Each of these shifts from the

traditional focus on teachers as a uniform group learning about their general deficiencies to the reformed model of individuals working toward a specific student-centered goal.

### **Teaching Students with Disabilities**

All pre-service teachers in Maine must complete a Department of Education-approved “teaching exceptional students in the regular classroom” course prior to obtaining certification. The purpose of such a course is to prepare teachers to accommodate students with above-average abilities or disabilities by informing the teachers about common conditions, legal responsibilities, and adaptive methods and technology. A course fitting this description is included in Maine university education programs, but those seeking alternative certification must ensure that they fulfill this requirement along with a methods course.

The effectiveness of pre-service courses in preparing teachers for every disability they may encounter in their classrooms has been questioned and studied. Researchers have shown interest not only in teachers’ abilities to implement special needs accommodations, but also in their attitudes toward issues such as inclusion. A study by Avramidis, Bayliss, and Burdern (2000) examined whether student teachers’ attitudes about inclusion and perceptions about their abilities to teach students with disabilities were dependent on age, gender, type of school, grade taught, or size of class (p. 282). The only category which showed a significant difference was gender; female teachers had a more positive attitude than males (p. 285). A surprising finding revealed that pre-service science educators held more negative views of inclusion than pre-service humanities teachers (p. 285). The researchers speculated that this difference was due to the science

students' greater concern for academic achievement in the context of a full-inclusion classroom (p. 289).

Attitudes toward the concept of inclusion were generally positive, which agreed with other studies referenced by Avramidis, Bayliss, and Burdern (2000) that pre-service and younger teachers are more open to inclusion principles than more experienced in-service teachers (p. 288). The attitudes of education students in this study were found to correlate with their perceived abilities to teach students with disabilities (p. 289). The better a pre-service teacher perceived his or her teaching skills, the more likely he or she was to have a positive attitude. Further themes were revealed when the study participants were asked open-ended questions about what could improve their attitudes toward inclusion. Sixty percent stated that they needed to know more about the range of disabilities and appropriate methods for helping students with specific disabilities. Nearly as many (56%) proposed that increased hands-on pre-service experience with special needs students would make them feel more positive about inclusion (p. 287). Interestingly, the researchers stated that "the most noteworthy finding of this investigation concerns the participants' lack of confidence in meeting the IEP requirements of children with special educational needs" (p. 286).

Lee-Tarver (2006) specifically investigated teachers' sentiments about Individualized Education Programs (IEP). Using a four-point Likert scale, general education teachers in Alabama and Georgia were asked about the efficiency and impact of IEPs, and their involvement in IEP development. The results showed that the teachers valued IEPs and were taking active roles in determining IEP content. When asked to respond to the statement *I feel I am a better teacher because I have the IEP to guide my*

*instructional planning* (p. 268), 52% of teachers agreed or strongly agreed. A majority of teachers agreed that IEPs helped them with organization and developing goals (pp. 266, 268). Nearly half of teachers, 48.8%, reported that they took part in students' goal-setting (p. 268). While not mutually exclusive, the teachers' lack of confidence in their abilities to implement IEPs revealed by Avramidis, Bayliss, and Burdern's (2000) study and the overall positive reactions to IEPs in Lee-Tarver's study seem intuitively inconsistent. This difference may be attributable to the sample groups. The first was a group of student teachers who would have had little relatively little practice designing and implementing IEPs compared to the second group of in-service teachers. If that is the case, then these studies together provide hope that pre-service teachers will eventually become confident in implementing IEPs. Lee-Tarver (2006) concluded that new teachers should be properly trained and mentored in accommodation strategies, and these studies suggest that in-service teachers would be appropriate for such supporting roles.

An international study of five university education programs in Australia, Singapore, Hong Kong, and Canada asked questions similar to Avramidis, Bayliss, and Burdern about pre-service teachers' attitudes toward inclusion and students with disabilities. The factor that differentiates Sharma, Forlin, and Loreman's (2008) research from that of Avramidis, Bayliss, and Burdern is the added variable of the pre-service program format. Pre-service teachers in Hong Kong, Singapore, and two Australian universities took a focused 10-week class in which they learned about disability education. The programs in Hong Kong, Singapore, and at one of the Australian universities emphasized "understanding the nature and needs of children with different disabilities" (p. 780) by focusing on specific disabilities. In contrast, students in Canada

experienced a two-year program in which a “non-categorical approach with a greater emphasis on the sociological aspects of disability” (Sharma, Forlin, & Loreman, 2008, p. 780) was integrated into all courses rather than being the subject of any one course. The non-categorical approach was also characteristic of the second Australian university, although the program length was different.

Participants’ attitudes toward inclusion principles were measured before and after their programs with an aim to detect any differences that may appear between the ten-week and two-year programs. Pre-service teachers’ post-disability studies attitudes changed significantly at each institution except in Singapore. The Australian university students that experienced a non-categorical approach had the greatest difference in attitude out of the five programs. When compared to the Canadian program which emphasized non-categorical disability studies using a two-year approach, Sharma, Forlin, and Loreman (2008) pointed out that their findings support an intensive program over an integrated program to promote positive attitude changes (p. 780). To the previously established consensus that pre-service and young teachers had generally positive attitudes toward inclusion, Sharma, Forlin, and Loreman added that teachers with advanced degrees were also more positive (p. 774). This finding appears to call into question the attitudes of the community of experienced teachers who halted their formal education after fulfilling the minimum requirements for teacher certification.

Sharma, Forlin, and Loreman (2008) also measured the change in students’ comfort levels when working with people with disabilities. The only cohorts that demonstrated a statistically significant positive increase were the two Australian samples. The researchers traced this difference to the amount of time the students spent with



people with disabilities. At the Canadian university, the pre-service teachers' only interactions with disabled populations were "routine and sometimes inconsistent" (p. 781), whereas the other programs required students to get to know a person with a disability. The authors concluded that "efforts should be made to systematically design experiences that will allow [the students] to understand that a person with a disability can be a friend and that he or she is not very different from anyone else" (p. 782).

A final measure of change in the five university populations was the concern pre-service teachers felt about applying inclusion practices in their classrooms. Concern significantly decreased for all except the Hong Kong students, but it is notable that the groups in Hong Kong and Singapore had the highest levels of concern before engaging in disability studies. One possible influence on these students' feelings was the cultural attitude toward inclusion. Sharma, Forlin, and Loreman (2008) noted that, unlike Canada and Australia, Hong Kong and Singapore do not have laws supporting inclusive education (p. 782). Students in the former countries learned about governmental resources for people with disabilities, which may have allayed their fears about implementing inclusion practices.

Sharma, Forlin, and Loreman (2008) ultimately determined that "the content and the pedagogy of a programme are by far the most significant predictors of pre-service teachers' attitudes, sentiments and concerns about inclusion" (p. 783). Although some of the positive changes in the five education programs were not significant, each cohort did exhibit a positive change overall. The most influential factor, however, was not the format of the program.

In an effort to identify the most common components of disability studies programs for pre-service teachers, Harvey, Yssel, Bauserman, and Merbler (2008) surveyed a national sample of university and college education faculty about their instruction. The researchers used a 5-point Likert-type scale to gauge responses, with “5” representing *strongly agree*. When asked if “all education majors take an introduction course in special education,” the mean response from elementary and secondary education faculty was 4.56, indicating that almost all pre-service teachers had a basic foundation in disability studies. Nearly as strong a response (4.41) was received when the sample was asked about providing inclusion and special needs instruction. The most common inclusion-based course topic was an introduction to exceptional children offered by 35% of these institutions. Inclusion-specific courses were available at 26%, and methods of teaching students with disabilities could be taken at 12%.

When it came to applying disability-related knowledge, the elementary and secondary education faculty responded that their programs had field experiences in which pre-service teachers could “work with diverse learners” (Harvey et al., 2008, Table 4) with a rating of 4.34. Only 11% of the national sample reported that they did not provide any field experiences in disability settings such as special education or inclusive classrooms. Harvey et al.’s (2008) findings overall indicated that pre-service teachers were able to enroll in courses focusing on special education, and that most were completing at least an introductory course (p. 30).

A survey of 400 elementary, middle, and high school teachers, and university education faculty distributed by Norman, Caseau, and Stefanich (1998) provides a different perspective of the results produced by Harvey et al. Norman, Caseau, and

Stefanich were inspired by studies that labeled science teachers as less enthusiastic about inclusion practices, as did the previously described study by Avramidis, Bayliss, and Burdern, to determine whether science teachers were aware of new options for accommodation and if they were implementing those accommodations. One area they investigated was the preparation received by science teachers before they entered the profession. When responses from the K-12 teachers were compared with those of the university faculty, Norman et al. (1998) observed “an alarming discrepancy...with regard to the disability categories for which [pre-service teachers] received some (even minimal) academic instruction in their undergraduate academic program” (p. 131). The faculty far overestimated their programs’ instruction on disabilities, leading one to question the merit of Harvey et al.’s findings.

According to Norman et al. (1998), high school teachers reported receiving less pre-service instruction in categories of disabilities than both elementary and middle school teachers, and far less than the university faculty indicated. Just 6.5% of high school teachers said they had learned about physical or health impairments, compared to about 24% of each elementary and middle school teachers (Table 2). Opportunities for such instruction were perceived by 63% of university educators. Out of *physical or health, motor/orthopedic, visual, cognitive, or hearing impairments*, and *learning or emotional/cognitive disabilities*, high school teachers most often reported that they had received instruction about learning disabilities, and only 21.7% at that, yet 76.1% of university educators acknowledged that they had. *Learning disabilities* was also the most frequently reported category of instruction by elementary and middle school teachers, at 46.5% and 40.7%, respectively.

The disparity in Norman et al.'s (1998) reports between the teachers and higher education faculty was just as pronounced when the groups were asked about instruction on disability education topics. Once again, high school teachers said they had received less instruction than both elementary and middle school teachers. Mainstreaming, reported by 17.4% of the high school teachers, was the most common topic which had been covered (Table 3). Yet 71.1% of university faculty said undergraduates learned about mainstreaming. Second most common among the high school teachers was *safety and legal concerns regarding students with disabilities* at 15.2%. Inclusion principles and *resources for information on teaching science to students with disabilities* were both taught to just 4.3% of teachers, but more than half of university faculty reported that each of those topics were part of the curriculum.

An important variation that emerges from the comparison of the studies performed by Harvey et al. (2008) and Norman et al. (1998) is the proportion of students who complete disability courses. Even the university educators in the latter study reported offering an introductory course (45.7%) or a general disability teaching methods course (30.4%) less often than those in the former study, who indicated that introductory special education courses were extremely common. Since Norman et al.'s research focused specifically on science teachers, this could indicate that pre-service teachers with a science concentration are much less likely to take special education courses than pre-service teachers in other content areas. If valid, that relationship may provide insight into Avramidis et al.'s (2000) previously discussed finding that pre-service science educators have more negative views of inclusion than pre-service humanities teachers.

The importance of being prepared to teach students with disabilities in the science classroom is rising as inclusion becomes the rule rather than the exception. Norman et al. (1998) reported that science teachers typically have little special education training and expect that special education teachers will assume responsibility for disabled students' accommodations. Conversely, special education teachers have little training in science and usually must rely on a textbook when the subject is left to them. This gap will widen as long as there is a "continuing lack of responsiveness by science teachers to adjust the learning environment so that students with disabilities feel a sense of success and accomplishment" (p. 128). Yet there are a number of factors working against secondary science teachers who want to instill that sense of success and accomplishment in their students with disabilities, not least of which is the issue that less information is available about students' special learning needs in each successive age group (p. 130). Unfortunately, these compounding factors end up hurting the students' education.

Norman et al. (1998) enhanced their study by asking science teachers how prepared they felt to accommodate students with disabilities. As with the survey results describing the topics covered during pre-service training, secondary science teachers gave much less favorable responses than elementary school teachers, but unlike the previous results, middle school teachers felt that they were at a comparable disadvantage. The researchers characterized those attitudes as "feelings of inadequacy" (p. 134) which arose from the comparatively heavy focus on content rather than pedagogy during training. The types of disabilities for which high school teachers felt most prepared to accommodate were physical or health impairments and cognitive impairments, both of which received a positive response from 13% of the sample. Most of the other disability

categories received a response indicating adequate preparation from about 11% of the high school science teachers (p. 134). Perhaps tellingly, the university science educators who were asked how prepared they felt to instruct future teachers about students with disabilities were equally insecure. Hearing impairments was the area of disability in which university educators were most confident, yet none of the teacher cohorts indicated that they felt exceptionally prepared in that area. Norman et al. (2008) asked the question that immediately becomes apparent from these statistics: “If so many university educators feel inadequately prepared to address teaching science to students with disabilities with pre-service teachers, where will the pre-service teachers gain this important training?” (p. 135).

A related question in the survey by Norman et al. (1998) asked teachers if they “felt adequately prepared to perform tasks related to teaching science to students with disabilities” (p. 135). For elementary, middle, and high school teachers, communicating with students was the most common responsibility for which they felt prepared. Still, just 30.4% of high school teachers fell into that category. Other tasks which included modification of instruction and working with parents and professionals received positive responses from between 15% and 22% of secondary teachers. Only 4.3% answered that they were adequately prepared to implement metacognitive strategies, which was the lowest response rate in every cohort. Norman et al. hypothesized that these issues may be attributable to a fundamental unawareness of appropriate accommodation strategies and techniques; if teachers do not know that a tool exists, they cannot implement it (pp. 135-136).

## **Professional Development for Teaching Students with Disabilities**

Students with disabilities, in particular, may benefit from what science class activities have to offer:

- (a) concrete, hands-on learning activities;
- (b) less need for language skills such as reading and writing;
- (c) high level of group interaction and participation;
- (d) provision for individual differences and success; and
- (e) encouragement of interest and inquisitiveness. (Atwood & Oldham, 1985, as cited in Norman et al., 1998, p. 145)

As the previously investigated research has shown, teachers would benefit from additional training in teaching students with disabilities. Norman et al. (1998) asked high school teachers who they perceived to need “considerable training,” and 28.3% answered “needed for self,” a lower percentage than they indicated for any other group. Yet, interestingly, 58.7% of that same sample indicated that other high school teachers needed considerable training (p. 136). There was not great variation in the proportion that thought middle and elementary teachers or university science content and methods instructors needed considerable training; the responses ranged from 41% (elementary) to 57% (methods instructors).

Suggested content for training in which high school science teachers learn how to teach students with disabilities can be ascertained from the results of an attitude survey in Norman et al.’s (1998) research. This survey provides insight into some biases and misconceptions that must be addressed prior to teaching accommodation techniques and strategies. Every teacher agreed with the statements “I would be receptive to suggestions

for making changes in my classroom environment and my teaching method to accommodate a student(s) with a disability” (p. 140) and “special needs students gain self-esteem and confidence through science activities” (p. 138); however, more than half of the sample (51.2%) countered that response by agreeing that “the regular classroom teacher should not be expected to make major adjustments to serve the special needs of students with disabilities” (p. 138). To confuse matters further, 72.7% asserted that training in teaching science to students with disabilities should be compulsory for all science teachers (p. 139). Three-fourths thought that some of that training should address teachers’ “prejudices and emotional barriers” (p. 138). The researchers point out that “it appears that teachers may be open to suggestion, but essentially do not seem to feel compelled to act on those suggestions” (p. 141).

The survey reveals practical, as well as affective, concerns. Teachers were anxious about the safety of the student(s) with disabilities (59.1%) and that of the other students in the class (44.4%) while performing laboratory activities (Norman et al., 1998, p. 138). Time management, a perpetual issue for science teachers, was a problem for the 39.5% who said that teaching students with disabilities takes attention away from other students. Perhaps having the proper skills to address safety and time management would alleviate these concerns, but 65.2% of teachers indicated that they felt unprepared to teach science to students with disabilities. Training should be available at all state and national science conferences, according to 91.1%. Interestingly, the comments from this survey specified that teachers need to be trained on the rationale for implementing accommodations, not just the strategies and techniques for doing so (p. 143). They cited



insufficient pre-service education and in-service professional development as the reason for their lack of knowledge in teaching students with disabilities (p.141).

A focus group interview of 52 regular and special educators from Tennessee attempted to bring to light common concerns, obstacles, and strategies for implementing inclusion practices. Trump and Hange (1996) noted that lack of training and planning time, among other issues, were cited as both concerns and obstacles (pp. 13, 16). Pre-service training was addressed by both the regular and special education teachers. Whereas special educators were insecure about teaching in a large class, regular education teachers bemoaned their lack of basic inclusion knowledge (p. 18). As in other studies, the teachers voiced the opinion that university education faculty do not have current, practical knowledge about inclusion (p. 25). The group agreed that improved pre- and in-service training in curriculum adaptation would be a remedy not only to teachers' doubts about their own abilities, but to other obstacles, such as classroom and time management, as well (p. 18).

Teachers in the Tennessee focus group discussed their positive professional development experiences and made recommendations for pre-service training practices. The most frequent suggestion was that pre-service teachers should spend more time in field experiences, with a particular emphasis on giving all education students practice in special education environments (Trump & Hange, 1996, p. 24). For in-service, the teachers found it helpful to visit successfully implemented inclusion classrooms to observe their colleagues. Conference panels were also deemed valuable sources of information. The general sentiment was that training should be geared toward practice and away from theory.

The National Joint Committee on Learning Disabilities ([NJCLD], 2000) published a statement defining its beliefs about “effective continuous professional development” (p. 3). Citing the recent changes and advances in many areas of education as the rationale for new training methods, the NJCLD states unequivocally: “Today professional development must include high-quality, ongoing training that reflects a variety of approaches, with intensive follow-up and support....It is not an event” (pp. 2-3). Among the suggestions for implementation in the report are several that Trump and Hange’s (1996) focus group would appreciate. For example, the NJCLD (2000) promotes peer coaching, observation, and teacher research as aspects of an effective professional development process (pp. 3-4). A National Science Teachers Association (2006) statement on professional development principles echoed the conviction that in-service training should be sustained and dynamic. It also suggests that that teachers should participate in “professional networks, action research, [and] lesson study” (p. 2). Although the NSTA statement asserts that professional development should, in part, reflect students’ science needs, there is no specific mention of students with disabilities. There is indirect support for inclusion, at most, in the several references to tailoring programs to each school’s circumstances and in the statement that professional development should “confront deeply held beliefs, knowledge, and habits of practice” (p. 2). The focus is primarily on science content and pedagogical content knowledge. In contrast, the NJCLD (2000) report encouraged training that “prepares teachers to provide instruction to students with learning disabilities in social skills, life skills, self-advocacy, and preparation for transitions” (p. 5). Ideally, professional development would embrace principles from both of these position statements.

One professional development experience that has been successful at improving science teachers' attitudes toward and skills in accommodating students with disabilities is the Creating Laboratory Access for Science Students project (CLASS). An important goal of this summer workshop that united 14 science and special educators with 20 middle and high school students was to engage more students with disabilities in science, technology, engineering, and mathematics fields (Kirch, Bargerhuff, Cowan, & Wheatly, 2007, p. 664). It addressed an important problem raised by Trump and Hange's (1996) Tennessee focus group: science teachers need to know how to teach students with disabilities and special educators need science class experience (p. 18; Kirch et al., 2007, p. 664).

CLASS administrators used the same "Teaching Science for Students with Disabilities" survey employed by Norman et al. (1998) to assess participating teachers' pre-service education. Students with learning disabilities and ADD/ADHD were the only two groups which teachers felt prepared to teach; all agreed that their science methods courses had not adequately, if at all, covered disability topics (Kirch et al., 2007, p. 674). The disadvantage of such a gap in knowledge becomes apparent when considering the categories of disability which the teachers were asked about: "motor/orthopedic impairments, visual impairments, hearing impairments, learning disabilities, attention deficit-hyperactivity disorder (ADHD), developmentally delayed, emotional/behavioral disabilities, speech/language disabilities, autism, deaf and blind, traumatic brain injury, physical or health impairments, multi-categorical, and 'other'" (pp. 673-674).

Despite their confessed lack of training, most of the teachers reported that they felt prepared to accomplish specific tasks related to teaching students with disabilities,

such as collaborating with colleagues (86%) and working with the students themselves (93%). The category in which they were the least confident was partnering with parents (50%). Statements recorded in daily journals implied that teachers had more room to grow than the survey indicated. One realized that her teaching methods had been “inflexible and too serious” (Kirch et al., 2007, p. 681). Several expressed surprise, and then embarrassment, at the realization that students with disabilities could physically perform the laboratory activities (with accommodations) (p. 677). These revelations came after the teachers got to know the students’ personalities and see beyond their disabilities.

Kirch et al. (2007) made recommendations for professional development based on the CLASS project. Both pre- and in-service teachers should interact with students with disabilities, learn about physical accommodations and assistive technology, and consider how to implement inclusion practices in their schools (p. 685). Disability awareness was the starting point for CLASS participants, and it is a necessary step in the “shift from thinking in terms of what a student cannot do to recognizing what they can do” (p. 686). The participants discovered that physical accommodations were often invented or repurposed. “Salad tongs, measuring cups and spoons, large funnels, [and] squeeze bottles” (pp. 685-686) became scientific equipment. In some cases, a change as minute as table height made a difference in students’ ability to participate. Pre- and in-service science teachers may learn that students with disabilities are the experts at those types of accommodations. When considering implementing inclusion practices at school, the CLASS participants emphasized the impossibility of managing groups of students without support from the administration and other teachers. If pre-service teachers learn about inclusion before entering the profession, they may be more open to trying inclusion

practices in their classrooms. The report concluded that students with disabilities are able to take part in science class with their peers.

### **Research Questions**

One important area in which teachers would benefit from enhanced professional development is in teaching students with disabilities. More than one-third of teachers, 36.1%, reported that they would benefit from professional development in designing instruction for special education in science and math (Chval, 2008). According to the NCCTQ (2008) survey, 82% of all pre-service teachers received instruction in teaching children with special needs. Levine found that 60% of education school alumni rate that they were prepared to address the needs of students with disabilities *very well* or *moderately well*. But principals and education school deans and faculty expressed a different view. Only 30% of principals agreed with the rating given by alumni. These reviews do not portray education institutions favorably, but even more importantly, the discrepancy indicates that there is disagreement about the skills a teacher needs to teach students with disabilities.

Beyond offering professional development to in-service teachers, a more permanent strategy for preparing them to teach students with disabilities is to identify and expand the effective aspects of certification programs. The special education skills teachers bring to their classrooms may vary by preparation route. Although Maine requires a course in “teaching exceptional students in the regular classroom,” there may have been other curricular, personal, or professional experiences that influenced a teacher’s preparation to teach students with disabilities. The literature does not explore the sources of educators’ efficacy in this area, nor does it determine whether alternative

or traditional certification programs are more effective at preparing teachers for disability diversity. There is no specific data about how teachers in subject areas must be prepared to integrate inclusion practices. Professional development models such as the CLASS project described by Kirch et al. (2007) may provide some guidance, but much of that data is qualitative. The field needs more widely-applicable information.

Delivering training about the most effective methods for teaching students with disabilities presents a challenge. Feistritzer (2011) has reported that only 20% of teachers find the most common PD events, seminars, to be *very effective*. Yet the need to distribute best practice information becomes particularly pronounced when one considers Maine's population of students with disabilities. In the 2008-2009 school year 17.3% of Maine children ages three to 21 were served under IDEA compared to the national average of 13.2%. In fact, Maine had the third highest percentage of children in that category, falling just behind Rhode Island and Massachusetts (USDOE, 2010b). Teaching students with disabilities is an area in which Maine science teachers must be proficient.

The lack of research on widely-applicable data about the most effective modes for preparing educators to teach students with disabilities, especially in content areas such as science, prompts these questions:

1. Are traditionally trained secondary science teachers in Maine better equipped than alternatively trained teachers to instruct students with disabilities?
2. Do alternatively certified high school science teachers bring unique strengths for teaching students with disabilities to the teaching profession due to previous experiences?

3. What kind of professional development are Maine high school science teachers currently experiencing in teaching students with disabilities, and what kind of professional development do teachers think would be most beneficial?
4. Do perceptions of needed professional development differ between traditionally and alternatively certified Maine high school science teachers?

### **Chapter 3**

#### **METHODS**

Secondary science teachers in Maine were the target sample for my thesis from the beginning of this project. I wanted to study a population that is relevant to my intended profession, with the aim that my findings would benefit my future colleagues. The scope of my research was limited to Maine for this reason, as well as the fact that this state has a relatively high incidence of students served under IDEA. Regular classroom teachers were chosen rather than special educators because the trend toward mainstreaming and inclusion practices will affect science teachers. My expectation was that the survey would reveal differences between the professional development needs of alternatively and traditionally prepared science teachers, but that some alternative teachers' previous life experiences may compensate for briefer formal training in teaching students with disabilities.

I decided to use a survey instrument to collect data about Maine secondary science teachers' experiences and perceptions. I had considered exploring the topic through case studies early in the process, but ultimately decided that quantitative statistics would allow for broader interpretation of the data. The survey standardized the questions presented to each respondent so the answers would as reliable as possible. It allowed me to organize subjective data into predefined categories; for example, rating preparedness on a Likert-type scale maintained more consistency than individual descriptions would have. The survey provided the advantage of being distributable throughout the state in order to reach as wide a sample as possible, ensuring that no subsection of teachers was



discriminated against due to location. Most importantly, the results would be more widely applicable than inferences from case studies.

Most of the first draft of my literature review was written when I began crafting questions for my survey. Some of the literature that gave information about teachers' preparation or professional development included samples of the questions used to poll their samples (see Chval, 2008; Feistritz, 2005, 2011; NCCTQ, 2008; Norman et al, 1998). These served as models for the format and objective of my survey questions. My original list of survey questions reflected the breadth of my sources. After narrowing my research topic from the differences between alternatively and traditionally certified teachers to teachers' preparation and professional development, I was able to write more questions aimed at gathering relevant information. However, the survey was still long, broad, and disorganized. More discussions with my advisor continued to refine my research until I narrowed my focus to the discrepancies about teaching students with disabilities that arose in the literature. I discarded some irrelevant questions and wrote new ones to cover my subject thoroughly. After a meeting with a committee member, I developed a clearer goal of the information I wanted my survey to collect in order to answer my research questions. This session produced the final version of most of the survey questions.

SurveyMonkey was originally planned to be the vehicle for my survey. The Basic Plan limits users to up to 10 questions and 100 responses, and the questions cannot be delivered all at once. My advisor and I realized that I would have to buy an advanced plan to meet my needs. At my advisor's suggestion, I contacted Gayle Jones of UMaine's Protection of Human Subjects Review Board to inquire if she knew of any other reliable

survey tools. She did not, but her direction to others who might be able to help eventually led to Qualtrics. This web-based survey tool was available to any student, faculty, or staff member with a PeopleSoft account. The software had previously been used by CentRO, the University of Maine System's Center for Tourism Research and Outreach, before the license was extended to the entire campus.

I used the "Quick Survey Builder" to create my survey. From there, I was able to type each question, choose the question type (e.g. multiple choice, rank order, etc.), and add as many item choices as were needed. Each question also had the option of "display logic" which means that a question would only appear if the respondent selected a specific answer in a previous question. For example, indicating that one has taken a class on teaching exceptional students would prompt a question to appear that asks how useful he or she rates that class. Questions were set to appear all at once rather than requiring respondents to click through multiple web pages.

Two options were available for recording data from participants: anonymous response and unique link. Anonymous response would send one survey link to all respondents and the returned data would be unidentifiable. For this survey, Qualtrics issued a unique link for each person who received an invitation email. This means that their names were linked with their completed surveys in the Qualtrics system as each participant submitted their answers. I chose to send unique links because it allowed me to schedule a reminder email to be delivered only to non-respondents at a date and time of my choosing. The reminder email was intended to increase the response rate which would increase the validity of my results.

An option that I did not use in this survey, due to the statement of voluntary participation in the informed consent, was “forced response.” If a question marked as a forced response was not answered, Qualtrics would alert the respondent that they must choose an answer before their survey would be submitted. For simplicity and clarity, I did not change the survey’s aesthetic elements or upload a graphic, although Qualtrics allows the user to make both of these adjustments easily. There are other sophisticated tools which can be used to organize and analyze data, but they were beyond the purpose and requirements of this survey.

I submitted the survey with my Institutional Review Board (IRB) application to use human subjects. The IRB determined that my study was exempt and suggested that some phrases in the informed consent be reworded. My application was approved upon making those changes.

As the IRB application was pending, I gathered names and email addresses for my target participants. The Maine Education Data Management System ([MEDMS], [https://www.medms.maine.gov/medms\\_public/LabelsHome.aspx](https://www.medms.maine.gov/medms_public/LabelsHome.aspx)) generated a list of grade nine through 12 science teachers. Many of the teachers without email addresses listed had contact information on their school’s website. For those that did not have publically available email addresses, I called their schools and requested the information. Only one school declined. The final list consisted of 749 secondary science teachers and was uploaded to Qualtrics as a “panel.” It was not an option, nor would it have been desirable, to select a sample reflecting a particular characteristic such as age range or region. My results are intended to be as widely applicable as possible, within the scope of the sample.

The survey was first distributed to desired participants on February 4, 2012. At that time, a follow-up email was scheduled to be delivered to all non-respondents on February 13, 2012. The rationale for these two dates was that the survey needed to be sent immediately in order to gather as much data as possible by the University's spring break, but my advisor and I agreed that some teachers may not check their email accounts during the weekend, and my survey could potentially be at the bottom of a long list by Monday. The second mailing was scheduled for a little more than a week later on a Monday in order to appear near the top of teachers' inboxes before they became entrenched in the week's work. It was imperative to distribute the survey twice before the week of February 19<sup>th</sup>, the public school system's February vacation, because the response rate would likely suffer if teachers were not obligated to check their email accounts.

The first distribution was successfully emailed to all but 57 desired participants, for whom I received undeliverable email notices. I then created a list of those people and used school websites again to look up their email addresses. This resulted in 46 updates to that list. Some errors in the original email addresses were due to incorrect information in MEDMS; others were simple typos. A survey invitation was sent to the panel of 46 teachers at the same time as the non-respondents from the first panel received a reminder email. The number of respondents had been stagnant at 97 for a few days, but the reminder emails prompted an influx of 30 more responses within six hours of being sent.

A second and final reminder email was sent to non-respondents on February 20, 2012. Throughout that week, the number of completed surveys rose to 201, representing a 26.8% response rate from the original 749 potential participants. My advisor and I

determined that this was a satisfactory sample size which could be used to make meaningful analyses.

### **Data Analysis**

The completed surveys appeared chronologically in the “Responses” section under the “View Results” tab in Qualtrics. Since the survey was not anonymous, respondents’ names appeared along with the date on which they took the survey and the amount of time it took. The data is not tabulated until the user generates a report in the “View Reports” section. Reports may be generated throughout the data collection process, but it suited my purpose to wait until I was ready to analyze the results.

The report provides the most basic information about responses, but it can also filter and regroup data based on the user’s preferences. Each question appears in a left-hand menu. Clicking on a question displays the number of responses for each option and a statistical table containing the minimum value, maximum value, mean, variance, and standard deviation for that question. Any additional comments appear below the data table. The “add graph” button will generate a visual representation of the results immediately. The drop-down menu labeled “Table Options” allows the user to manipulate the presentation of the data and export the data table to Microsoft Word, PowerPoint, Excel, or Adobe Acrobat.

Two features were useful during my data analysis: filter and drill down. Filtering lets the user create “if...then” subgroups in which only the respondents who selected a particular answer to a question will be accounted for. For example, when I needed to view just the responses from alternatively certified teachers, I filtered results only from respondents who answered *yes, independently, yes, through a program, or yes, other to*

the question *Did you obtain your teaching certificate through an alternative route to certification?* Drill down uses the responses from one question to divide the answers to other questions. For example, drilling down the question which asked if a teacher was male or female would calculate the gender ratio for every other question to see if there was a difference in the way males and females responded. Filters and drill downs can be applied to any question.

Qualtrics combines filter and drill down capabilities in “Cross Tabulation” which is also located under the “View Results” tab. This feature lets the user choose two or more questions to compare in a matrix. A “banner” is the question that will appear at the top of the table, and a “stub” is the question that will appear vertically. Only respondents who answered each of the questions being compared will factor into the table. Cross tabulations provided me with most of the information I needed in order to make conclusions and answer my research questions. Questions in which the choices followed a Likert scale format could be managed by merging similar results. For example, I merged the response *very helpful* with *somewhat helpful* and *very unhelpful* with *somewhat unhelpful* in questions with those options to gain a clearer view of the spread of data. The percentages for each response set were recalculated automatically. Cross tabulation was useful for organization and data calculations. I used the survey report and cross tabulations to compare answers from subgroups, such as alternatively trained and traditionally trained teachers. Since each of my survey questions applied to the respondents’ characteristics, pre-certification preparation, teaching experiences, professional development needs, or professional development experiences, I structured the data report based on my research questions. The final step was downloading my data

tables to Excel, which allowed me to create graphs to visually emphasize trends and anomalies. These data and graphs are presented in the “Results” section.

## **Chapter 4**

### **RESULTS**

The high population of Maine students with disabilities and teachers' lack of preparation to effectively teach those students, according to data reported from other state and national studies, reveal important questions about how teachers should be educated throughout their careers. With the introduction of new alternative routes to certification in Maine, and alternative certification programs proliferating across the nation, the skills teachers possess with regard to teaching students with disabilities during their first few years in the classroom may vary widely. Teachers of science require particular attention because science subjects often require students to work and learn in multiple settings, such as laboratories and outdoors. Analyzing data from Maine's science teachers can help anticipate the most appropriate preparation and professional development (PD) opportunities for teachers with certain characteristics in order to facilitate full educational inclusion for students with disabilities. With that goal in mind, a survey was designed to answer the following questions:

1. Are traditionally trained secondary science teachers in Maine better equipped than alternatively trained teachers to instruct students with disabilities?
2. Do alternatively certified high school science teachers bring unique strengths for teaching students with disabilities to the teaching profession due to previous experiences?
3. What kind of professional development are Maine high school science teachers currently experiencing in teaching students with disabilities, and what kind of professional development do teachers think would be most beneficial?



4. Do perceptions of needed professional development differ between traditionally and alternatively certified Maine high school science teachers?

The survey was sent to 749 secondary science teachers in Maine and returned electronically by 221, resulting in a response rate of 29.5%. The ratio of traditionally trained to alternatively trained respondents was about 4:3. Traditionally trained teachers were more likely than alternatively trained teachers to have earned initial certification in another state. Females slightly outnumbered males, and the two most populous age ranges were 50 to 59 and 30 to 39. Most respondents indicated that they teach in the southern half of Maine, which reflects Maine's general population distribution.

### **Teacher Characteristics**

*Did you obtain your teaching certificate through a traditional route to certification?*

*Did you obtain your teaching certificate through an alternative route to certification?*

This study began with the presumption that Maine science teachers have been certified through both traditional and alternative routes. Receiving enough responses from each group was the crucial factor for making valid inferences about the effects of certification. Two survey questions aimed to determine whether a teacher was prepared through a traditional or alternative route. The first defined "traditional route" as "a route to initial certification in which the teacher graduated from a university-approved program with either a four-year undergraduate education degree or a master's education degree" and asked: *Did you obtain your teaching certificate through a traditional route to certification?* Of 215 respondents to that question, 125 answered *yes* and 90 answered *no*.

The second question defined "alternative route" as "a route to initial certification through which the teacher held a conditional certificate, targeted needs certificate, or

certification waiver after a transcript review, but did not complete a university approved education program” and asked: *Did you obtain your teaching certificate through an alternative route to certification?* The 211 respondents to that question divided their answers into 64 *yes, independently*; 16 *yes, through a program*; 13 *yes, other*; and 118 *no*; for a total of 93 alternatively prepared and 118 non-alternatively prepared (assumed traditionally prepared) teachers.

As a result of using two questions to determine teachers’ routes, there is slight variation in the number of traditionally versus alternatively trained teachers. In order to be as accurate as possible, only the 125 respondents (58.1%) who answered *yes* to the first question were considered to be traditionally prepared and only the 93 respondents (44.1%) who answered *yes, independently*; *yes, through a program*; or *yes, other* to the second question were considered to be alternatively prepared (see Figure 1). This is the method that has been consistently used to differentiate between preparation routes throughout the data analysis.

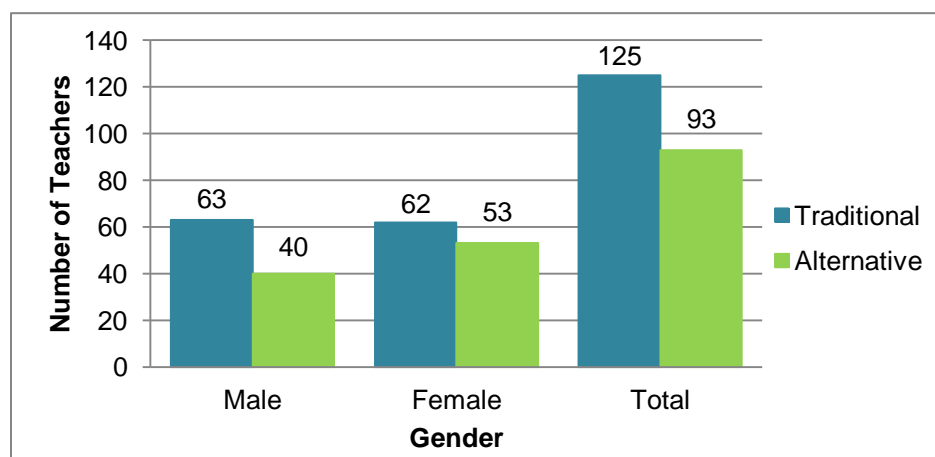
***Did you enter the teaching profession through a program such as Teach for America or Troops to Teachers?***

Teachers who answered that they had been trained through an alternative route were asked whether they went through an established program or pursued certification independently. As reported above, the majority of alternatively certified teachers, 68.8%, chose to seek certification autonomously. Of the 17.2% who went through a program, none used Teach for America, one teacher utilized Troops to Teachers through the Air Force Junior Reserve Officer Training Corps, two comments specified the Extended Teacher Education Program (ETEP) at the University of Southern Maine, and one comment noted an internship through the University of New Mexico. The remaining

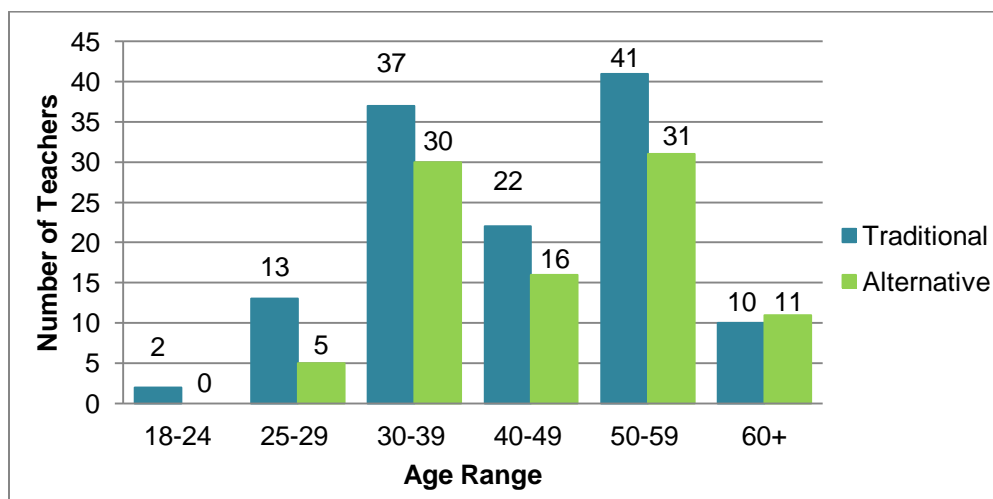
14.0% indicated that they had taken a different alternative route, neither independent nor through a program. As noted in the comment box, teachers' prior degrees include biology, zoology, chemical engineering, and physical education.

***What is your gender?***

***What is your age range?***



*Figure 1.* Certification route by gender and overall.



*Figure 2.* Certification route by age range.

Survey respondents were nearly equally split by gender; females represented 52.7%. Traditionally prepared teachers showed a close distribution (49.6% female), but alternatively prepared teachers were more likely to be female (57.0%; see Figure 1). The

only two respondents in the age 18 to 24 range were traditionally certified. The 60+ age range was the only one in which there was both a greater number and proportion of alternatively certified teachers than of traditionally certified teachers (see Figure 2). The ten traditionally trained teachers in the 60+ age range represented 8.0% of all respondents in that certification group, and 11 alternatively trained teachers represented 11.8% of those teachers. This can be compared to the distribution within the 30 to 39 age range which was composed of 37 traditionally trained teachers, making up 29.6% of that total certification group, and 30 alternatively trained teachers, representing 32.3% of those teachers. There were more traditionally trained teachers than alternatively trained teachers in the 30 to 39 age range, but a greater proportion of the group of alternatively trained teachers fell between the ages of 30 and 39. Age ranges other than 18 to 24 and 60+ were also nearly evenly distributed between the two certification routes in terms of percentages. The 50 to 59 age range had greatest representation, describing 33.0% of respondents, closely followed by the 30 to 39 age range with 30.7%.

*Where were you first certified to teach?  
At what type of school are you currently working as a teacher?  
What grade(s) are you teaching this academic year?*

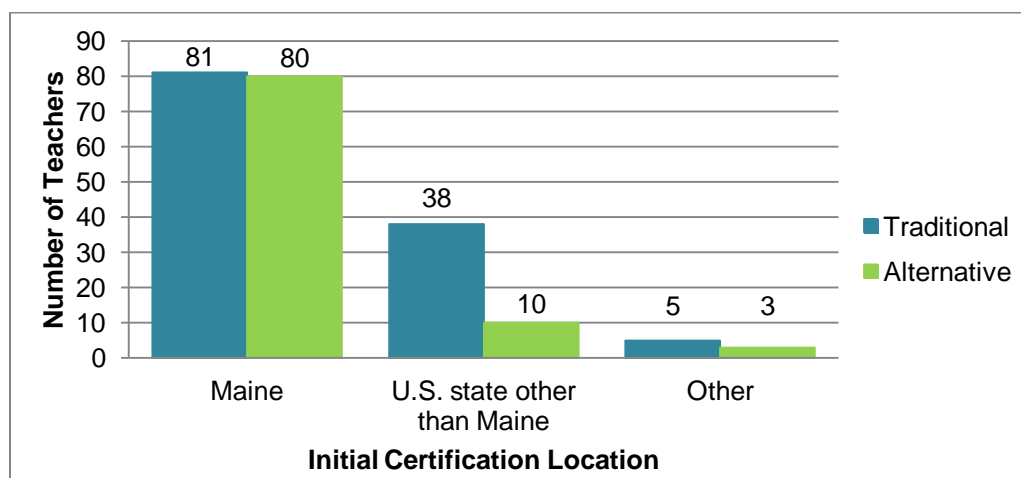


Figure 3. Certification route by initial certification location.

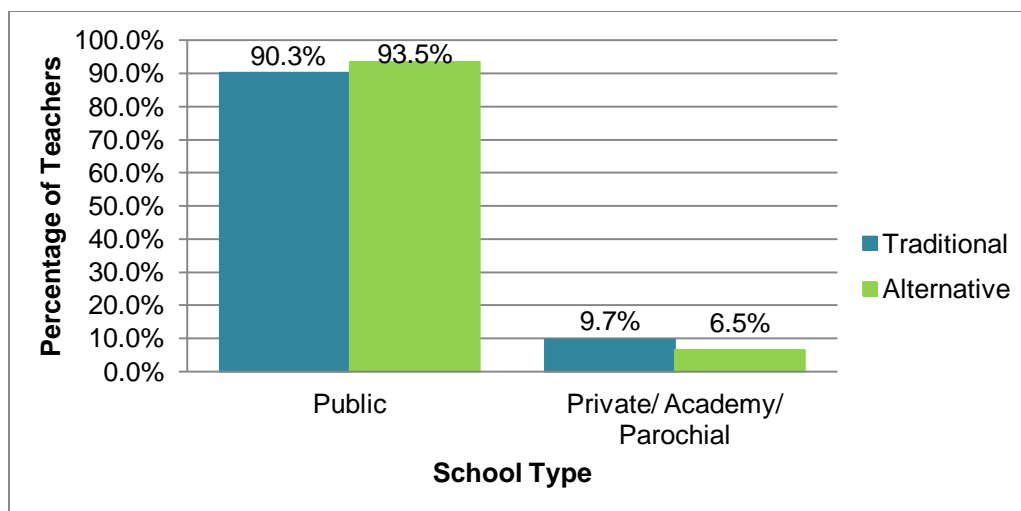


Figure 4. Certification route by school type.

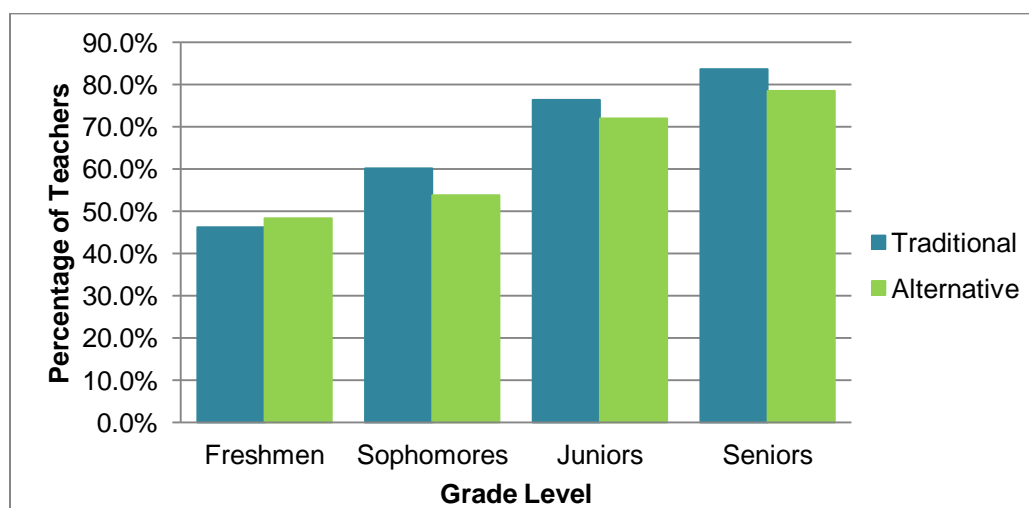
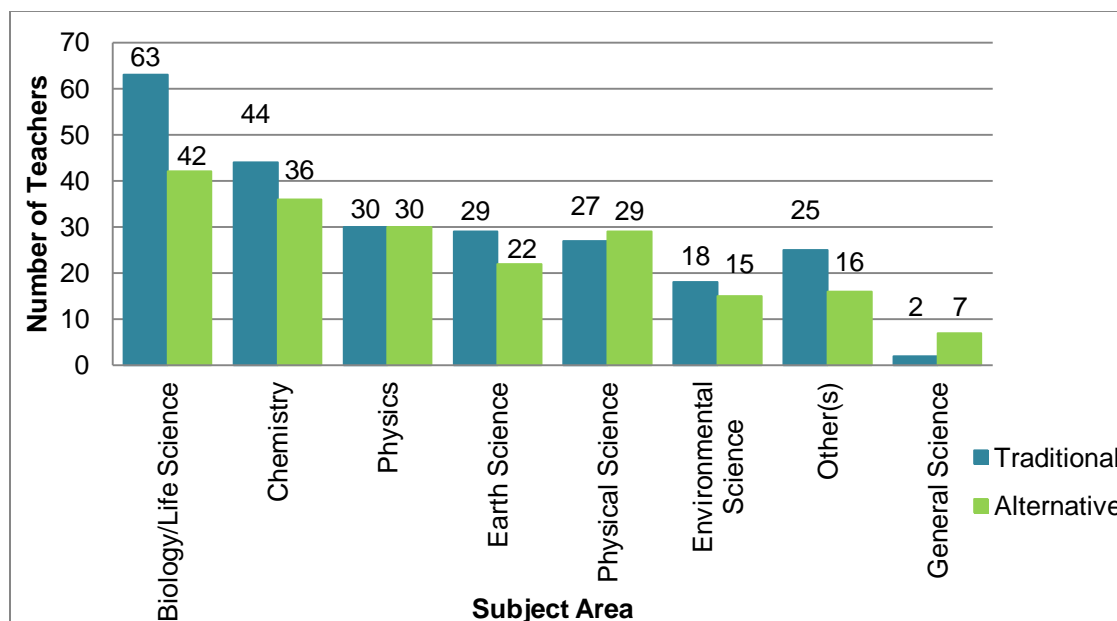


Figure 5. Certification route by grade level.

Alternatively certified teachers were more likely than traditionally certified teachers to have obtained their certification in Maine, with 86.0% doing so versus 65.3%, respectively (see Figure 3). Other states specifically mentioned as initial certification locations were Ohio, Rhode Island, Texas, and Vermont. Only eight respondents earned certification outside of the United States. Many more surveys were received from public school teachers (91.7%) than from private, parochial, or academy teachers (see Figure 4). Initial certification route appears not to matter when teachers are deciding between a

public school and private school setting; traditionally and alternatively certified teachers were nearly equally as likely to opt for public schools over private. Distribution among grade levels was similarly symmetric. For both certification routes, teachers were most likely to report teaching seniors and least likely to teach freshmen (see Figure 5).

***What subject(s) are you teaching this academic year?***



*Figure 6.* Certification route by subject area.

Biology was the most commonly taught subject by both traditionally and alternatively certified teachers, followed by chemistry and physics (see Figure 6). Alternative route teachers were notably more likely than traditional to teach physics (32.3% vs. 24.2%), physical science (31.2% vs. 21.8%), and general science (7.5% vs. 1.6%). In the *other* option, eight teachers reported teaching anatomy and physiology, six taught forensic science, five taught engineering, and seven taught various levels of math. Two teachers were responsible for out-of-discipline courses (other than mathematics): English/psychology and academic support. Other classes that were noted only once

include meteorology, aquaculture and horticulture, STEM problem solving, ocean science, and taxidermy.

### Pre-Certification Preparation

*Did you complete a course on teaching exceptional students in the regular classroom?*

*How helpful was that course in preparing you to teach students with disabilities?*

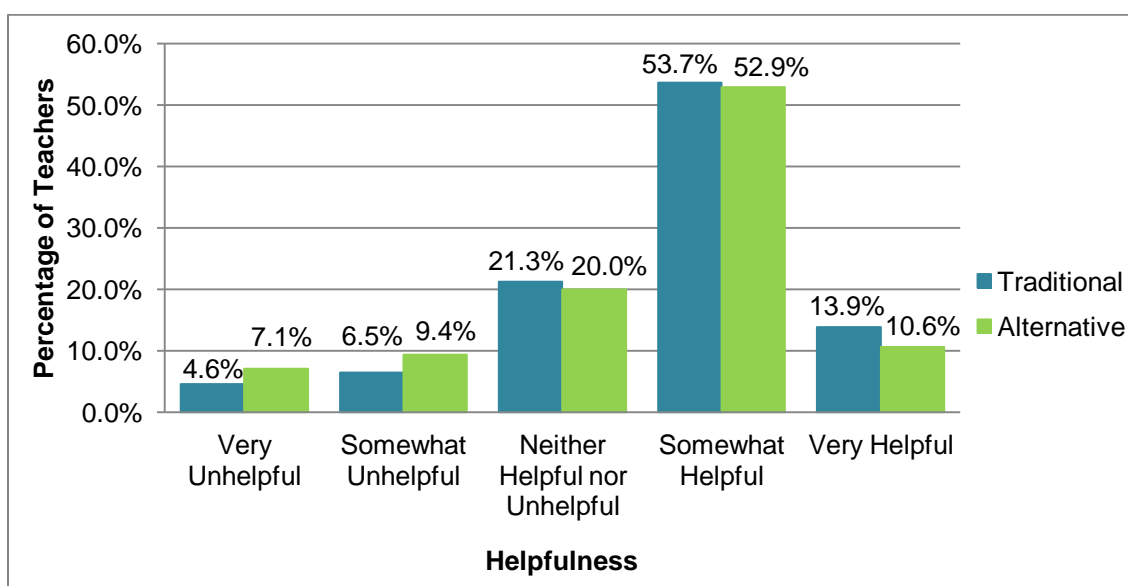


Figure 7. Helpfulness of the “teaching exceptional students in the regular classroom” course in preparing secondary science teachers to teach students with disabilities.

Maine requires that all teachers, regardless of certification location, complete a course on “teaching exceptional students in the regular classroom.” Out of 218 teachers, 89.4% indicated that they had taken a course fitting this description; 87.1% of traditionally trained and 92.5% of alternatively trained teachers answered affirmatively. Traditionally trained teachers were more positive about their experience taking the “exceptional students” class; 67.6% rated it *very helpful* or *somewhat helpful* compared to 63.5% of alternatively trained teachers (see Figure 7). They were also less likely to feel that it was *somewhat unhelpful* or *very unhelpful*.

*Was instruction on teaching students with disabilities integrated into your other education classes?*

*How helpful was that integrated instruction in preparing you to teach students with disabilities?*

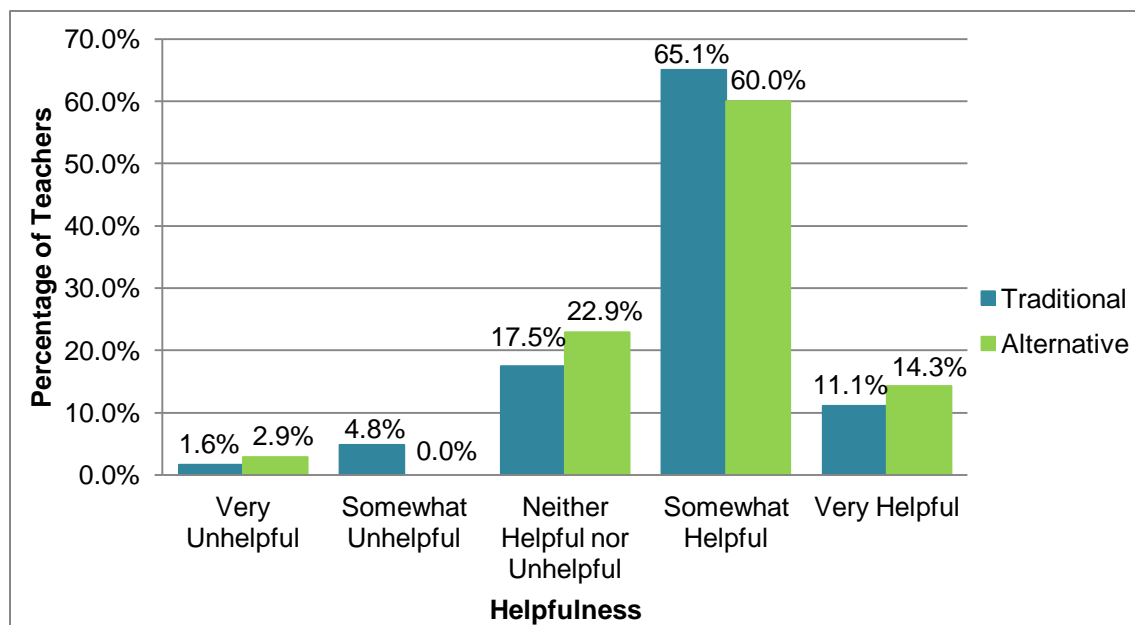


Figure 8. Helpfulness of integrated instruction in preparing secondary science teachers to teach students with disabilities.

Although fewer teachers reported that they had received integrated instruction on teaching students with disabilities in other classes (45.0%) than had taken an “exceptional students” course (89.4%), the smaller group was more optimistic about the usefulness of the integrated instruction than the “exceptional students” class. Just 5.2% of all respondents to the question of the helpfulness of integrated instruction rated their integrated instruction as *somewhat unhelpful* or *very unhelpful*, and 75.2% described it as *somewhat helpful* or *very helpful* (see Figure 8). There was little difference in ratings between the two certification groups, but a greater proportion of traditional route teachers than alternative route teachers, 51.2% versus 38.0%, reported receiving integrated instruction.



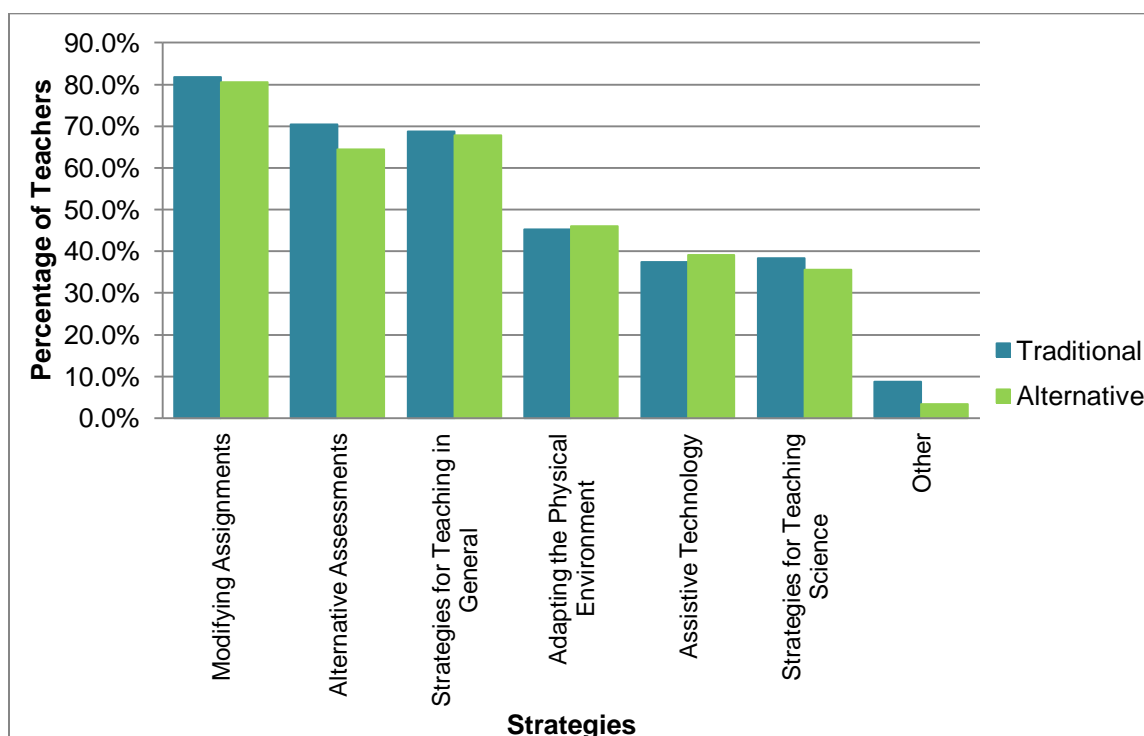
### **Exceptional students course and integrated instruction.**

Regardless of certification route, all teachers who had received integrated instruction gave it more *somewhat helpful* and *very helpful* ratings than they gave the “exceptional students” course (75.3% versus 66.5%). The “exceptional students” course also received a greater proportion of *somewhat unhelpful* and *very unhelpful* responses than did the integrated instruction (13.4% versus 5.2%).

Integrated instruction appears to be more valuable, but it is important to know whether teachers who rated it *somewhat helpful* or *very helpful* were comparatively satisfied with the “exceptional students” course. This comparison reveals that 90.0% of traditional route teachers and 79.2% of alternative route teachers who rated the integrated instruction *somewhat helpful* or *very helpful* also rated their “exceptional students” course as highly. Reversing this analysis by scrutinizing the responses from those who found their “exceptional students” course helpful establishes that slightly fewer traditionally (85.7%) and alternatively (76.0%) trained teachers thought that their integrated instruction was *somewhat helpful* or *very helpful*. These high percentages show that teachers who felt positively about either experience were more likely to value both their “exceptional students” course and their integrated instruction than to feel that either one was appreciably more helpful than the other. However, the higher rate of dissatisfaction with the “exceptional students” course, especially among the 16.5% of alternatively trained teachers who reported that it was *somewhat unhelpful* or *very unhelpful*, implies that integrated instruction was more helpful overall than the “exceptional students” course.

Filtering the survey responses to display only those respondents who had neither the “exceptional students” course nor the integrated instruction identified six traditionally and four alternatively prepared teachers. More reassuringly, 54 traditionally and 32 alternatively prepared teachers had received both types of instruction. Still, it is dismaying that 10 teachers completed their certification programs without the standard instruction in teaching students with disabilities.

*Select all of the topics you had exposure to in your general education and/or teaching exceptional students classes pertaining to teaching students with disabilities: assistive technology, adapting the physical environment, alternative assessments, modifying assignments, strategies for teaching science, strategies for teaching in general, other.*

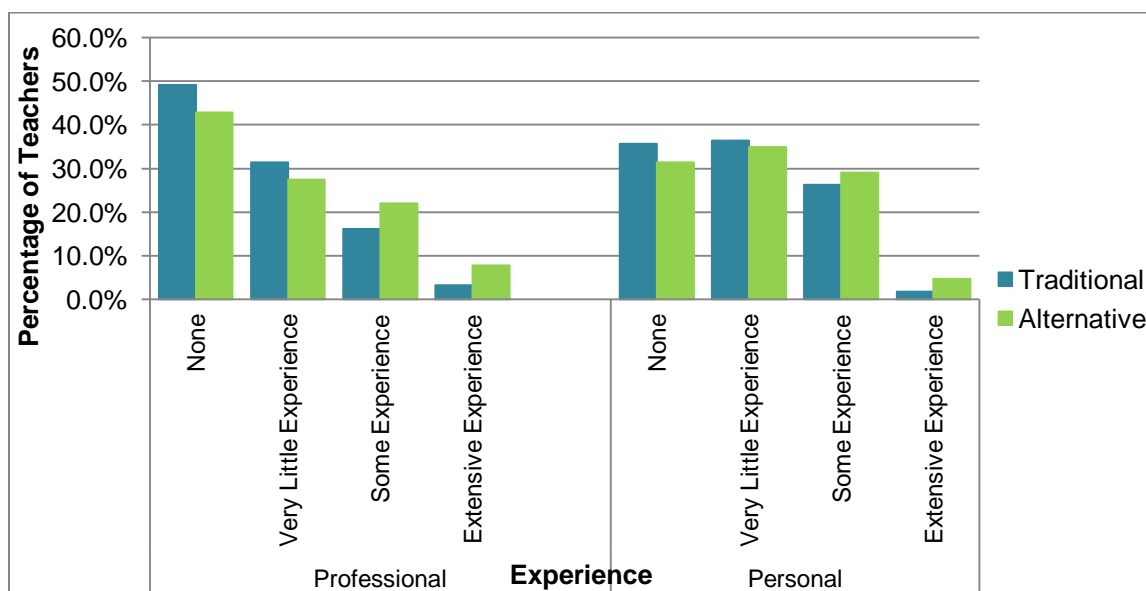


*Figure 9.* Topics teachers had exposure to in their general education and/or teaching exceptional students classes pertaining to teaching students with disabilities.

Teachers were asked to select from a provided list each topic on which they had received instruction relating to students with disabilities. The most common topic was

*modifying assignments*, which 80.6% of respondents recalled from their education (see Figure 9). Instruction on *alternative assessments* and *strategies for teaching in general* was reported by 67.7% and 67.2%, respectively. The two least common topics were *strategies for teaching science* (35.8%) and *assistive technology* (39.8%). The poor coverage of how to adapt the physical environment for students with disabilities, which 46.3% of teachers studied, may be a contributing factor to the feelings of a lack of preparation to accommodate students with physical disabilities. There was little difference in the proportion of traditionally and alternatively certified teachers who studied the topics listed, suggesting that the breadth of education is comparable regardless of route. Twelve respondents used the *other* option to report that they had also learned about, among other topics, special education law, response to intervention, and etiology of disabilities.

***How much experience did you have in working with students with disabilities prior to earning your initial teaching certificate?***



*Figure 10.* Secondary science teachers' professional and personal experiences working with students with disabilities prior to earning an initial teaching certificate.

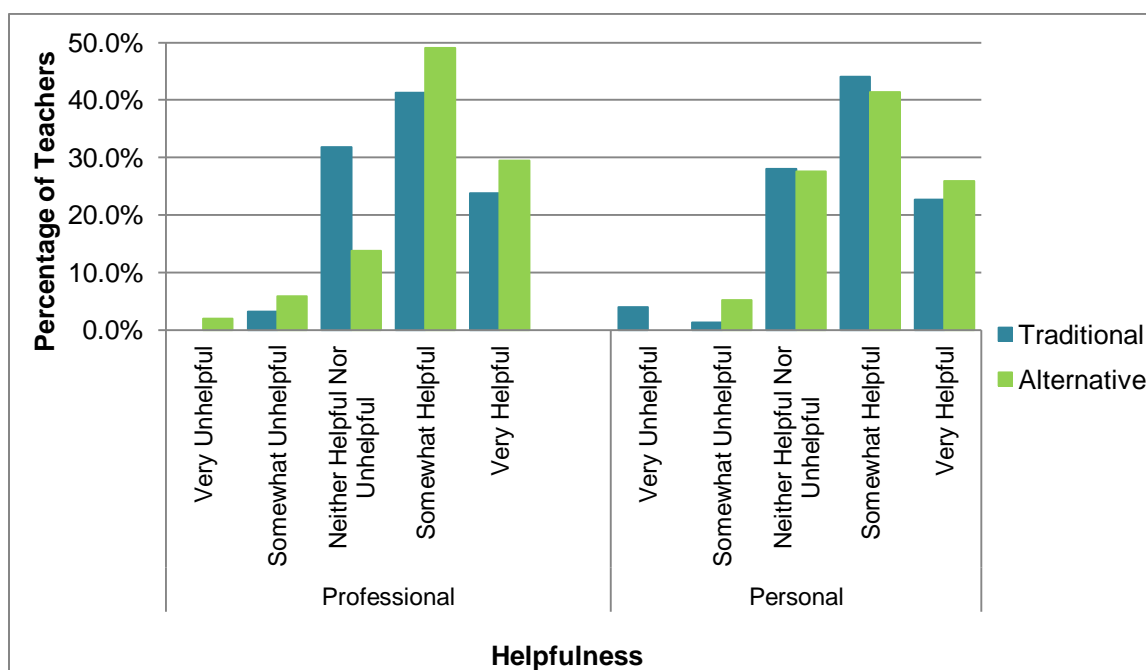
This question asked about teachers' professional and personal experiences separately. Respondents were more likely to have past personal experience working with students with disabilities than they were to have past professional experience. A plurality, 47.0%, reported that they had no prior professional experience, with progressively fewer affirmative responses leading up to the 5.1% who reported *extensive experience* (see Figure 10). Answers to the same question about teachers' previous personal experience showed the same trend, but more subtly. The percentage of responses of *none* (35.3%), *very little experience* (34.3%), and *some experience* (27.5%) portray a more even distribution of those with and without personal experience than was seen with the rapid decrease in the extent of professional experience.

Alternatively trained teachers reported more previous experience in both professional and personal areas than traditionally trained teachers. In the first group, 29.7% had *some experience* or *extensive experience* in the professional realm compared to the second group's 19.4%. As for personal experience, 33.7% of alternative teachers had *some experience* or *extensive experience* compared to 28.0% of traditional teachers. Overall, a greater number of teachers had prior personal experience and described their personal experience as more extensive than their professional experience. These results corroborate the assumption that the alternatively trained teachers bring more experience working with students with disabilities to the teaching profession. The gap between the two groups of teachers appears to derive more from professional rather than personal experience since there were 10.3 percentage points difference between their professional experience and 5.7 percentage points between their personal experience.

When comparing the teachers who had *some experience* and *extensive experience* with those who had *very little experience* or *none*, regardless of whether it was professional or personal, in relation to their feelings of preparation, the teachers with more experience felt more prepared than those with less experience to accommodate students with disabilities in every category on which they were surveyed. This disparity is particularly notable when considering teachers' perceived preparation to accommodate students with disabilities in science, a category in which just 31.3% of all respondents felt *somewhat prepared* or *very prepared*. Of those who had previous personal experience, 41.0% were *somewhat prepared* or *very prepared* for physical disabilities, whereas only 26.1% of teachers with little or no previous personal experience felt as confident.

***How helpful has your previous professional experience been for teaching students with disabilities?***

***How helpful has your previous personal experience been for teaching students with disabilities?***



*Figure 11.* Secondary science teachers' perceptions of the helpfulness of previous professional and personal experience for teaching students with disabilities.

Despite having more extensive personal experience working with students with disabilities, respondents were more satisfied with their previous professional experiences. Responses were largely positive, with 71.9% stating that their professional experience had been *very helpful* or *somewhat helpful* and 66.9% reporting the same about their personal experience (see Figure 11). Roughly one-quarter said that their professional (23.7%) and personal (27.7%) experiences had been *neither helpful nor unhelpful*. Only 4.4% of all survey respondents felt that their professional experience was unhelpful and 5.4% said the same of their personal experience.

Alternatively trained teachers reported that their past experience, especially previous professional experience, was *somewhat helpful* or *very helpful* more often than traditionally trained teachers. Professional experience was *somewhat helpful* or *very helpful* for 78.4% of alternative route teachers and 65.1% of traditional route teachers, and personal experience was *somewhat helpful* or *very helpful* for 67.2% and 66.7% of each group, respectively. Contributing to the helpfulness gap in professional experience between traditionally and alternatively trained teachers was the 31.7% of traditionally trained teachers, more than twice the proportion of alternatively trained teachers, who were ambivalent about their professional experience and selected *neither helpful nor unhelpful*.

## Teaching Students with Disabilities

*In general, how prepared did you feel during your first year of teaching?*

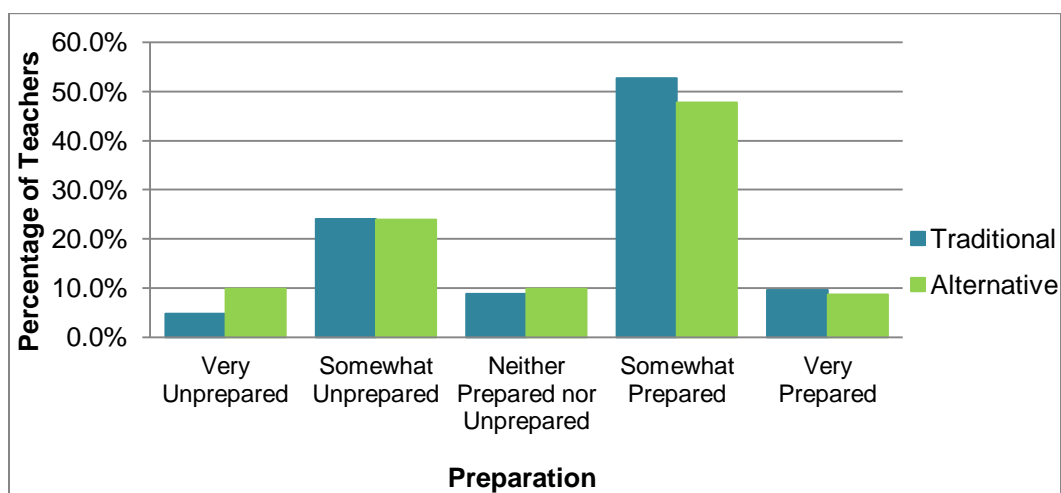
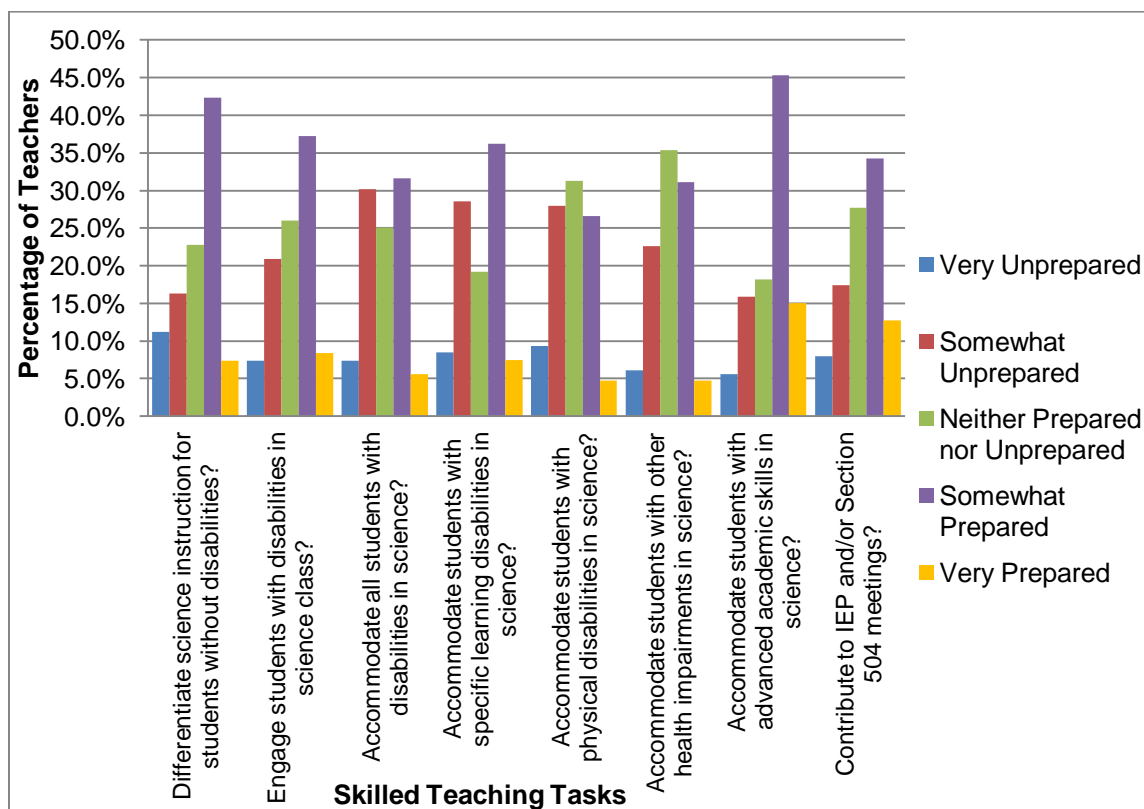


Figure 12. Secondary science teachers' perceptions of general preparation during the first year of teaching.

To establish a baseline for questions that would probe teachers' feelings of preparedness to teach students with disabilities, survey participants were asked, in general, how prepared they felt during their first year of teaching. Exactly half answered *somewhat prepared* and 10.1% felt *very prepared*, compared to 30.7% who felt *somewhat unprepared* or *very unprepared* (see Figure 12). The breakdown between traditionally and alternatively certified teachers shows that the former felt more confident in general when they began teaching. Of those respondents, 62.4% were *somewhat prepared* or *very prepared* compared to 56.5% of alternatively certified teachers. The alternative teachers also provided a greater proportion of *somewhat unprepared* or *very unprepared* answers than their counterparts (33.7% versus 28.8%).

***In your first year of teaching after completing a teacher certification program, how prepared did you feel to: differentiate science instruction for students without disabilities? engage students with disabilities in science class? accommodate all students with disabilities in science? accommodate students***

*with specific learning disabilities in science? accommodate students with physical disabilities (orthopedic impairments) in science? accommodate students with other health impairments in science? accommodate students with advanced academic skills in science? contribute to IEP (Individualized Education Program) and/or Section 504 (of the Rehabilitation Act of 1973) meetings?*



*Figure 13. Secondary science teachers' perceived preparation to teach students with disabilities. In your first year of teaching after completing a teacher certification program, how prepared did you feel to...*



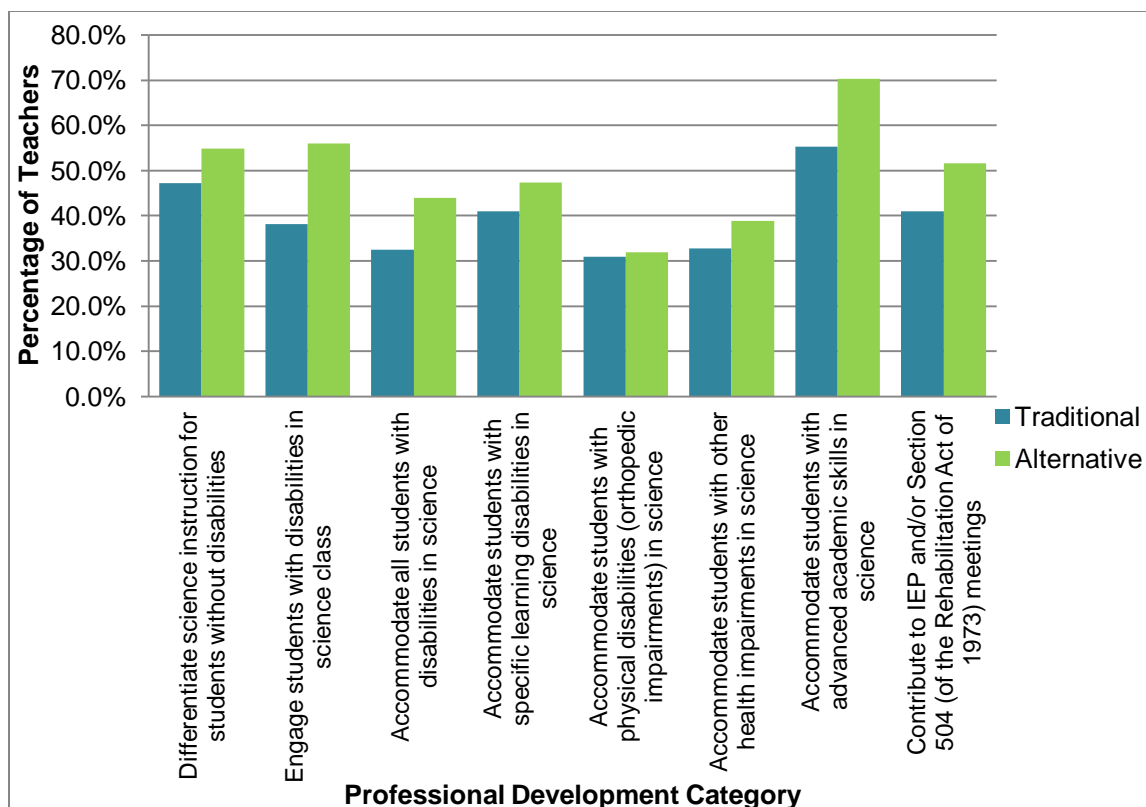


Figure 14. Teachers indicating that they felt *somewhat prepared* or *very prepared* to make accommodations by certification route.

A matrix of eight questions aimed to ascertain teachers' feelings of preparation to perform a variety of skilled teaching tasks during their first year in the classroom. Six of the questions related directly to teaching students with disabilities. Definitions of *child with a disability*, *specific learning disability*, *orthopedic impairment*, and *other health impairments* from the Individuals with Disabilities Education Act (IDEA) were provided to ensure that respondents were consistently addressing the same issues.

The two questions not related to students with disabilities asked how prepared teachers had felt to *differentiate science instruction for students without disabilities* and to *accommodate students with advanced academic skills in science*. When considering the answers *very prepared* and *somewhat prepared* together, these tasks received the

greatest proportion of positive responses (see Figure 13). The first question was answered positively by 49.7% of teachers and the second by 60.3%. However, more teachers responded *very unprepared* (11.2%) to the question of their ability to *differentiate science instruction for students without disabilities* than in any other category. The notably greater feelings of preparedness to *accommodate students with advanced academic skills in science*, especially among alternatively trained teachers, could be due to teachers holding advanced degrees in a science field.

The categories which gauged teachers' perceptions of preparation for teaching students with each kind of disability received fewer *somewhat prepared* or *very prepared* responses than the categories dealing with general teaching and accommodations, indicating that teachers are less comfortable than average with the task of accommodating students with special needs. Feelings of preparation to accommodate students with physical disabilities (orthopedic impairments) were the least confident. Only 31.3% of teachers responded that they felt *very prepared* or *somewhat prepared*, and 37.3% felt *very unprepared* or *somewhat unprepared*. Teachers reported feeling more prepared to accommodate students with specific learning disabilities (43.7%) than to accommodate those with other health impairments (35.8%). When considering their initial abilities to accommodate all students with disabilities in science, 37.2% of teachers had felt *very prepared* or *somewhat prepared*. *Engaging students with disabilities in science class* was a task at which 45.6% of respondents felt proficient. The final question probed teachers' perceptions of their initial preparation to contribute to Individual Education Program (IEP) and Section 504 meetings, for which 47.0% felt they had been *very prepared* or *somewhat prepared*.

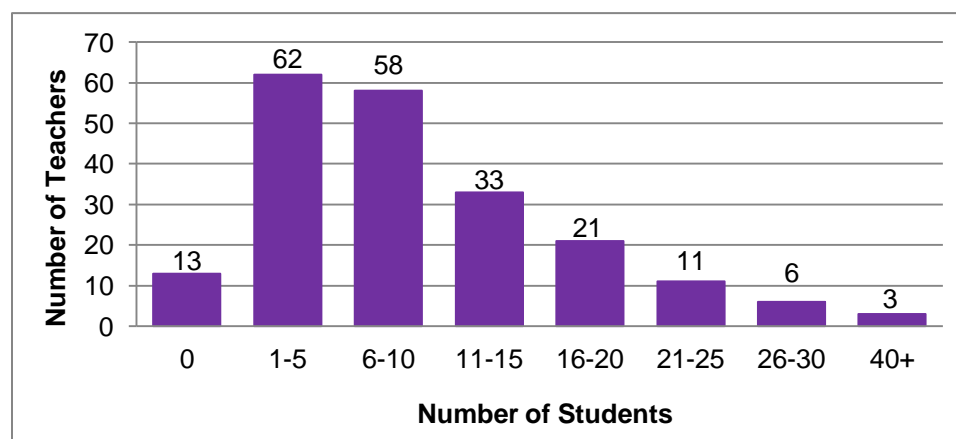
Computing a cross tabulation table with certification route against perception of preparation shows that alternatively certified teachers felt more prepared for all of the situations listed than did traditionally certified teachers (see Figure 14). Alternative route teachers were notably more likely to feel *very prepared* or *somewhat prepared* in their first year to *engage students with disabilities in science class* (56.0% versus 38.2%), *accommodate all students with disabilities in science* (44.0% versus 32.5%), *accommodate students with advanced academic skills in science* (70.3% versus 55.3%), and *contribute to IEP and/or Section 504 meetings* (51.6% versus 41.0%). Moreover, traditional route teachers were more likely than alternative route teachers to feel *very unprepared* or *somewhat unprepared* in their first year to *accommodate students with other health impairments in science* (36.1% versus 20.0%). It is concerning that less than half of all respondents in most categories perceived themselves to be *somewhat prepared* or *very prepared*.

Teachers who reported receiving integrated instruction on teaching students with disabilities during their certification programs showed great differences in feelings of initial preparation when broken down into their certification routes. Alternatively trained teachers were more likely than traditionally trained teachers, all of whom had received integrated instruction, to feel *very prepared* or *somewhat prepared* in every category except accommodating students with physical disabilities in science, for which the two groups were equal. The two most striking disparities were in respondents' self-reported preparation to *engage students with disabilities in science class*, for which 67.6% of alternatively trained teachers and 47.6% of traditionally trained teachers felt *very prepared* or *somewhat prepared*, and to *accommodate all students with disabilities in*

*science*, for which 61.8% of alternatively trained teachers and 42.9% of traditionally trained teachers felt *very prepared* or *somewhat prepared*.

The consistency with which alternative route teachers felt more prepared than traditionally trained teachers is maintained when considering just those teachers who previously had *some experience* or *extensive experience*, either professional or personal, in teaching students with disabilities. Previous professional experience had a more positive impact on each preparation category than personal experience for both groups of teachers. Nearly twice as many alternatively trained teachers (73.1%) as traditionally trained teachers (37.5%) with professional experience felt prepared to *engage students with disabilities in science class*. As in the comparison of teachers who received integrated instruction, the only category in which traditionally and alternatively certified teachers responded comparably was in their preparation to *accommodate students with physical disabilities in science*.

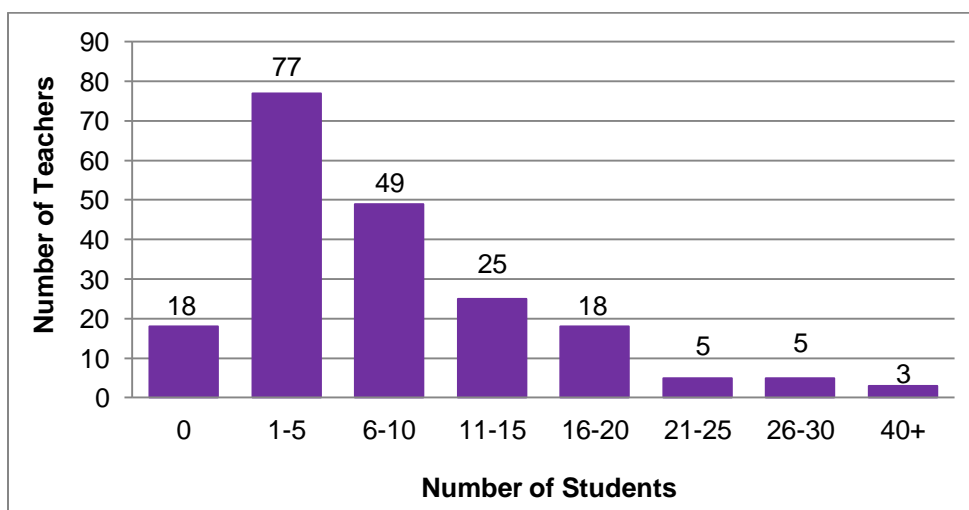
***How many students with special needs are you teaching in science class(es) this school year?***



*Figure 15.* Number of students with special needs taught by secondary science teachers.

The number of students with disabilities for which a Maine high school science teacher has responsibility ranges from none to more than 40, according to the survey (see Figure 15). Out of 214 textual responses to the question of how many students with special needs each respondent teaches in science classes, 207 were able to be quantified. Sixty-two teachers instruct between one and five students with special needs, 58 teach between six and 10 students, 33 teach between 11 and 15 students, and the number continues to decrease in relation to higher ranges of populations of students with special needs. Thirteen teachers taught zero students in this category, and three taught more than 40.

*How many students with special needs do you regularly make accommodations for in science class(es) this school year?*



*Figure 16.* Students with special needs requiring regular accommodations by secondary science teachers.

Some students with disabilities may not require regular accommodations. When asked how many science students with special needs they regularly accommodated, 214 teachers responded and 200 of those responses were quantifiable. Seventy-seven teachers regularly accommodated between one and five students with special needs, 49

accommodated between six and 10, 25 accommodated between 11 and 15, and 18 accommodated between 16 and 20 (see Figure 16). Eighteen teachers made regular accommodations for zero students, and three were responsible for accommodating more than 40. The response box allowed respondents to enter more than numeric answers, and one teacher commented that he tries to use universal design for learning “so accommodations [sic] are written into the course.” Another teacher noted that his students rarely choose to use their permitted accommodations. More than one comment alluded to the fact that the number of students with disabilities for which teachers are responsible can vary greatly from year to year.

### **Professional Development**

***Select the top three professional development activities you feel would most benefit your ability to teach students with disabilities: workshop or conference on special needs accommodations for science class, workshop or conference on special needs accommodations in general, postsecondary course(s) in education, postsecondary course(s) in science, observing colleague(s), planning with special education teacher, individual or collaborative research, mentoring another teacher or student teacher, reading professional education literature, reading professional science literature, reading education blogs, other.***

Half or more of all respondents rated three activities in their top three most needed: *planning with the special education teacher* (68.3%), *attending a workshop or conference on special needs accommodations for science class* (64.7%), and *observing colleagues* (50.0%; see Figure 17). The three least frequently chosen were *mentoring another teacher or student teacher* (8.7%), *conducting individual or collaborative research* (7.3%) and *reading education blogs* (2.8%). Taking postsecondary science and education courses and reading professional science and education literature fell between these two extremes, and were less popular than the choice of attending a *workshop or conference on special needs accommodations in general* (22.0%). Additional comments

suggested talking to students with special needs and watching “videos of teachers working with students in real time.” One respondent wrote that “our profession goes way to [sic] far with formal professional development lead [sic] by people who failed in the classroom and decided to become parasitic experts in the fields where they failed.”

Analyzing the quantitative results with respect to certification route reveals few differences. Traditionally trained teachers were more likely than alternatively trained teachers to opt for a *workshop or conference on special needs accommodations in general* (24.8% versus 18.5%). Conversely, alternatively trained teachers more often selected a *postsecondary course in science* (21.7% versus 11.2%). Within that group, teachers displayed a stronger preference for a science course than an education course (21.7% versus 10.9%), but traditionally trained teachers chose those two options almost equally (11.2% versus 12.0%).

***Select all of the professional development activities dealing specifically with teaching students with disabilities you have participated in within the last 12 months: workshop or conference on special needs accommodations for science class, workshop or conference on special needs accommodations in general, postsecondary course(s) in education, postsecondary course(s) in science, observed colleague(s), planned with special education teacher, individual or collaborative research, mentored another teacher or student teacher, read professional education literature, read professional science literature, read education blogs, other.***

A similar question, which surveyed teachers’ actual professional development activities, produced a different distribution. The three most commonly practiced professional development activities were *planning with the special education teacher* (69.0%), *reading professional education literature* (29.8%), and *observing colleagues* (25.7%; see Figure 17). Receiving the fewest votes were taking a *postsecondary course in science* (4.7%) and attending a *workshop or conference on special needs*

*accommodations for science class* (5.3%). Taking a postsecondary education course was more popular than taking a science course (17.0% versus 4.7%); choice of professional literature mirrored this partiality as 29.8% of respondents read education-related material and 19.3% read science-related material.

Analyzing the quantitative results with respect to certification route reveals few differences. Traditionally certified teachers showed stronger favoritism for *reading professional education literature over reading professional science literature* (32.3% versus 17.7%) than did alternatively certified teachers (27.6% versus 23.7%). Traditionally trained teachers were more likely than alternatively certified teachers to attend a *workshop or conference on special needs accommodations in general* (16.7% versus 9.2%). On the other hand, alternatively certified teachers were more apt than their counterparts to *read education blogs* (15.8% versus 6.3%) and to enroll in both education and science courses, although the latter two differed between the groups by only about five percentage points each.

Supplementary comments added one new activity and reiterated one on the provided list. One respondent mentioned a literacy conference “to help students with reading and writing problems in content classes.” Three comments highlighted the importance teachers place on planning with special education teachers, suggesting that, in fact, *more* time for working on IEPs and discussing strategies with other teachers (both special educators and classroom teachers) is needed during the school day. Beyond professional development, one teacher opined that “experience is a huge advantage.” A respondent expressed a view that was not considered in the list, writing, “I avoid wasting my precious time....Non-teaching educators are held in contempt by teachers.”



### Professional development experiences and perceived needs.

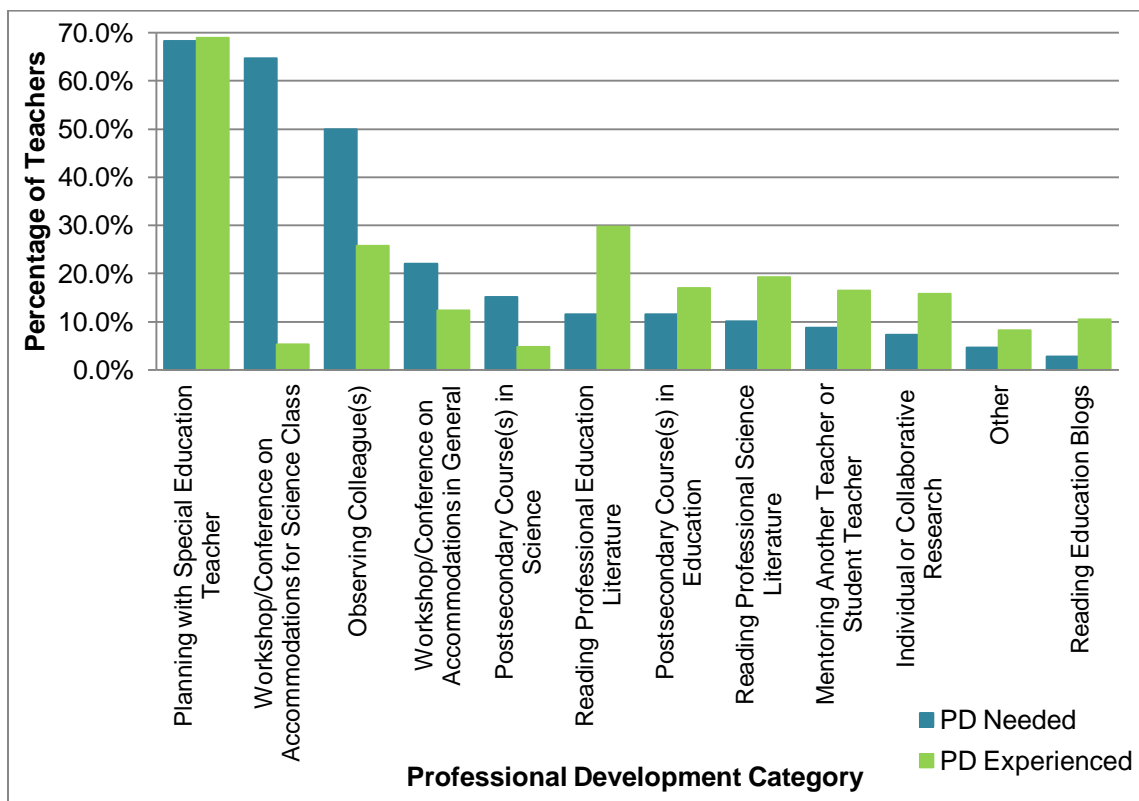


Figure 17. Secondary science teachers' experienced and needed professional development.

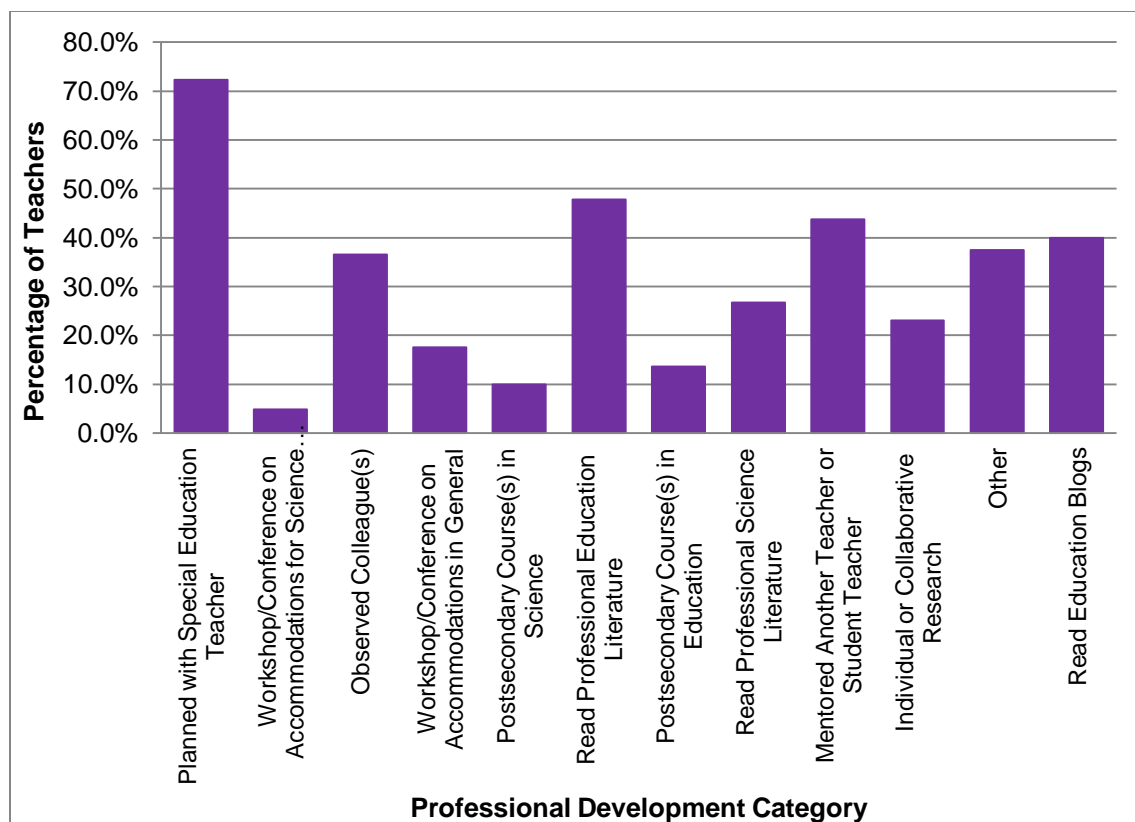


Figure 18. Secondary science teachers who indicated need for each professional development category *and* have actually participated in that particular professional development category.

The use of identical categories in the questions gauging teachers' professional development experiences and perceived needs accommodates a direct assessment of the gaps between actual and desired opportunities.

One positive comparison shows that 68.3% of respondents felt that *planning with the special education teacher* was a top priority and 69.0% were engaging in that activity (see Figure 17). However, the activity receiving the next highest number of votes, a *workshop or conference on special needs accommodations for science class*, was needed by 64.7% of teachers and only experienced by 5.3%. That is the greatest disparity within any PD category listed. Also unsatisfactorily met was the need for *observing colleagues*.

Twice as many teachers who have participated in that activity feel that it is needed (25.7% versus 50.0%). Although less commonly needed, attending a *workshop or conference on special needs accommodations in general* and taking a *postsecondary course in science* showed similar relationships between the proportion of respondents who felt they were needed and the proportion actually experiencing these activities.

In some cases, the expressed need for a professional development activity was less than the participation rate. The proportion of respondents who participated in reading professional literature, taking a postsecondary education course, mentoring another teacher, conducting research, and reading blogs was smaller than the proportion that listed those among their top three needed activities. Although 17.0% of teachers reported that they had taken a course in education, just 11.5% indicated that an education course was a priority. Conversely, only 4.7% of teachers took a science course, yet 15.1% rated a science course in their top three needed activities.

A cross analysis comparing the overlap between respondents who are experiencing and perceiving a need for each PD category adds further data about this relationship. If the respondents who have experienced a certain type of PD also identified it as needed, then the conclusion would be that the PD activity was valuable because those teachers wanted to repeat the experience. Similarly, if the respondents who identified a needed PD category also participated in that category, then it can be concluded that the PD need was, at least quantitatively, satisfied. This cross analysis reveals that there is high variation in whether respondents' perceived needs have been valuable and satisfied.

Of the teachers who had attended a *workshop or conference on special needs accommodations for science class*, 55.6% also ranked that event in their top three needed professional development activities from the list provided. Of those who participated in a *workshop or conference on special needs accommodations in general*, 33.3% expressed a need. This relationship was strongest for *planning with the special education teacher* (72.9%) and *observing colleagues* (68.2%), indicating that the majority of teachers who expressed a need for each activity have been able to participate. The smallest overlap between those participating and those needing a particular event was seen in the *postsecondary course in education*. Taking a postsecondary science course was much more valuable to teachers, with 37.5% of those who experienced it also listing it as needed.

Reversing the overlap analysis shows the level of satisfaction teachers feel with their professional development (see Figure 18). That is, by quantifying the teachers who ranked a certain PD activity in their top three needed activities and examining whether those teachers have actually participated in that activity, teachers' contentment with the availability of a particular PD category may be ascertained. This analysis reveals that just 4.8% of teachers who highly rated a *workshop or conference on special needs accommodations for science class* have actually attended one. A greater proportion, yet still less than one-fifth (17.5%) of respondents who indicated a need for a *workshop or conference on special needs accommodations in general*, had participated in such an activity. Also unsatisfactorily met was the need for a *postsecondary course in science*, which only 10.0% of respondents who ranked it highly have actually completed. Teachers were more satisfied with their ability to plan with the special education teacher

(72.3%), but the next most common fulfillment of a need was *reading professional education literature*, which benefitted just 47.8% of teachers.

The basic comparison of needed and experienced professional development activities relating to students with special needs, and the overlap analyses, illustrate that the majority of teachers' PD needs are not being met. Teachers clearly expressed their desire for workshops or conferences on special needs accommodations, science courses rather than education courses, and a continuation of productive activities such as planning with the special education teacher.

### **Targeting professional development.**

Teachers describe ideal professional development as being specifically applicable to their grade level and subject. In order to determine whether these or other teacher characteristics correlate with a lack or excess of a particular category of PD, or with an especially strong need for a particular category, it is pertinent to compare such characteristics with the ratings of PD needs and participation.

Analyzing professional development by grade level taught points to disparity between teachers of freshmen and all other teachers. Respondents who teach at least one freshman course were more likely than teachers of other grade levels to feel they needed a *workshop or conference on special needs accommodations for science class* (68.3%), but at a participation rate of 2.4% they were the least likely to have experienced that activity. The same relationship is evident between freshman teachers and a *workshop or conference on special needs accommodations in general*; 22.1% listed it in their top three needed events, but just 8.5%, a lower proportion than any other cohort of grade level

teachers, had participated. Freshmen teachers were also most likely to *read education blogs* at 15.9%, but were least likely to feel they needed that activity (1.9%).

Scrutinizing professional development with regard to age range exposes important implications, especially for younger teachers. Only two teachers in the 18 to 24 age range responded, so that sample will not be considered. Respondents between ages 25 and 30 indicated more often than any other age group, 83.3% versus about 62% for other age groups, that they needed a *workshop or conference on special needs accommodations for science class*, yet not a single teacher in that range had attended such a conference. This relationship was repeated with the need to observe colleagues. Once again, the greatest proportion of teachers needing this activity, 61.6%, were between ages 25 and 29, but the smallest proportion of that group, 15.4%, had that opportunity. The greatest need for mentoring was among the respondents between ages 40 and 49, at 24.1%, but only 5.4% had been a mentor during the past year.

*Planning with the special education teacher* has proven to be one of the most highly desired and practiced forms of professional development. However, just 46.2% of teachers in the 25 to 29 age range have engaged in this activity compared to 69.0% of the entire sample. Teachers within that age range rated *planning with the special education teacher* highly more often than any other age range (77.8%). At the other end of the age spectrum, 10.0% of respondents ages 60 and older rated a *postsecondary course in science* in their top three most needed activities, but zero had taken a course. Instead, 12.5% had taken an education course for which only 5.0% indicated a need.

Examining school type demonstrates that there are some professional development activities which may be more aptly suited to teachers in different settings.

Although the proportion of teachers at private schools ranking the need for *observing colleagues* highly (35.7%) does not measure up to the proportion actually participating in this activity (47.1%), it is higher than the proportion of public school teachers engaging in observations (24.4%). Conversely, *planning with the special education teacher* was an activity reported by 70.5% of public school teachers and just 50.0% of private school teachers, suggesting that these two environments may emphasize different styles of collaboration. But private and public school teachers both ranked *planning with the special education teacher* among their top needs, with 70.6% and 68.5% of respondents agreeing, respectively.

Inspecting professional development differences between science disciplines did not show many differences. General science teachers were more likely to feel they needed to conduct *individual or collaborative research*, but they were also the group participating the most in that category. Environmental science teachers expressed a great need for *planning with the special education teacher*, with 79.4% ranking that activity in their top three.

*Rank the following professional development topics from most needed to least needed: assessment, general adaptations for students with disabilities, classroom management, state and national science standards, facilitating laboratory activities, science content, adapting science class for students with disabilities, developing curriculum, teaching inquiry-based science.*

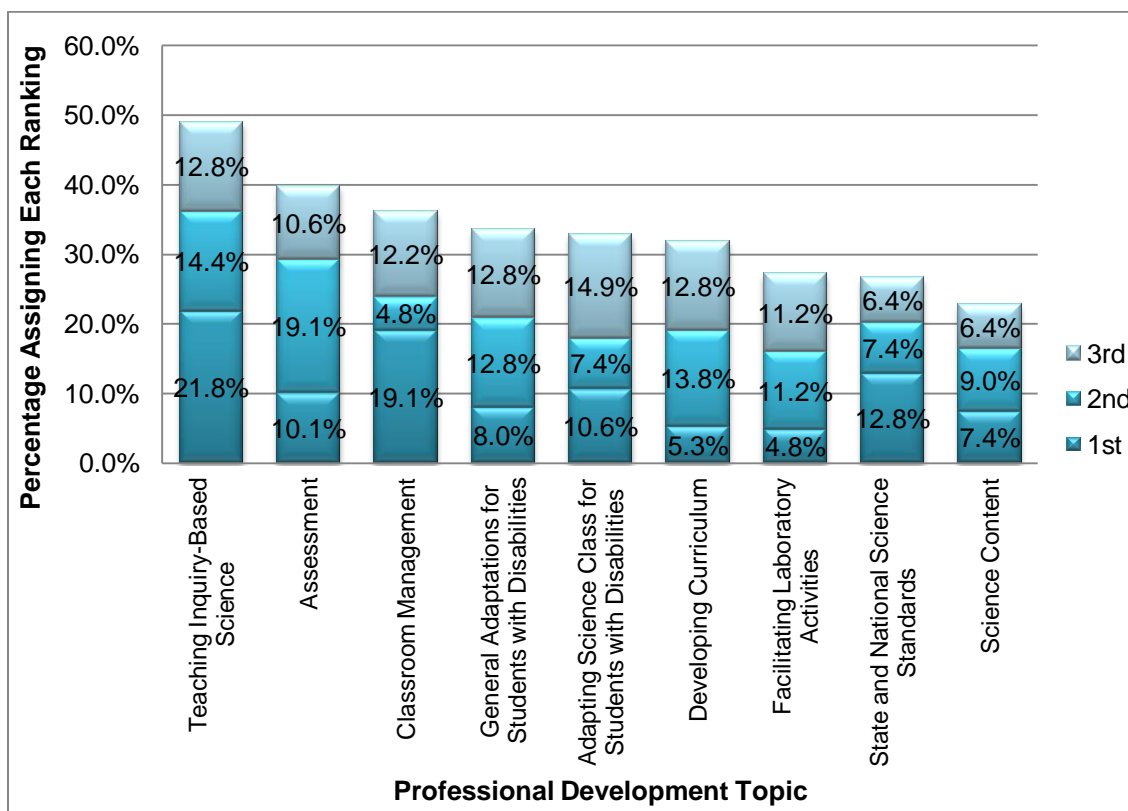


Figure 19. Secondary science teachers' most often first, second, or third choice forced rankings of needed professional development topics from most needed to least needed.



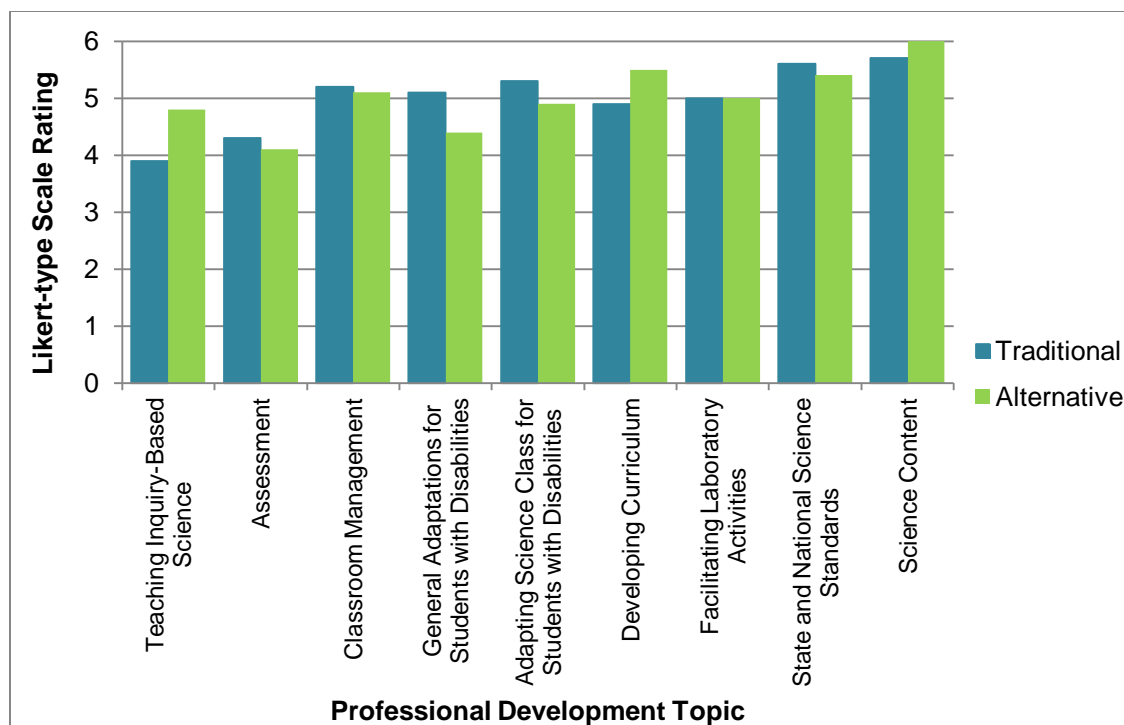


Figure 20. Traditional and alternative route secondary science teachers' forced rankings of needed professional development topics using a Likert-type scale, with lower scores indicating a higher need.

Respondents were asked to position nine items in a forced-rank order question according to their needs for professional development, from the topics in which they most needed professional development to the least. Seven were pedagogical topics for the science classroom and two were directly related to teaching students with special needs. The rank order reveals the importance with which teachers regard professional development for special needs issues versus other teaching issues. *Teaching inquiry-based science* was moved to the top of the list by a plurality of teachers, 21.8%. Receiving the next most frequent number one votes were *classroom management* (19.1%) and *state and national science standards* (12.8%). *State and national science standards* also received the most 9<sup>th</sup> place votes (21.8%).

Taking the top three list positions into account as a block presents a different view of teachers' rankings (see Figure 19). The topic of *teaching inquiry-based science* was still at the top of the list with 49.0% of teachers assigning it first, second, or third most important, but the next highest number of 1<sup>st</sup>, 2<sup>nd</sup>, and 3<sup>rd</sup> designations went to *assessment* (39.8%) and *classroom management* (36.1%). Using this same method, *science content* received the fewest top designations (22.8%), as well as the most placements in the 7<sup>th</sup>, 8<sup>th</sup>, and 9<sup>th</sup> most important spots (45.8%). *Assessment* was least often put in the last three spots, with just 17.5% of respondents making that decision, followed by *facilitating laboratory activities* (29.3%).

When the responses are in the form of a 9-point Likert-type scale (lower numbers represent higher priority) and the mean rank is calculated for each category, the most needed professional development topic is *assessment* with a score of 4.2, closely followed by *teaching inquiry-based science* at 4.3. *Science content* scores the lowest at 5.8 and *state and national science standards* scores 5.5.

This forced ranking pointed toward a larger difference in professional development needs between traditionally and alternatively trained teachers than did the previous two questions. In terms of the priority for special needs PD, traditionally and alternatively trained teachers ranked *adapting science class for students with disabilities* in their top three at a similar rate of 31.1% and 34.5%, respectively. Although these percentages are close, using the Likert-type scale calculated from each category's mean rank shows that *adapting science class for students with disabilities* was seventh most important for traditionally trained teachers and fourth most important for alternatively trained teachers (see Figure 20). *General adaptations for students with disabilities* was

also a more important category to alternatively trained teachers. Of that group, 43.2% rated it within their top three needs, a greater percentage than resulted in any other category. Using the Likert-type scale it was designated as the second most needed category, compared to just 28.4% of traditionally trained teachers who ranked it as their fifth most popular choice. Using both the Likert-type scale and the top three rank positions as an aggregate for each category, alternatively trained teachers were more concerned than traditionally trained teachers with their need for special education professional development.

Disparity is also evident between the two groups when it comes to the pedagogical topics *developing curriculum* and *teaching inquiry-based science*. In both cases, traditionally trained teachers were more likely to position those categories in their top three needed professional development topics, with 34.0% of traditionally trained teachers doing so for *developing curriculum* versus 28.3% of alternatively trained teachers, and 51.9% versus 43.2% doing so for *teaching inquiry-based science*. *Teaching inquiry-based science* was ranked most needed by traditionally trained teachers using the Likert-type scale, and *developing curriculum* was third. Alternatively trained teachers felt that both topics were less important, ranking *teaching inquiry-based science* third and *developing curriculum* eighth.

### **Summary**

The survey results are the product of a 29.5% response rate from the target respondents. It was found that integrated instruction on teaching students with disabilities was perceived as more helpful to teachers than the required “exceptional students” course. There was negligible difference in the topics covered in traditional and alternative

programs. A greater number of teachers had past personal experience, but professional experience was rated as more helpful. Alternatively trained teachers were more likely than traditionally trained teachers to have past personal and professional experience working with students with disabilities. Alternatively trained teachers were also more likely to have initially felt prepared to accommodate students with disabilities in every category surveyed. Professional development needs differ by age range, school type, and somewhat by certification route, and the majority of those needs are not being met. This data provides sufficient evidence with which to make inferences about appropriate preparation and professional development components to help Maine science teachers effectively instruct students with disabilities. The final question on the survey provided a text box for any additional comments. Those comments, interpretations of the results, and recommendations will follow in the “Discussion” section.

## Chapter 5

### DISCUSSION

#### **Are Traditionally Trained Secondary Science Teachers in Maine Better Prepared Than Alternatively Trained Teachers to Instruct Students with Disabilities?**

This research question addressed an issue which is causing controversy as alternative route programs proliferate: which certification route better prepares teachers for the realities of managing a diverse classroom? This study investigated the possibility that traditionally trained teachers substantially benefit from comprehensive integrated instruction on teaching students with disabilities throughout their education programs, and consequently feel more prepared in a range of classroom contexts. In this view, alternatively trained teachers would not have received as much sustained integrated instruction on classroom management, assessment, psychology, and other concepts included in traditional programs. Therefore, they would feel less prepared to apply principles for teaching students with disabilities in real classroom situations.

The results show that alternatively trained Maine secondary science teachers initially felt more prepared than traditionally trained teachers to accommodate students with special needs in every category surveyed. Without considering the effect of integrated instruction, it appears that the answer to this research question is that traditionally prepared teachers do not feel better prepared to instruct students with disabilities. However, it is useful to know if receiving integrated instruction was the factor that made the difference. Since similar proportions of traditionally and alternatively trained teachers took a “teaching exceptional students” course, and there

was almost no difference in the subjects which were taught to each cohort, those factors should not have an appreciable impact on the effect of integrated instruction.

As was expected, a greater proportion of traditionally trained teachers received integrated instruction during their certification programs. Yet, when examining just the teachers who had integrated instruction, the gap between the proportions of traditionally and alternatively prepared teachers expressing feelings of initial preparedness widens further than was evident in the overall sample. The “Results” section noted that this difference was greatest in preparation to engage students with disabilities in science class. The large disparity when it comes to engaging students in science may be due, in part, to alternative teachers’ interest (and perhaps knowledge) in their subject area, leading to greater enthusiasm. Many alternatively trained teachers have degrees in their subject area, indicating a dedicated focus to the subject, whereas education majors chose to make the subject a component of their studies.

This analysis shows that integrated instruction does indeed have a positive effect on teachers’ initial feelings of preparedness, but not as strongly for traditionally trained teachers. Alternatively trained teachers who received integrated instruction feel better prepared to instruct students with disabilities. There is evidence that the sustained comprehensive instruction characteristic of traditional education programs has a positive effect on feelings of preparation; however, this only applies to general preparation unrelated to teaching students with disabilities.

One survey respondent added a comment about the lack of value in the mandatory “teaching exceptional students” course, positing that the demand “has created a market for some pretty terrible courses.” This supports the idea that pre-certification teachers

should be receiving integrated instruction in addition to the basic course. A second teacher expressed a sentiment which represents the ideal mindset for teachers when they enter the classroom: “Although there are many students with identified disabilities. . . , the accommodations needed by most of these students fall within the range of what I would call ‘good teaching.’” The point of integrated instruction should be to inure teachers to making accommodations in any classroom context as a principle of “good teaching,” rather than make it a hardship from insufficient preparation.

An issue which emerges from the survey results is the overall feeling of a lack of preparedness for instructing and accommodating students with disabilities among all teachers. Although alternatively trained teachers felt more prepared, the rate at which they felt *somewhat prepared* or *very prepared* was unsatisfactorily low in some categories, particularly those referring to making accommodations. For example, accommodating students with physical disabilities in science received less than one-third of positive responses. This is more concerning than the difference between the self-reported preparedness of traditionally and alternatively trained teachers because neither certification route is adequately preparing teachers to make substantive modifications. The survey results offer one possible explanation for this lack of confidence in these teachers’ preparedness: the infrequency with which the topics of adapting the physical environment and assistive technology were included in teachers’ pre-service education. These are not topics that should be overlooked during science teachers’ training.

Every teacher education program, traditional and alternative, should expand its coverage of topics so science teachers are prepared to make substantive changes in the classroom and laboratory. Assistive technology will become ever more important as the

trend toward inclusion demands more devices for easily involving all students. Competence in adapting the physical environment is especially important for science teachers since the classroom laboratory introduces a range of potential barriers to inclusion that require different accommodations and strategies than seatwork. Teachers need to be familiar with both technological tools, such as talking calculators and modified microscope eyepieces, and innovative “low-tech” adaptations, such as using plastic squeeze bottles in place of glassware. The University of Washington’s DO-IT Center (Disabilities, Opportunities, Internetworking, and Technology) provides excellent information and strategies for science laboratory accommodations on its AccessSTEM website (<http://www.washington.edu/doi/Stem/>). Assistive technology and environmental adaptations could be covered in the curriculum easily if they were incorporated with learning specific strategies for teaching science to students with disabilities. The most appropriate venue for addressing these topics is in the science methods course that is required for all pre-service Maine science teachers, whether traditionally or alternatively prepared.

Science methods courses taught at institutions with special education teacher preparation programs should take advantage of the resources in that department. One feasible arrangement is to combine future science and special education teachers for a segment of the methods course during which the two groups could concurrently learn strategies for teaching science to students with disabilities. This would be especially advantageous if the science methods instructor lacks knowledge of special needs accommodations. The pre-service science teachers could learn how to take on responsibilities which they otherwise may have expected the special education



department to perform, and the pre-service special education teachers could gain a firmer grasp on which accommodation skills will be most applicable in science classes. This design also prepares both groups to work successfully with each other when they are teaching in schools, whether the school has an established co-teaching model or if teachers must initiate their own inter-departmental partnerships. Subject-specific instruction on teaching students with disabilities will give pre-service teachers the confidence and ability to instruct *all* of their students in science, a fundamental duty that is being overlooked in current teacher education programs.

**Do Alternatively Certified High School Science Teachers Bring Unique Strengths for Teaching Students with Disabilities to the Teaching Profession Due to Previous Experiences?**

This research question considered the possibility that alternatively trained teachers possess superior skills in working with students with disabilities because they generally have previous personal or professional experience in addition to the “teaching exceptional students in the regular classroom” course. Traditionally trained teachers are more likely to have entered their teacher education program directly after high school, permitting little time to accumulate hands-on experience. Alternative route programs are often touted as a means to bring knowledgeable professionals into the classroom to teach shortage subject areas, but whether that profitability extends to teaching students with special needs may be influenced by past experiences.

The results have already shown that alternatively trained teachers felt more prepared initially to instruct and accommodate students with disabilities. They are also more likely than traditional route teachers to have prior professional and personal

experience. Having more extensive previous experience may be a contributing factor to the greater feelings of preparedness among alternatively certified teachers; however, the difference in the depth of which traditionally and alternatively trained teachers reported having previous experience does not appear to be significant enough to produce such a large gap in feelings of preparedness.

It is important to consider the quality of past experiences in teaching students with disabilities when determining whether teachers are likely to transfer those skills to the classroom. No more than about one-third of respondents reported that their prior professional and personal experiences were anything other than *very helpful* or *somewhat helpful*; alternatively trained teachers noted having particularly positive experiences. From these results, it appears that most teachers benefit from prior experience teaching students with disabilities, and this is especially true for alternatively trained teachers due to their more extensive and more helpful experiences.

Many additional comments at the end of the survey specified that experience is more valuable than any course for learning to teach students with disabilities. One respondent conclusively wrote, “I have a masters degree in special education and most of those classes were not all that helpful for teaching science to students with disabilities! Student teaching was worth more than all the classes put together.” A number of teachers referred to using the “trial and error” approach to develop strategies over years. One comment sums up the overall sentiment: “The most significant way to learn ANYTHING about teaching is to do it.”

The significant value teachers place in their experiences working with students with disabilities verifies that it would be overwhelmingly beneficial to give pre-service

classroom teachers more applied special needs training. Both traditional and alternative teacher education programs incorporate practica during which pre-service teachers are placed in classrooms to participate at varying levels. Depending on the placement, a pre-service teacher may or may not work with students with disabilities or observe the teacher planning or implementing accommodations; the most efficient accommodations can be invisible to the pre-service teacher unless he or she directly asks about or is told of them. These practica should be undertaken with a partial focus on learning techniques for instructing students with disabilities. Confidentiality is easily maintained by omitting names and by speaking in terms of accommodations for certain learning needs rather than for specific disabilities (e.g. for a visual learner instead of a student with dyslexia).

The positive feedback from both traditionally and alternatively certified teachers about their prior experiences validates the recommendation to teach inclusion principles in an authentic environment. At best, teacher education institutions should set up additional placements in dedicated inclusion classrooms or resource rooms where pre-service teachers can learn from proficient classroom and special education teachers. At the very least, the existing arrangement provides an opportunity to designate a portion of pre-service teachers' total practicum time to a special needs setting. Regular immersion in these situations where future teachers can study comprehensive inclusion practices will help overcome the inequalities between those with and without prior personal and professional experience, and prepare all teachers to effectively instruct all students.

**What Kind of Professional Development are Maine High School Science Teachers Currently Experiencing in Teaching Students with Disabilities, and What Kind of Professional Development Do Teachers Think Would Be Most Beneficial?**

This research question aimed to determine how satisfied teachers are with their current professional development activities related to teaching students with disabilities. Educators should be engaging in professional development experiences which match their needs for their classrooms. If this is not the case, then their students with special needs may not benefit from appropriate assistive technology or instructional strategies. As classrooms shift toward total inclusion, it is imperative that teachers continue to learn a variety of methods to ensure that all students can participate. As one teacher prudently noted, professional development should give teachers the skills to “design dynamic learning opportunities that allow for student centered customization while at the same time championing student choice and voice. In this way, all students are able to...develop their skills in a way that best fits them.”

Secondary science teachers are not receiving the professional development experiences that they perceive to be needed. The great disparity between those experiencing and needing a workshop or conference on special needs accommodations for science class, for example, suggests that teachers may be more effective in that area if they received training. Results of other categories, in which there are more teachers participating in an activity than expressing a need for it, imply that a lack of relevance may be contributing to teachers' dissatisfaction with professional development. Emphasis on these areas should be reduced while providing more commonly desired activities.

An apparent trend in teachers' actual professional development activities relating to students with disabilities is that the activities are easily accessible and potentially short-term. The ubiquity of online education literature has facilitated instantaneous access to a worldwide library of relevant information. Teachers do not have to dedicate their attention to a limited selection of journals with year-long subscriptions. Within their schools, teachers are observing colleagues and planning with the special education teacher during the school day. The immediacy of results in these situations can be compared to longer-term activities such as taking postsecondary courses or attending workshops, both of which require more planning and tend to offer more general information than one-on-one collaboration or internet searches for specific resources.

Despite the high rate of participation in such accessible and short-term professional development activities, teachers clearly want other options. The need for workshops and conferences focusing on students with special needs is not being met. Although these activities require more time to implement and produce results, they may be conveniently located in an individual's district or school. It would be well worth organizing an event that gives science teachers skills for accommodating students within their subject because of the overwhelming need reported in the survey.

Other discrepancies between needed and experienced professional development for teaching students with special needs have simple solutions that can be implemented once the need is identified in a school. Teachers in the 25 to 29 age range have the greatest need to observe colleagues, and teachers in the 40 to 49 age range have the greatest need to be mentors. Pairing teachers within these two age ranges in mentor-mentee relationships would provide each with a professional development experience

which they rate highly. Another easy resolution only requires giving teachers the option to take a postsecondary science course rather than an education course, if they should so choose. It is possible that the pressures of the profession persuade science teachers that an education course would be more appropriate; perhaps one's district will only subsidize an education course. Whatever the reason, teachers are more often taking education courses when they feel that science courses would be more effective.

Finally, the popularity of planning with the special education teacher implies that teachers need more time to dedicate to this activity. Encouraging such collaboration where it does not exist and providing structured time during the school day in which the planning can take place require modest effort on the parts of teachers and administrators. Sufficient planning for resources, instructional strategies, and accommodations between the science teacher and special educator may be the difference between a student's ability and inability to participate in a laboratory activity.

Additional comments by survey completers support the quantitative results that stress the value of planning with the special education teacher. One teacher wrote, "My best resource is the special Ed [*sic*] teachers in my building. We work together to do our very best for the kids." Another teacher felt that there are too many disabilities to learn about from one "teaching exceptional students" class, so "the best [solution] is to have a strong special education department to help you through those cases." At least one respondent felt that it is only right that "the special ed teacher should work in conjunction with classroom teachers to help students on their case load" because a science teacher is "not an expert in the field, yes we have training but I wouldn't want an [E]nglish teacher

teaching my chemistry class, and we have 90 vs. 30 students to be working with.” For a number of reasons, science teachers value collaboration with special education teachers.

The survey results can be used to identify the most effective and desirable types of professional development for teaching students with disabilities for teachers who fit various profiles. Grade level, age range, and school type provide guidelines for offering the most useful and satisfying professional development experiences. For example, private school science teachers are less likely than public school teachers to plan with the special education teacher, so those schools may find that encouraging collaboration would increase satisfaction with professional development activities.

This study also provides evidence to support professional development in other aspects of science teaching. Teachers indicated that training in teaching inquiry-based science, assessment, and classroom management were needed as much as, if not more than, professional development related to instructing students with disabilities. All schools should find out what activities teachers have experienced, what activities they need, and what activities are effective in order to deliver pertinent information and serve all students to the greatest degree possible.

### **Do Perceptions of Needed Professional Development Differ Between Traditionally and Alternatively Certified Maine High School Science Teachers?**

This research question aimed to determine whether different types of professional development for teaching students with disabilities should be provided to teachers based on their route to certification. Contrasts between the perceived needs for professional development of traditionally and alternatively trained teachers could be due to pre-certification components such as instruction or experience, individual interests such as an

emphasis on students versus subject area, or cultural factors such as support in the school environment. Of course, there is variation within each route to certification and within specific programs, not to mention differences from person to person. However, the analysis is meant to look for trends that may be characteristic of the traditional or alternative certification route.

As shown in the “Results” section, there is little variation between the professional development needs of traditionally and alternatively trained teachers based on the survey of teachers’ top three needed activities. It has already been established that teachers should have the chance to take postsecondary science courses rather than education courses, and this analysis emphasizes that the option is particularly appropriate for alternatively trained teachers. Other categories did not show enough disparity to warrant targeting teachers from one certification group for a certain professional development event; all teachers would benefit from the adjustments to the activities previously discussed.

The results from the rank order question about teachers’ professional development needs show divergence between traditionally and alternatively certified teachers in terms of the importance they place on professional development for instructing students with disabilities versus general pedagogical topics. Alternatively trained teachers feel that they need more professional development in accommodation skills; they ranked both options dealing with students with disabilities as more important than traditionally trained teachers ranked either option. This indicates that the proportion of professional development allotted to topics about teaching students with special needs should be increased for alternate route teachers in particular.



Traditionally trained teachers have concerns about pedagogical issues specific to science class which they feel are more imperative than special needs professional development. The Likert-type scale which showed these needs in relation to other pedagogical and content professional development categories revealed that the two disability categories, *general adaptations for students with disabilities* and *adapting science class for students with disabilities*, were fifth and seventh most important, respectively, out of a list of nine. However, alternatively trained teachers clearly want to make special needs professional development a priority. They ranked those two categories second and fourth most important, respectively, and the former was ranked most important when considering how often it was ranked in the top three positions.

Districts and administrators should consider the relative representation of traditionally and alternatively trained teachers employed when determining professional development content. High incidences of alternatively prepared teachers warrant particular emphasis on learning skills for instructing students with disabilities, but topics within this category would be beneficial to all teachers, regardless of certification route. Traditionally prepared teachers' needs could be simultaneously accommodated by addressing these skills within the context of the science classroom.

### **Limitations**

There are limitations to the survey and the study. First, the respondents represent a sample of Maine secondary science teachers. Although I made an attempt to reach the entire population with an initial email and two reminder emails, the response rate was 29.5%. The resulting data are representative of all Maine secondary science teachers only as far as the sample reflects the population. The survey format is also a possible factor in

the response rate. SurveyMonkey is often the survey program of choice. I was unsure of how Qualtrics would compare in terms of ease of use since it has not been widely used by many University of Maine departments thus far. My advisor and I estimated that the response rate with SurveyMonkey would be about 20% based on previous experiences with that service. I can only estimate the degree to which the survey format positively or negatively affected the response rate, but in this case, Qualtrics surpassed our expectations for SurveyMonkey.

Second, a survey cannot ask every appropriate question or address every possible option or category that might fit a participant's response. Teachers who did not see a desirable answer for a question may have chosen to give no response or to select the answer that fits most closely. Either of these scenarios would have an effect on the raw data that could change how those results are interpreted. However, the questions and answer choices were based on a review of relevant literature and competently attempted to anticipate the probable responses.

Third, it became apparent after analyzing the data that one more statistic would have allowed me to draw further conclusions about the differences between traditionally and alternatively certified teachers. I should have included a question to help determine the age at which respondents earned initial certification, either by asking directly or by surveying the number of years they have been teaching and their current age. It would still be possible to categorize teachers by age range if they provided a single number, although some respondents may be uncomfortable giving a specific age. This piece of data about the age of initial certification could have confirmed that many alternatively trained teachers entered the profession as a second career, as the literature indicates, and

revealed whether there is a correlation between the number of years spent in a previous career and feelings of preparation to teach students with disabilities.

Fourth, the survey questions with options falling along a continuum (e.g. *very unhelpful, somewhat unhelpful, neither helpful nor unhelpful, somewhat helpful, very helpful*) introduced more ambiguity to the results than was intended. The data would have been more revealing if teachers were forced to quantify their experience and preparation with preference toward one extreme or the other. The middle options wasted data in that they did not provide much information about the teachers who selected them. In future surveys, I will consider only offering options on a continuum that reflect a decision leaning toward one direction or the other rather than allowing respondents to choose non-descriptive options.

Fifth, the survey does not take into account the reality that Maine secondary science teachers comprise a diverse and dynamic group. The results and analyses which apply to the current cohort of teachers may not be applicable to future generations of teachers or to those in atypical situations. Interpretation must be limited in time and scope.

Sixth, this study used teachers' self-reports of preparedness, which may differ from their real preparedness and performance in the classroom. Measuring actual preparedness would have required methods beyond the capacity of a survey. Consequently, the survey results do not provide information beyond the validity of teachers' perceptions to determine whether they were truly prepared.

Finally, the study confronts a unique problem since Maine does not have true alternative teacher certification *programs*; the State Board of Education only recognizes

an alternative *route* (i.e. transcript review; see “Introduction” page 1). Thus, the comparisons drawn between alternatively prepared teachers in Maine versus those in other states are not completely parallel. Some states, including Maine, report their alternative routes synonymously as programs, adding to the diversity of those falling into the category of “alternatively certified.” The topic of this study would be worth revisiting after formal alternative certification programs have been implemented in Maine.

### **Conclusion**

One of my goals when I began this thesis project was that the research would contribute to my future profession, and I believe that both the process and the final product have achieved that goal. Not only do the findings add to our understanding of Maine secondary science teachers’ perceived strengths and weaknesses in teaching students with disabilities, but I believe that the survey prompted science teachers to reflect on the importance and complexity of including all students in their classes. It was clear from the additional comments at the end of the survey that science teachers have strong feelings about the overall lack of preparation for this responsibility. Addressing the issue of effectively instructing students with special needs has hopefully encouraged teachers to be more conscious of their professional development needs and the needs of younger teachers for whom they could be mentors.

Systemic changes that attend to teacher training can normalize the perception of teaching science to students with disabilities as “good teaching.” The Maine State Board of Education is currently expanding its alternative route options for certification, but these only go as far as requiring that a post-secondary institution and a school district form a partnership to educate and advise the pre-service teacher. It appears that they do

not intend to facilitate organized programs. The new certification options are a step in the right direction; this much-needed update to the process will make the teaching profession more accessible for people who are already involved in education or who hold an advanced degree. However, alternative certification programs would be ideal for Maine citizens because future teachers would not have to manage the certification process independently. With such a geographically wide population spread, and few central locations for education programs, pre-service teachers would be part of a statewide network that could provide support and guidance whether a teacher candidate is in York or Madawaska. Although the State Board of Education has decided not to establish formal programs, post-secondary institutions, school districts, and private organizations all have the option of doing so.

I predict that alternative certification programs will soon be offered in Maine. Pressure from the federal government and innovative program models in other states will convince some entity to coordinate a program, perhaps aimed at supplying teachers for rural schools or attracting ethnically diverse educators. At that point, it will be important to know if alternative routes to certification are still preparing teachers more effectively to make special needs accommodations in science. Even before programs are established, further research on the current community of science teachers to ascertain which specific disabilities received the most attention during their training would be valuable. It would also be interesting to survey teachers about their past careers to determine which skills are most transferrable to their responsibilities for special needs in the classroom. Teachers of subjects other than science would benefit from this same type of analysis about preparation and professional development needs for teaching students with

disabilities. The issue is unlikely to exist only among science teachers; continuing education on inclusion practices could serve as a school-wide project for the benefit of all students.

Full inclusion challenges teachers to be more creative and compassionate each time they encounter a student with a unique learning need. Those who stay in the profession long enough will develop strategies that far exceed the depth and breadth of instruction they received during training. But more of these strategies can and should be developed before teachers are put in the position of learning by “trial and error.” Teacher education institutions espouse the value that all students can learn and endeavor to produce teachers who believe as much, but to learn students must participate, and teachers are responsible for facilitating participation. Teacher education programs, schools, and individuals all must contribute to preparing teachers who will enter the profession ready to engage with classroom realities.

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## **Appendix A**

### **Informed Consent**

This survey is a component of the research for an Honors thesis project being conducted by Haley Richardson at the University of Maine under the supervision of faculty sponsor John Maddaus. This thesis will explore the preparation and professional development needs of Maine high school science teachers to teach students with disabilities, with a specific focus on the method of teacher certification. Data will be used to analyze the effectiveness of different certification routes and types of professional development.

### **What Will You Be Asked to Do?**

If you decide to participate, you will be asked to voluntarily complete an online survey which may take approximately 15 minutes. You may stop at any time or skip questions you do not wish to answer. Identifying information, such as your district of employment, is requested as a means of comparing data based on teachers' locations (i.e. rural vs. urban) and type of school.

### **Risks**

There are no risks to you for participating in this study other than the time and inconvenience of completing the survey.

### **Benefits**

While there is no direct benefit to you, the results of this study may provide information about appropriate professional development to Maine teachers.

### **Confidentiality**

You are asked to complete an online survey on Qualtrics which uses a secure server. Your school district of employment is requested in order to compare data based on

teachers' locations (i.e. rural vs. urban) and type of school. The survey results will be stored in a password protected folder on the University of Maine server and on the secure Qualtrics server, which will only be accessible to the principal investigator. Your survey responses will be associated with your email address in the Qualtrics system, but no identifying data will be used in any publications. The data will be destroyed when analysis is complete by the end of 2012.

### **Voluntary**

Participation is voluntary. If you choose to take part in this study, you may stop at any time without penalty. You may skip any questions you do not wish to answer. Return of the survey implies consent to participate.

### **Contact Information**

If you have questions about the thesis project, please contact principal investigator Haley Richardson at [haley.richardson@umit.maine.edu](mailto:haley.richardson@umit.maine.edu) or (207) 214-8322, or faculty sponsor John Maddaus at [john.maddaus@umit.maine.edu](mailto:john.maddaus@umit.maine.edu) or (207) 581-2429. If you have questions about your rights as a research participant, please contact Gayle Jones, Assistant to the Protection of Human Subjects Review Board, at 581-1498 or [gayle.jones@umit.maine.edu](mailto:gayle.jones@umit.maine.edu).

### **Follow this link to the Survey:**

{!://SurveyLink?d=Take the Survey}

Or copy and paste the URL below into your internet browser:

{!://SurveyURL}



## Appendix B

## Institutional Review Board Approval

APPLICATION FOR APPROVAL OF RESEARCH WITH HUMAN SUBJECTS  
Protection of Human Subjects Review Board  
114 Alumni Hall, 581-1498

PRINCIPAL INVESTIGATOR: Haley Richardson  
 EMAIL: haley.richardson@maine.edu TELEPHONE: 207.214.8322  
 CO-INVESTIGATOR(S): N/A  
 FACULTY SPONSOR (Required if PI is a student): John Maddaus  
 TITLE OF PROJECT: Classroom Realities: A Comparison of Maine's Traditionally and Alternatively Certified  
 Secondary Science Teachers' Professional Development  
 START DATE: January 2012 PI DEPARTMENT: Education  
 MAILING ADDRESS: 5707 Balentine Hall, Rm. 323; University of Maine; Orono, ME 04469-5707  
 FUNDING AGENCY (if any): N/A  
 STATUS OF PI:  
 FACULTY/STAFF/GRADUATE/UNDERGRADUATE Undergraduate

1. If PI is a student, is this research to be performed:
- |                                     |  |                          |                        |
|-------------------------------------|--|--------------------------|------------------------|
| <input checked="" type="checkbox"/> | for an honors thesis/senior thesis/capstone? | <input type="checkbox"/> | for a master's thesis? |
| <input type="checkbox"/>            | for a doctoral dissertation?                 | <input type="checkbox"/> | for a course project?  |
| <input type="checkbox"/>            | other (specify)                              |                          |                        |
2. Does this application modify a previously approved project? N (Y/N). If yes, please give assigned number (if known) of previously approved project: N/A
3. Is an expedited review requested? Y (Y/N).

SIGNATURES: All procedures performed under the project will be conducted by individuals qualified and legally entitled to do so. **No deviation from the approved protocol will be undertaken without prior approval of the IRB.**

Faculty Sponsors are responsible for oversight of research conducted by their students. By signing this application page, the Faculty Sponsor ensures that the conduct of such research will be in accordance with the University of Maine's Policies and Procedures for the Protection of Human Subjects of Research.

1/19/2012  
Date

Haley Richardson  
Principal Investigator

John Maddaus  
Faculty Sponsor

\_\_\_\_\_  
Co-Investigator

\_\_\_\_\_  
Co-Investigator

\*\*\*\*\*  
 FOR IRB USE ONLY Application # 2012-01-07 Date received 1/23/2012 Review (F/E): E  
 Expedited Category: \_\_\_\_\_

## ACTION TAKEN:

- Judged Exempt; category Z. Modifications required? Y (Y/N) Accepted (date) 2/2/2012  
 Approved as submitted. Date of next review: by \_\_\_\_\_. Degree of Risk: \_\_\_\_\_  
 Approved pending modifications. Date of next review: by \_\_\_\_\_. Degree of Risk: \_\_\_\_\_  
 Modifications accepted (date): \_\_\_\_\_  
 Not approved. (See attached statement.)  
 Judged not research with human subjects

Date: 1/24/12 Chair's Signature:

Cynthia A. Erdley

10/09

## Appendix C

### Survey

What is your gender?

- Male
- Female

What is your age range?

- 18-24
- 25-29
- 30-39
- 40-49
- 50-59
- 60+

In what school district are you currently employed?

At what type of school are you currently working as a teacher?

- Public
- Private or Academy
- Parochial
- Other \_\_\_\_\_

What subject(s) are you teaching this academic year? Check all that apply.

- Biology/Life Science
- Physical Science
- Physics
- Earth Science

- Environmental Science
- Chemistry
- General Science
- Other(s) \_\_\_\_\_

What grade(s) are you teaching this academic year? Check all that apply.

- Freshmen
- Sophomores
- Juniors
- Seniors

Where were you first certified to teach?

- Maine
- U.S. state other than Maine
- Other \_\_\_\_\_

A traditional certification route is a route to initial certification in which the teacher graduated from a university-approved program with either a four-year undergraduate education degree or a master's education degree. Did you obtain your teaching certificate through a traditional route to certification?

- Yes
- No

An alternative certification route is a route to initial certification through which the teacher held a conditional certificate, targeted need certificate, or certification waiver after a transcript review, but did not complete a university approved education program. Did you obtain your teaching certificate through an alternative route to certification?

- Yes, Independently
- Yes, Through a Program
- Yes, Other \_\_\_\_\_
- No

Did you enter the teaching profession through a program such as Teach for America or Troops to Teachers?

- Yes, Teach for America
- Yes, Troops to Teachers
- Yes, Other \_\_\_\_\_
- No

Did you complete a course on teaching exceptional students in the regular classroom?

- Yes
- No

How helpful was that course in preparing you to teach students with disabilities?

- Very Helpful
- Somewhat Helpful
- Neither Helpful nor Unhelpful
- Somewhat Unhelpful
- Very Unhelpful

Was instruction on teaching students with disabilities integrated into your other education classes?

- Yes
- No

How helpful was that integrated instruction in preparing you to teach students with disabilities?

- Very Helpful
- Somewhat Helpful
- Neither Helpful nor Unhelpful
- Somewhat Unhelpful
- Very Unhelpful

Select all of the topics you had exposure to in your general education and/or teaching exceptional students classes pertaining to teaching students with disabilities.

- Assistive Technology
- Adapting the Physical Environment
- Alternative Assessments
- Modifying Assignments
- Strategies for Teaching Science
- Strategies for Teaching in General
- Other \_\_\_\_\_

How much experience did you have in working with students with disabilities prior to earning your initial teaching certificate?

	None	Very Little Experience	Some Experience	Extensive Experience
Professional Experience	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Personal Experience	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

How helpful has your previous professional experience been for teaching students with disabilities?

- Very Helpful
- Somewhat Helpful
- Neither Helpful Nor Unhelpful
- Somewhat Unhelpful
- Very Unhelpful

How helpful has your previous personal experience been for teaching students with disabilities?

- Very Helpful
- Somewhat Helpful
- Neither Helpful Nor Unhelpful
- Somewhat Unhelpful
- Very Unhelpful

In general, how prepared did you feel during your first year of teaching?

- Very Prepared
- Somewhat Prepared
- Neither Prepared nor Unprepared
- Somewhat Unprepared
- Very Unprepared

In your first year of teaching after completing a teacher certification program, how prepared did you feel to

	Very Prepared	Somewhat Prepared	Neither Prepared nor Unprepared	Somewhat Unprepared	Very Unprepared
Differentiate science instruction for students without disabilities?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Engage students with disabilities in science class?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Accommodate all students with disabilities in science?*	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Accommodate students with specific learning disabilities in science?**	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Accommodate students with physical disabilities (orthopedic impairments) in science?***	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Accommodate students with other health impairments in science?****	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Accommodate students with advanced academic skills in science?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Contribute to IEP (Individualized Education Program) and/or	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Section 504 (of the Rehabilitation Act of 1973) meetings?					
---	--	--	--	--	--

\*34 C.F.R. § 300.8(a)(1) states that a “*child with a disability* means a child evaluated in accordance with Sec. Sec. 300.304 through 300.311 as having mental retardation, a hearing impairment (including deafness), a speech or language impairment, a visual impairment (including blindness), a serious emotional disturbance (referred to in this part as ‘emotional disturbance’), an orthopedic impairment, autism, traumatic brain injury, an other health impairment, a specific learning disability, deaf-blindness, or multiple disabilities, and who, by reason thereof, needs special education and related services.”

\*\*34 C.F.R. § 300.8(c)(10) states that a “*specific learning disability* means a disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, that may manifest itself in the imperfect ability to listen, think, speak, read, write, spell, or to do mathematical calculations, including conditions such as perceptual disabilities, brain injury, minimal brain dysfunction, dyslexia, and developmental aphasia....Specific learning disability does not include learning problems that are primarily the result of visual, hearing, or motor disabilities, of mental retardation, of emotional disturbance, or of environmental, cultural, or economic disadvantage.”

\*\*\*34 C.F.R. § 300.8(c)(8) states that an “*orthopedic impairment* means a severe orthopedic impairment that adversely affects a child's educational performance. The term includes impairments caused by a congenital anomaly, impairments caused by disease (e.g., poliomyelitis, bone tuberculosis), and impairments from other causes (e.g., cerebral palsy, amputations, and fractures or burns that cause contractures).”



\*\*\*\*34 C.F.R. § 300.8(c)(9) states that “other health impairment means having limited strength, vitality, or alertness, including a heightened alertness to environmental stimuli, that results in limited alertness with respect to the educational environment, that—

(i) Is due to chronic or acute health problems such as asthma, attention deficit disorder or attention deficit hyperactivity disorder, diabetes, epilepsy, a heart condition, hemophilia, lead poisoning, leukemia, nephritis, rheumatic fever, sickle cell anemia, and Tourette syndrome; and

(ii) Adversely affects a child's educational performance.”

How many students with special needs are you teaching in science class(es) this school year?

How many students with special needs do you regularly make accommodations for in science class(es) this school year?

Select the top three professional development activities you feel would most benefit your ability to teach students with disabilities.

- Workshop or Conference on Special Needs Accommodations for Science Class
- Workshop or Conference on Special Needs Accommodations in General
- Postsecondary Course(s) in Education
- Postsecondary Course(s) in Science
- Observing Colleague(s)
- Planning with Special Education Teacher
- Individual or Collaborative Research
- Mentoring Another Teacher or Student Teacher
- Reading Professional Education Literature

- Reading Professional Science Literature
- Reading Education Blogs
- Other \_\_\_\_\_

Select all of the professional development activities dealing specifically with teaching students with disabilities you have participated in within the last 12 months.

- Workshop or Conference on Special Needs Accommodations for Science Class
- Workshop or Conference on Special Needs Accommodations in General
- Postsecondary Course(s) in Education
- Postsecondary Course(s) in Science
- Observed Colleague(s)
- Planned with Special Education Teacher
- Individual or Collaborative Research
- Mentored Another Teacher or Student Teacher
- Read Professional Education Literature
- Read Professional Science Literature
- Read Education Blogs
- Other \_\_\_\_\_

Rank the following professional development topics from most needed to least needed.

\_\_\_\_\_ Assessment

\_\_\_\_\_ General Adaptations for Students with Disabilities

\_\_\_\_\_ Classroom Management

\_\_\_\_\_ State and National Science Standards

\_\_\_\_\_ Facilitating Laboratory Activities

\_\_\_\_\_ Science Content

\_\_\_\_\_ Adapting Science Class for Students with Disabilities

\_\_\_\_\_ Developing Curriculum

\_\_\_\_\_ Teaching Inquiry-Based Science

Additional Comments

### **Author's Biography**

Haley Richardson was born in Machias, Maine on July 1, 1989 to Doug and Shirley Richardson. She graduated from Shead High School in Eastport, Maine in June 2007. Haley is a member of the Honors College Student Advisory Board, Golden Key International Honour Society, Kappa Delta Pi International Honor Society in Education, Pi Lambda Theta International Honor Society of Educators, Sigma Tau Delta International English Honor Society, and the Student Education Association of Maine. She will graduate from the University of Maine with a major in secondary education (life sciences) and a minor in English in December 2012 after student teaching. Haley worked as a peer tutor in the University of Maine Writing Center and has been a regular volunteer for the Maine Audio Information and Reading Service in Brewer. She aspires to teach science abroad, earn a master's degree, adopt at least one child, and eventually return to Maine.