

Chapter 2 -- Review of Related Literature

The "reality shock" of beginning teachers

Studies of beginning teachers' attitudes and expectations reveal that many beginning teachers have a very positive, perhaps an excessively positive, attitude. This attitude has been termed "unrealistic optimism" by Huling-Austin (1992) and "naive idealism" by Kaufman and McDonald (1992). A study by Weinstein (1988) of teachers about to enter the profession revealed a prevalent belief among the novices that they would face less difficulty than the "average" first year teacher. These teachers emerged from their preservice education believing that teaching was not a difficult job.

However, as Sanford (1988) points out, teaching is a very challenging profession with a frequently non-supportive environment. Encountering this unexpectedly difficult situation can create a condition of "reality shock" (Veenman, 1984) in these optimistic new teachers. One of the respondents to a needs assessment survey by Covert, Williams, and Kennedy (1991) illustrated the situation in vivid terms (p. 9):

... the first year teacher believes that this is going to be a truly enjoyable experience, only, in certain circumstances, to be faced with a pack of hungry animals.

The negative emotional impact of this "reality shock" may cause teachers to focus away from students and onto themselves. Wubbels, Créton, Hooymayers, and Holvast (1982) report that while many new teachers may begin with very idealistic and iconoclastic attitudes, the bad experiences of the first year of teaching may force them to retrench and become more conservative. Karge, Sandlin, and Young (1993) report that novice teachers focus on "self" concerns, revolving around simple professional survival at the start of their first year, and turn to "task" concerns intended to improve their teaching.

Kaufman and McDonald (1992) identify four phases in the attitude of teachers that follow a similar pattern. Teachers in their study began with a picture of themselves as agents of change in students' lives, a stage the authors term "naive idealism." The teachers very quickly change their attitude, however, to focus away from students and onto content and pedagogy. The teachers experienced an eventual re-emergence of their idealism, but only after a difficult period of pessimism and depression. Veenman (1984) notes that if this period of disillusionment persists for too long, teachers may leave the teaching profession altogether, connecting the problem of reality shock to the problem of high levels of beginning teacher attrition. The reality shock may be even more intense for science teachers in many public schools, since they often face unique challenges arising from a scarcity of standard curricula and the possibility of teaching a science subject outside their academic training (Sanford, 1988).

There is some evidence that minor "reality shocks" may occur during preservice programs that have a major component of actual classroom experience. Lederman, Gess-Newsome, and Latz (1994) report that after actual teaching experience commences, student teachers' confidence begins to wane, and their conceptions of teaching change. After a long-term study of prospective teachers over their entire undergraduate education, Zielinski and Preston (1992) observed a series of changes in attitude and focus. During the first two years of school, the future teachers concerned themselves primarily with their own acquisition of content. Possibly as a result of educational theory classes taken during the third year, concerns began to become more student-centered during that year. As the actual classroom teaching experiences of the senior year loomed, however, the undergraduates' concerns shifted back onto themselves. Once they had gotten some teaching experience under their belts, the student teachers gradually shifted their focus back onto their students. Linking this pattern to the findings of Karge et al., (1993) above, we see that this "pendulum" can swing back to self-centered, "survival" concerns once the student becomes a full-fledged teacher.

Wubbels, et al. (1982) propose that preservice education may be partially responsible for reality shocks, in that new teachers may be troubled by a perceived “gap” between the theory they learn in their education classes and the realities of the actual practice of teaching. This sentiment is echoed by Fuller and Bown (1975). However, it is possible that these smaller "shocks" during preservice education can actually be beneficial in the long run, perhaps helping to "inoculate" the prospective teacher against what is to come. Many authors certainly recommend extensive classroom teaching experience during the preservice phase. Koestsier and Wubbels (1995) discuss the success of a two-step introduction to teaching for student teachers in at least partially pre-empting the effects of the reality shock. First, a small group of three student teachers forms a “support group” of sorts, and a cooperating teacher at the school and a supervisor at the university closely supervise the triad. If a student teacher performs well under these conditions, he or she advances into an “Independent Final Teaching Period” lasting 14 weeks. During this time, the student teacher performs all the functions of a regular teacher, with constant, but very “long arm” supervision from school and university personnel. The student teacher is introduced to students as a qualified teacher, has a workload realistic for a full-time teacher, and is monitored from a distance, with no required classroom visits. In general, participants found the experience helpful in lessening or avoiding reality shock. One respondent in the Koestsier and Wubbels study confirmed the experience as a form of inoculation (p. 337): “It’s better to go through two small reality shocks, than one major one you can barely cope with.”

De Jesus and Paixdo (1996) propose that an educational model that includes much classroom experience "should be able to clarify implicit theories and irrational beliefs and to promote the formation of realistic expectations about teaching." Russell (1994) asserts that teaching in the field provides students with a "context" for learning about teaching. Karge et al. (1993) suggest that preservice education follow the pattern of teachers' internal development that they have observed. In other words, preservice programs should focus on "survival skills" at the start, and then move on to issues of content as student teachers become more receptive to such issues. They suggest extensive

classroom-based experience throughout preservice education. Many authors propose that reflection on actual classroom experiences can assist prospective teachers to develop a "pupil-centered" perspective more quickly and efficiently (MacKinnon, 1987; Hacker, 1988; Ginnis & Watters, 1996). This reflection is best begun during preservice education, since stress may hamper the reflection process once full-time teaching has begun (Zielinski & Preston, 1992). Wubbels, et al (1982) stress that preservice education should make student teachers as aware as possible of what will be expected of them, and should present student teachers with strategies for coping with classroom situations. In the end, however, they conclude that some reality shock may be inevitable for all teachers, since the experience of being an independent teacher cannot be simulated in preservice training.

Assessments of teachers' needs

Fuller (1969) and Fuller and Bown (1975) present a developmental framework for the occupational concerns of teachers that has impacted the thinking of teacher educators for almost four decades. They identified four stages in the development of teacher needs and concerns:

1. During the "preteaching" phase, preservice teachers express concerns about their future students. Rather than attributing these feelings to altruism, the authors speculate that since student teachers are not so far removed from being students themselves, they identify more with the students they were than with the teachers they will become.
2. During the classroom phase of student teaching, as well as the first part of full-time teaching, new teachers' concerns focus on "survival skills" such as classroom management and content knowledge. During this time, the "innovative" teaching techniques discussed in preservice education may be abandoned for the security of more traditional and authoritarian methods. Feiman-Nemser (2001) proposes that cooperating teachers during the student

- teaching phase may aid and abet this process by trying to “protect” student teachers from the “radical” teaching strategies of preservice education.
3. When teachers have resolved most of their basic concerns about “survival skills,” they then progress to pondering the quality of their teaching. Concerns shift to issues of optimal time management, quality materials, and subject material mastery. At this point, teachers may scramble to recall alternative teaching techniques from preservice classes, confident now that they can operate from a secure base. Now that they know they can be teachers, they focus on being teachers. However, the focus is still on the self.
 4. Fuller and Bown see the ultimate phase of teacher concerns as very student-focused. Teachers in this developmental phase are comfortable in both survival and the pursuit of professional excellence, so they can afford to be concerned about what their pupils are thinking and feeling. Meeting the individual needs of students becomes a higher priority, whereas earlier in their careers they were focused on getting through the day.

Setting aside the initial naïve preservice phase, these developmental stages can be seen to mirror the progression of Maslow’s (1970) hierarchy of needs, referenced in Chapter 1. At first, teachers are concerned with the occupational equivalent of food, water and shelter: the skills that will allow them to control a classroom and at least give the appearance of a content expert. Brickhouse and Bodner (1992) make the common analogy between throwing someone into water to teach them how to swim, and “throwing” the beginning teacher into the classroom (p. 483): “The sink or swim experience is damaging to beginning teachers, because it forces them to devote time to devising survival strategies rather than designing thoughtful instruction.”

Once these survival needs are met in the teacher’s mind, the focus shifts to those skills that will foster a sense of self-esteem and self-respect, the skills that will promote mastery of the practice of teaching. Only when that self-esteem is on a firm foundation does the teacher feel comfortable in looking outside the self to others, in this case the

students. The evolution of a teacher into a student-centered educator parallels the pinnacle of Maslow's hierarchy: truth, beauty, and aesthetic satisfaction. In a way, the "luxury" of focusing on student needs is for many teachers an elusive consummation, greatly to be desired, but attained by only the most gifted, dedicated, or fortunate.

There is evidence to support the developmental stages of Fuller and Bown. For example, Wubbels, et al (1982) note that teachers' complaints about discipline problems tend to peak about six months into full-time teaching, and then taper off. Loughram (1994) found that during the first year teachers felt a conflict between what their preservice instruction told them they should be doing, and what they had to do to succeed in the classroom. The initial idealism of preservice education was often repressed by the realities of teaching. However, by the second year, concerns about survival issues such as classroom management were largely resolved. The concerns of second-year teachers shifted to issues of time (to prepare lessons and learn / update content knowledge), confidence (to get away from mere knowledge transmission and give students more responsibility), and support (from colleagues and students).

Gilles, Cramer, and Hwang (2001), on the other hand, caution that Fuller and Bown's scheme may be too simplistic. Teachers' concerns are often multilayered, straddling a number of these developmental stages. Teachers can see the interconnection between their survival, their mastery, and the success of their students.

Over the past four decades, several attempts have been made to survey the perceived needs and concerns of teachers, and some of these studies have focused on beginning teachers. Veenman (1984) summarizes the results of 91 studies of the problems of beginning elementary and secondary teachers from the years 1960-1982. Of these studies, 27 dealt exclusively with secondary school teachers, and 36 with elementary and secondary teachers combined. An overwhelming majority of the exclusively secondary studies (23 out of 27) rated classroom discipline as an important concern. Over half of the studies (16) rated student motivation as an important concern. Issues such as dealing

with individual differences between students, assessment of students' work, and dealing with the problems of individual students were also noted as important in many of the studies. The combined studies yielded similar results, with additional concerns emerging regarding relations with parents and organization of class work. Teachers in many of the studies also reported insufficient preparation for the job of teaching. Veenman does not mention any differentiation between the needs of teachers of science and teachers of other subjects in any of the studies he summarizes.

In a more recent study, Covert, et al. (1991) surveyed 57 teachers in their sixth month of teaching in Newfoundland. The teachers were presented with a questionnaire asking them to rate concerns in eight broad categories on a three-point scale from "most important" to "least important." The category most on the minds of the teachers was "classroom discipline," by a substantial margin: 49 out of 57 respondents ranked it as "most important." The authors attempted to give the category a more "positive" connotation by including issues of student motivation, but most teachers, judging by their written comments, interpreted discipline in the more "traditional" sense of classroom order. The next most important category was "student interaction," which encompassed determining student needs and resolving student disputes, with 36 teachers rating it "most important." This was followed by "instructional management," defined to mean planning classroom activities and setting instructional goals, with 31 teachers giving it the highest rating. Of least importance to the teachers were concerns about relating to parents and the community (only 22 votes for "most important") and concerns about their personal communication skills, which received 21 votes for "most important" and 21 for "least important." Also, the categories of "relating to parents and the community" and "personal communication skills" had no written comments elaborating on them from those surveyed, indicating that perhaps the teachers had not reflected much on those issues.

Thomas and Kiley (1994) surveyed 68 middle and high school teachers in a Maryland school district. The teachers were fairly evenly divided among first year

teachers (28), second year teachers (15) and experienced teachers who were new to that particular district (28). Respondents were presented with a list of "concerns and problems," both in-class and out-of-class, and asked to rate their importance on a scale of 1 (not very important) to 4 (very important). The survey results on class-related concerns indicate that major concerns for all the teachers were lesson planning and time spent in preparation and evaluation. The first- and second-year teachers (and especially the first-year teachers) were very concerned with classroom control, management, and discipline. The second-year teachers and the experienced teachers new to the district were concerned with record keeping and administrative matters. Least important to all the teachers were issues of content knowledge, skill in discussions, and their rapport with students.

A few studies have focused on the perceived needs of science teachers. Baird and Rowsey (1989) asked 797 Alabama secondary science teachers at a variety of experience levels to fill out their Science Teacher Inventory of Needs, an instrument describing 54 "need items" and asking teachers to rate their importance on a five-point scale, from 1 (not familiar with this need) to 5 (great need). The respondents ranked the following needs as the most important: motivating students to learn, identifying sources of materials, using computers to teach science, and updating their scientific knowledge in a variety of disciplines. The least important tasks to the teachers were more "mechanical" tasks such as determination of grades, development of single class lesson plans, administration of tests, and record keeping.

Enochs, Oliver, and Wright (1990) surveyed 405 Kansas secondary science teachers at a variety of experience levels. The teachers were asked to rate 16 "concerns" according to their significance, and 15 "needs" according to the amount of assistance they would like from outside sources to meet that need. Both ratings were on a five-point scale, with 1 meaning "not a significant concern" / "no assistance needed," and 5 meaning "a serious problem" / "would like assistance." The teachers did not see significant problems with concerns such as inadequate numbers of textbooks, lack of teacher interest and preparation, and maintaining discipline. To these teachers, serious problems

revolved around lack of student interest and reading abilities, insufficient funding and facilities, and a lack of continuity in science instruction across grade levels. The respondents did not feel that they needed assistance with discipline issues, actual teaching of lessons, lesson planning, and setting instructional goals. They felt the greatest need for assistance with using computers to teach science, learning new teaching methods, obtaining subject matter and instructional materials, and using "hands-on" materials in the classroom.

The results of the more discipline-general studies of Covert, et al. (1991) and Thomas and Kiley (1994) disagree in many places with the science-specific studies of Baird and Rowsey (1989) and Enochs et al. (1990). Teachers surveyed in the more general studies were concerned with issues of discipline and classroom management. They were focused on the "mechanics" of teaching, such as lesson planning, assessment, and record keeping. Such matters were of low priority to the teachers in the science teacher studies. The science teachers were more concerned with improving their teaching through inclusion of computers, new teaching methods, and updated knowledge. The science teachers were also more focused on students, being concerned with students' motivation and reading ability.

Do these differences in priority truly reflect differences in attitude between science teachers and teachers of other disciplines? Better insight is likely found in an examination of the experience levels of the participants in the various surveys, rather than their academic disciplines. The more general studies feature respondents that are at the very least new to their teaching situation; most are new to teaching entirely. By contrast, the science teacher studies are dominated by the voices of highly experienced teachers. Of the respondents in the Baird and Rowsey (1989) survey, over half had more than ten years of teaching experience, and the overwhelming majority (92%) had more than three years teaching experience. Similarly, in the Enochs, et al. (1990) study, 58% of the respondents had 12 years or more of teaching experience. What we are seeing when we are comparing the two groups of studies is likely the contrast between the concerns of

beginning teachers and the concerns of their more experienced colleagues. Seen in this light, the results parallel the developmental scheme of Fuller and Bown (1975) and the findings of Karge, et al. (1993), cited above: beginning teachers tend to focus on self-centered "survival skills," while more experienced teachers think about improving their professional practice and better serving their students.

Fuller and Bown (1975) claim that teacher education must deal with beginning teachers' concerns in the proper developmental order. They therefore urge teacher educators to determine the needs of beginning teachers. They claim that teaching in harmony with teachers' needs may not only make teacher education more effective, it may also be a good model for the student teachers themselves to follow in their own practice.

Adams and Krockover (1997) surveyed 11 beginning secondary and middle school science and mathematics teachers who took preservice classes at Purdue University. They note that there are few studies published involving feedback from graduates of preservice education programs, yet they feel that it is vitally important for preservice programs to try and get that feedback. They conducted a series of telephone interviews asking the new teachers questions about their school environment, what they learned during their first year of teaching, what advice they would give to new teachers, and how well their preservice education prepared them. Causal conversations and demographic surveys supplemented the interviews. The authors do not describe any kind of process for confirming their impressions with their interview subjects (such as the "member checking" process employed in this study and described in the next section), nor do they mention if the new teachers had a role in determining the interview protocol. It is assumed that neither of these procedures was performed.

The new teachers in the Adams and Krockover (1997) survey expressed concerns that the authors grouped into two categories. The first category contained concerns related to the mechanics of the profession of teaching. For example, many teachers were

concerned about having to teach a class with subject matter outside the bounds of their preservice content courses. Also, the new teachers were concerned that they might be held responsible for developing new curriculum, perhaps because they were perceived as having cutting-edge ideas and training, or perhaps as well because instructors with more seniority did not want the job. The second category of concerns revolved around teaching as a craft. The new teachers were concerned about their time management and organization skills, and their ability to go beyond a “one size fits all” approach to maintaining discipline. The new teachers were also concerned with honing their abilities to stimulate students to learn and present information in an engaging and effective manner.

Freiburg (2002) divides the skills needed by new teachers into three categories. The first category is made up of “organizing strategies” such as lesson planning and design, time management, and classroom discipline. He stresses that novice teachers may have the most difficult time developing these skills, since it is difficult to “see” these skills at work by simply observing a veteran teacher. For example, Freiburg characterizes good classroom management as “nearly invisible.” Such skills can best be gained through experience and engaging in intense discussion with experts. The second category encompasses the wide variety of instructional strategies, all along the spectrum from teacher-centered lectures to student-centered inquiry. Freiburg notes that in pressure situations, novice teachers tend to revert to the teacher-centered strategies that they recall from their own school experiences. He stressed that teachers need to experience more student-centered strategies and actually use them to develop proficiency in their use; there is no substitute for time and experience. The final category comprises assessment strategies. As with instructional strategies, teachers tend to “fall back” on assessment techniques they experienced as learners if they have little personal experience with alternative strategies. However, this category includes not only the obvious techniques for assessing student progress, but also techniques of personal reflection that teachers can use to assess their own progress as professionals. Freiburg contends that such skills are essential for teachers to improve their practice.

Freiburg notes that most novice teachers find themselves having to develop the skills they need by a process of trial and error. He believes that many new teachers leave the profession because they are unsuccessful or unhappy with this process. He proposes that schools offer new teachers more opportunities to learn from expert teachers, through mentoring and staff development. He also suggests that schools work more closely with teacher educators to provide more meaningful preservice education.

Assessments of the effectiveness of preservice education

Studies asking science teachers about their needs are rare, but studies asking teachers to assess their preservice preparation are even more rare. In fact, studies of preservice education in general are few and far between, as noted by Richardson and Roosevelt (2004). They point out with a sense of amazement that journals with names like *The Journal of Teacher Education and Teaching* and *Teacher Education* contain very few studies of teacher education programs! As can be seen in this section and the next, the few such studies that do exist tend to be small-scale, short-term studies of single programs that are very descriptive in nature. Richardson and Roosevelt contend that this renders such studies of limited utility to those who seek to formulate large-scale policy, and so there is little interest in such research. They note that some programs may not be interested in publishing the results of their self-studies, thinking no one else would be interested.

Richardson and Roosevelt point out that many purported studies of “teacher education” are actually studies of teachers themselves, focusing on their beliefs and attitudes, and only occasionally analyzing how preservice education shapes (or, more often, fails to shape) those beliefs and attitudes. For example, a number of studies – including Brickhouse and Bodner (1992), Simmons, Emory, Carter, Coker, Finnegan, Crockett, Richardson, Yager, Craven, Tillotson, Brunkhorst, Twiest, Hossain, Gallager, Duggan-Haas, Parker, Cajas, Alshannag, McGlamery, Krockover, Adams, Spector, La

Porta, James, Rearden, & Labuda (1999), and Skamp & Mueller (2001) – sought to discover the professed beliefs of preservice and beginning teachers about science teaching, and compare those professed beliefs to what actually occurs in their classrooms. Typically, these studies make the discovery that teachers’ professed beliefs do not match their classroom practices. The remarks of Fuller and Bown (1975), referenced in Chapter 1, come to mind when perusing this body of literature; in many ways it seems that nearly three decades after Fuller and Bown’s remarks, education research is no closer to being the teacher’s friend. Unflattering things are still being discovered, and the focus seems to be more on doing research “on” preservice teachers than doing research “with” them.

Some education researchers have been scathing in their assessment of the effectiveness of preservice education programs. In a survey of 40 studies, Kagan (1992) sees a general consensus that university preservice education programs consistently fail to adequately prepare novice teachers, going so far as to state (p. 162)

...university courses fail to provide novices with adequate procedural knowledge of classrooms, adequate knowledge of pupils or the extended practica needed to acquire that knowledge, or a realistic view of teaching in its full classroom/school context.

Other researchers agree with Kagan:

...in our view no one- or two-year plan of teacher education has yet been proposed that holds any promise of turning out beginning teachers who possess even minimal **initial** competencies needed in contemporary schools. Cogan (1975, p. 213, emphasis his)

The lack of support for beginning teachers is not only evidenced by ‘sink or swim’ feelings among beginning teachers, but... by a lack of

understanding about what ‘swimming’ is. Brickhouse and Bodner (1992, p. 483)

The typical preservice program is a weak intervention compared with the influence of teachers’ own schooling and their on-the-job experience. Feiman-Nemser (2001, p. 1014)

Too often teacher educators do not practice what they preach. Classes are either too abstract to challenge deeply-held beliefs or too superficial to foster deep understanding. Feiman-Nemser (2001, p. 1020)

Many teachers enter the teaching field from university teacher preparation programs, where they mastered minimal pedagogical knowledge or skills. Freiburg (2002, p. 56)

In particular, Fuller and Bown (1975) pull no punches:

Teacher education is orthogonal to the teacher. (p. 25)

No one knows what is actually taught in teacher education, or whether it is taught in consonant with teachers’ needs. (p. 39)

Their education professors do not model for education students the kind of teaching the students are expected to do. (pp. 48-49)

Teacher education is not speaking to teachers where they are. Feelings of anger and frustration about teacher education are typical among teachers. (p. 50)

Fuller and Bown's last comment invites education researchers to ask teachers exactly what they think about their preservice education. While few studies have asked beginning teachers directly to assess their preservice preparation, respondents in some studies provide such assessments while providing other information. For example, one respondent in the survey of Kaufman and McDonald (1992) was critical of preservice emphasis on ideology over practicality, declaring (p.20) "I want you to tell me what I should do. I want to be able to benefit from your experience. There are some mistakes worth repeating and some not."

Respondents to the needs survey of Covert, et al. (1991) also made comments about how well their preservice programs had helped them meet those needs. Most of the comments were not complimentary. For example, the source of the "pack of hungry animals" quote in the first section of this review blamed preservice education for giving new teachers an inaccurate picture of the teaching profession. Many of the student teachers interviewed by Loughram (1994) expressed this view as well.

Teachers in the Covert, et al study noted that their university instruction dealt rarely, if at all, with issues of discipline. Many expressed a desire that preservice education present practical how-to issues: as one teacher said, "Classroom management, not psychological theory." Of all the written comments in Covert, et al. (1991), only one cited university education as being useful for successfully negotiating the first year of teaching.

Similar results were seen in a study by Ost and Baird (1989). They surveyed 491 teachers in Alabama who held at least a Master's degree. Respondents rated their level of ability or personal knowledge in 34 categories. They were also asked to indicate the point in their lives when they acquired the skill or knowledge they had just evaluated: their undergraduate education, their graduate student years, or their time as a classroom teacher. The respondents came from all disciplines, but the researchers singled out science teacher responses for separate analysis and comparison to the general sample.

The results of the Ost and Baird (1989) survey do not shed a favorable light on preservice education preparation. In only one category did a substantial number of teachers credit their undergraduate education as being useful: 49.8 % of teachers in general and 37% of the science teachers credited their undergraduate education with teaching them important lessons about use of a variety of instructional media (films, tapes, etc.) In only three other categories did more than a third of the teachers surveyed credit their undergraduate experience as being useful: utilizing a variety of learning modes (visual, auditory, etc.) to promote learning, applying understanding of the purposes of education, and emphasizing good communication skills in learning activities. In most other categories, the majority of teachers claim that their years of practical experience were most useful. Ost and Baird found few differences between science teachers and teachers in general. In all four instances where the two groups differ, the science teachers found their undergraduate education experiences less useful than teachers in general. The authors conclude that "teacher education programs are not attending to science teacher needs."

A study by Housego (1994) gave 16 graduates of an elementary teacher-training program at the University of British Columbia the opportunity to evaluate how well that program had prepared them for their first year of teaching. Following their first year of teaching, participants were presented with 50 "tasks central to teaching," and asked to think about how well the program had prepared them for those tasks. The participants fell into three main groups. The largest group felt best equipped to be creative in their teaching, e.g., designing class activities, and least prepared to deal with issues of assessment and classroom management. The second group felt most prepared to deal with technical aspects of teaching, such as lesson planning and record keeping, and poorly prepared to deal with issues of classroom management. The third group felt best prepared to plan for their classes and communicate with students. Ironically, they felt least prepared to communicate with parents and staff, in addition to the ubiquitous classroom management problems. The author then arranged the results into Venn

diagrams to discover crossovers between groups. In general, participants felt best prepared to plan lessons, and least prepared to manage the classroom.

The Housego (1994) survey was followed up by a series of seventeen-question structured interviews. In these interviews, many respondents confirmed that they felt ill prepared to deal with issues of classroom management and assessment. They did praise their preservice programs for preparing them to plan lessons thoroughly. As in the Covert, et al. (1991) study, many criticized their preservice education for having too much theoretical emphasis at the expense of practical training. The teachers wished for more practical information about beginning the school year, more help in finding employment opportunities, and more exposure to a wider variety of teaching techniques.

There are instances where preservice education earns praise from prospective teachers. Prescott and Wolff (1990) report on an attempt to incorporate co-operative learning strategies into a methods course for future reading teachers, with positive results. The students saw their methods class as a good model for their future classroom practice. The student teachers approved of the “sense of belonging” that the co-operative strategy fostered, claiming that it inspired confidence and made class more enjoyable than traditional lecture. Loughram (1994) asked second-year teachers to reflect on the things that influenced the way they taught, and some of them praised their preservice classes for providing opportunities to plan lessons and reflect on their practice, and for exposing them to a variety of teaching methods. Perhaps these more experienced teachers viewed their preservice education more charitably once their “survival needs” were met.

Some studies reinforce the notion that student teachers’ field experiences are much more valuable to them than their time spent in an education classroom. In fact, Griffin (1985) claims that it is the actual classroom setting that transforms the concepts and ideas of preservice education in teachers’ minds, not the other way around. Feiman-Nemser (2001) notes that student teachers frequently identify student teaching, not education classwork, as the most instructive part of their preservice experience. Emmer

(1986) asked two science teachers where they got their ideas for classroom activities; the teachers cited the influences of science content courses, discussions with colleagues, and their classroom experience, with no mention of preservice education classes. The respondents in the study of Gess-Newsome and Lederman (1993) credited the act of student teaching with having the greatest influence on their development, and made no mention of their education classes.

The new teachers surveyed in the Adams and Krockover (1997) study mentioned above expressed opinions about the effectiveness of their preservice program in preparing them to be teachers. In most instances, the general consensus of the teachers was that the preservice program provided little to assist them in addressing their concerns. The teachers confronted with the challenge of teaching outside of their discipline typically got support from their peers and drew from their past experiences; they could remember nothing from their preservice education that prepared them for that challenge. Similarly, they could recall nothing that even warned them of the possibility that as new teachers they might be held responsible for constructing brand new curriculum materials. The new teachers wished that more field experiences had been provided by their preservice program, since they felt that skills in classroom discipline and content presentation are best learned “on the job” by making mistakes and learning from them. A few especially mentioned that being employed as an undergraduate teaching assistant at the university was a valuable opportunity to practice their presentation skills in an environment where other issues, such as discipline, were less of a distraction.

The new teachers in the Adams and Krockover (1997) study also wished that the professors in their content courses had coordinated more effectively with the professors in their pedagogy courses, to more closely tie the material they were expected to teach with the best way to teach it, and to tie both to what was actually going on in their classrooms. They were concerned that often the content in the university science courses was not the content they were expected to teach, both in terms of complexity and subject matter. Some gave the example of the focus on cellular and molecular biology in university

biology courses, to a degree not seen in a secondary classroom, while popular topics in high school biology, such as taxonomy and physiology, were neglected by their university curriculum. In a parallel vein, many were of the opinion that the content in their education theory courses seldom had any connection to actual classroom practice. They repeated their call for more field experiences, to help them discover and forge connections between theory and practice.

Allan (2003) emphasized the importance of quality teacher education programs, contending that the education of young people is too important to have teachers do too much of their learning “on the job.” In a massive survey of the education literature, Allan found very few studies of teacher education programs, and thus had a difficult time answering his “Eight Questions on Teacher Preparation.” Of the studies he did locate, he considered only a few to present “moderate support” for answers to the questions; those were usually the studies that involved some quantitative measure of student success and teacher quality. Most of the studies reviewed by Allan were considered too descriptive, qualitative, and context-specific to provide more than “limited support” for their conclusions, and many were judged “inconclusive.” Allan has a very low opinion of education research in general: he claims that policy makers have lost faith in education research as a means of informing action, calling much of it “partisan and politicized.” (p.3)

Given the qualitative and descriptive nature of the current study, obviously this researcher does not agree with Allan’s harsh evaluation of the education literature. On the other hand, his contention that single studies have limited utility for setting general policy is a point well taken. He also presents a valid point when he criticizes education researchers for rarely including the input of classroom teachers when setting their research agenda. However, he seems guilty of such neglect himself, since there is no evidence that teachers were consulted when he constructed his “Eight Questions!”

Allan's first three questions deal directly with elements of teacher effectiveness that can be addressed by preservice training programs. His first question asks how important content knowledge is in determining a teacher's effectiveness. The conclusion he draws from his survey of the literature is that subject-matter preparation is inadequate for a large number of teachers. He determines that subject-matter competency is essential to good teaching, but notes that the research is unclear about exactly how many and what kind of courses would be needed. He also concludes that subject-matter knowledge is inadequate; knowledge of how to teach is also essential to being an effective teacher. In that vein, Allan's second question revolves around the importance of instruction in pedagogy to effective teaching. He found limited support for the notion that preparation in techniques of pedagogy can improve teaching, but found the research results unclear as to whether instruction in a university classroom or extensive field experiences are more important to that preparation. He acknowledges that it may be impossible to separate and isolate the potential effects of the three components of most preservice programs: content courses, education courses, and field experiences.

The effect of field experiences on teaching effectiveness was the topic of Allan's third question, and he located a larger-than-average number of studies dealing with field experiences. He found little use for most of them, however, since he felt most of them focused too much on how field experiences influenced teachers' beliefs and attitudes, and not enough on how they made the teachers more effective in the classroom. Allan also found it difficult to assess the general efficacy of field experiences, due to the incredible variability of field experiences in terms of length, coordination of host school and university, and integration of field experiences with courses in pedagogical theory. Additionally, many of the studies illustrated that field experiences will have different effects on student teachers with diverse personalities, levels of content knowledge, and preconceived notions about teaching. He did note, however, that many of the studies agreed in questioning the value of the "traditional" 8-14 week student teaching experience. Allan was also able to pull together a list of common characteristics of effective field experiences, including

- Coursework prior to student teaching has a practical emphasis, focusing on situations the student teacher will encounter in the field.
- The “cooperating” teachers supervising the student teachers in the school are well trained and understand their roles well.
- The cooperating teachers give the student teachers considerable responsibility and autonomy.
- Student teachers are given time and encouragement to reflect on their experiences in the classroom.
- University professors also supervise the student teachers.
- The student teachers support and learn from one another.
- A variety of well-organized and well-coordinated field experiences are involved.

A number of researchers are not merely critical of teacher education, but also offer suggestions for improving practice that are informed by their research. Stover (1990) echoes the “practice what you preach” metaphor of Feiman-Nemser (2001) and urges teacher educators to adopt a student-centered approach that listens to and addresses the concerns and fears of prospective teachers. Feiman-Nemser (2001) further suggests five “central tasks” for teacher education. Most of these tasks deal with the “survival needs” of beginning teachers:

- Giving novices a chance to reflect on teaching and formulate their beliefs
- Developing novice teachers’ content knowledge
- Helping novices better understand learners and the learning process
- Guiding novice teachers in developing a “repertoire” of approaches to teaching
- Helping novice teachers to develop the ability to study the teaching process, as practiced by themselves and others

After surveying 40 studies of preservice education, Kagan (1992) came to a number of conclusions:

- Preservice programs should focus on giving students the procedural knowledge that will help them succeed in the classroom. Teacher educators should honor the need that novice teachers may have to learn the “tricks of the trade.”
- Preservice education should promote habits of self-reflection in teachers, rather on focusing on the “big ideas” of education.
- Preservice education should provide novice teachers with opportunities to interact with students. Theoretical classwork is no substitute for actual experience.
- Preservice education should put novice teachers in situations where they can safely make mistakes and question their own beliefs, without having to worry about a professor or cooperating teacher imposing their will.
- Teacher educators need to expect that novice teachers will be preoccupied with “survival” issues of discipline and class control, and should honor, respect, and speak to those concerns.

In perhaps her most radical suggestion, Kagan proposes that teacher education should be willing to entertain the possibility that formal education theory may not be relevant to some teachers at *any* point in their careers. The notion that one of the functions of preservice education is to “plant a seed” of formal theory that will grow as a teacher “matures” may need to be re-evaluated. In the end, some teachers may be their own first, best, and only source of theory. One size may not fit all.

Korthagen and Kessels (1999) are deeply critical of teacher education, which they see as “polarized” between two extremes: programs that emphasize pedagogical theory at

the expense of extensive field experiences, and those who regard theory as useless compared to practical field experience. They propose that the choice should not be which of these aspects to emphasize, but rather how to integrate both into preservice education. Using Aristotelian concepts, Korthagen and Kessel distinguish between two different kinds of theory: *episteme*, which is general knowledge informed by research and applicable to a wide variety of situations, and *phronesis*, knowledge born from a particular situation or context. A balance between these two types is needed in teacher education, according to the authors. Episteme is needed because occasionally teachers will occasionally need to craft novel solutions to new situations. However, an over-emphasis on episteme could leave teachers fumbling for answers when they have little time to synthesize solutions from general theory. Phronesis can provide teachers with those quick answers to common problems, but an over-emphasis on phronesis could lead to situations where teachers have few resources to craft solutions to new problems. A balance between educational theory and field experiences, with expert guidance and ample time for reflection and synthesis, will promote a balance between episteme and phronesis in teacher education.

Korthagen and Kessels observe that when novice teachers get into the classroom, they tend to shift their attitudes and practices to conform to their perception of the school environment, rather than considering the theory and ideas they were exposed to in their pedagogy courses. They contend that in many situations, novice teachers need (p. 5) “quick and concrete answers to situations in which they have little time to think.” Since they so often lack the luxury of time to reflect on pedagogical theory in high-pressure situations, they may try to fall back on their own experiences as learners in the familiar “teach as they were taught” reaction. They suggest that extensive field experiences will give novice teachers an opportunity to experience teaching in a lower-pressure environment, where they can reflect on how theory relates to practice, preferably with expert guidance from professors and mentor teachers. Korthagen and Kessels feel that field experiences will motivate novice teachers to pay more attention to theory by creating specific and personal concerns about teaching that can be addressed by theory. Student

teachers will then see value in the theory, and teacher educators will be able to take advantage of “teachable moments.”

Korthagen and Kessels express surprise that so many teacher education programs still cling to an approach where theory is often devoid of context and concrete application. They contend that teacher educators are too proscriptive and instructor-centered in their curriculum choices. They even going so far as to accuse teacher educators of putting more energy into trying to make students “buy in” to certain theories than they do into trying to uncover which aspects of educational theory the students will actually need in their particular situations. They argue that the “gap” that teacher educators are trying to bridge between student teachers and theory is largely of the teacher educators’ own making, and that teacher educators need to close the gap by getting more in touch with their students’ needs.

Korthagen and Kessels propose a more student-centered approach that builds on the student teachers’ experiences, where reflection on real problems encountered in the classroom forms the basis for investigation of theory. Student teachers need a variety of field experiences, so they can form ideas about teaching based on experience instead of preconceived notions. The student teacher’s professional development grows out of his or her ideas and feelings, not vice versa. In this approach, the teacher educator is still in the role of content expert, but is more of a guide to the student’s investigations, to interdict radically wrong turns and “reinventing the wheel.” They draw a parallel with the “transfer problem” that many students have in science and mathematics, when students can solve textbook problems perfectly well, but cannot apply those same principles to everyday situations. Just as “hands-on” learning strategies have been proposed for science and mathematics, Korthagen and Kessels propose what they call a “realistic” teacher education strategy that integrates theory and practice.

Zeichner (2003) also sees too much extremism in teacher education, but he perceives three different “agendas” in the philosophies of modern preservice programs.

He feels that, in desperation to address the problems of teacher attrition and lack of proper certification, these programs are becoming too radical in their approaches. The “professionalization agenda” seeks to insure professional competence by promoting performance-based testing. Zeichner contends that standards for this testing are too narrow, and will exclude many good teachers. Also, teacher educators may find themselves “teaching to the test,” as many pre-college teachers are pressured to do by high-stakes testing. The “deregulation agenda” seeks to downplay or eliminate instruction in education theory, focusing instead on content knowledge and oratory skills. Zeichner also derides this agenda as too narrow in focus, and challenges the implicit notion that teachers can pick up theoretical knowledge “on the job.” Finally, the “social justice agenda” emphasizes multicultural knowledge and interpersonal skills when dealing with diverse populations, placing such knowledge and skills on a par with content knowledge. Zeichner feels that this agenda is also too narrow in its focus, noting especially a tendency to emphasize helping white teachers work with non-white students, rather than helping all teachers teach all students. He does not see any of these agendas as necessarily wrong or harmful, just too focused. He proposes an integration of the three agendas, to provide a healthy mix of pedagogical knowledge, content knowledge, and multicultural awareness.

Andersen (2000) reflects on many years as a teacher educator and education researcher and makes a number of observations about teacher education. He observed that, in his experience, older, more experienced students (typically students pursuing graduate degrees) were more complimentary of their education courses than less academically experienced students. He proposes that few freshmen are mature enough to make a commitment to teaching. Andersen also expressed a strong belief that prospective teachers should be allowed and encouraged to learn from their mistakes during their student teaching experience. However, he states that few novice teachers are actually given the time and support needed to reflect productively on their experiences during their preservice education. It is not enough to Anderson for student teachers to “survive” their negative experiences; novices must be given training and opportunity to transform

failures into learning experiences. He warns that students will not be able to fully utilize the instruction that they receive in pedagogical theory unless they have experiences in an actual classroom that they can relate to elements of that theory. He also stresses the importance to the novice teacher of expert guidance and mentoring; even if a novice teacher cannot find a formal mentor, he nonetheless encourages novices to seek out a confidante who will be constructively critical of their ideas and actions. Anderson closes by noting that the biggest challenge in teacher education is to facilitate a smooth transition from student teacher to teaching professional.

In a call to action for leaders in higher education, Sanders (2004) gives a harsh assessment of the current state of teacher education, focusing on programs in science and mathematics education. He claims that science and mathematics preservice programs suffer from poor evaluation methods, “flabby” curricula, and low standards for entering and graduating students. He feels that most fail to meet the important needs of student teachers: solid subject matter knowledge, knowledge of effective teaching methods, familiarity with the possibilities of educational technology, and proper support and mentoring. In harmony with many of the authors above, he promotes an approach that balances content knowledge, pedagogical knowledge, and field experiences. Sanders makes a number of suggestions for things that colleges and universities can do to promote good science and mathematics teacher education: instituting extensive program evaluations by graduates, expanding responsibility for teacher education beyond the education department, monitoring graduates of the program after they become full-time teachers, and providing support and mentoring to teachers during and after their time in the program.

The assessments cited above of teacher education in general, and science teacher education in particular, are striking in their harshness. Even more striking, however, is the scarceness of the voices of classroom teachers, the graduates of these programs. Much of the criticism comes from thinkers in the education field, based upon their experiences. Other opinions come from studies by government agencies and “think

tanks,” based on surveys of existing literature or anecdotal evidence. Little effort has been made to uncover the “lived reality” of the classroom teacher in a systematic way, and see preservice education through their eyes. The current study seeks to address this lack.

New Approaches to Teacher Education

In response to widespread dissatisfaction with preservice science and mathematics, some attempts have been made in the past decade to introduce new elements into teacher education. For example, Grankvist (1996) discusses efforts to allow student teachers in Norway more time to reflect on field experiences. He eliminated “microteaching” exercises – practice teaching in front of fellow student teachers – from the preservice program, decriing the process as an unacceptable substitute for practice in a real classroom. During the 12-14 weeks of student teaching in Grankvist’s program, each week is structured to promote reflective practice: planning sessions are held on Mondays, teachers are in the classroom Tuesday through Thursday, and Friday is a time for teachers to meet to reflect and discuss the week’s events with their fellow teachers. University instructors are directly involved with the student teachers in the planning and reflection stages. Grankvist reports that giving student teachers time and opportunity to reflect on their experiences has improved their teaching skills and their attitudes toward teaching, although he presents only anecdotal evidence to support this assertion.

In their teacher education program at Utrecht University, Korthagen and Kessels (1999) have incorporated a number of changes to help their student teachers more easily integrate theory and practice. In their program, the student teachers have schedules that alternate between time teaching in actual classrooms and time reflecting on and discussing their experiences in the preservice classroom. Students bring actual challenges that they have encountered in their student teaching to the discussion, and the teacher educators help the student teachers select and explore the aspects of theory that can assist

them in meeting these challenges. Instruction is tailored to the student teacher and his or her specific concerns, rather than only offering general principles. The program coordinates and communicates very closely with the secondary schools, to insure that the classroom is a “safe” environment where student teachers can make mistakes and learn from them. Korthagen and Kessels also realize that as teacher educators, they themselves have a duty to cultivate skills as reflective practitioners. They report that their strategies have had a positive impact on their graduates, helping them be more thoughtful and confident in the classroom, but, similar to Grankvist (1996), they present mostly anecdotal evidence in the form of a few student quotes to back this claim.

Taylor (2000) was taken aback when his preservice students asked him the question that comprises the title of his paper: “When are we ever going to use this?” He was accustomed to hearing such a question from students taking mathematics classes, but not from prospective teachers. As he explored the question with his student teachers, he discovered that what they were seeing in their classroom observations and field experiences did not seem to match up with what they were being taught in their preservice classes. The students wondered if they would actually be allowed to use innovative techniques in the classroom once they became full-time teachers. To give the students practice with using innovative techniques in a traditional setting, Taylor challenged the students to create a non-traditional problem-solving lesson based on a unit from a more traditional textbook. Students presented their lessons to their peers in a microteaching session and received critique and advice. The students found the exercise very useful, and were encouraged that they could introduce new teaching techniques to subtly transform a more traditional program.

Taylor himself learned from this experience. He came to realize that he had to “practice what he preached” as a teacher educator; traditional methods of teaching pedagogy would not produce innovative teachers. He found that students of education theory need to have that theory grounded in a context of personal experience, even as students of mathematics need to have a context for learning problem-solving. He

concluded that as a teacher educator he needed to model in his courses the kind of strategies and attitudes that he would like his student teachers to develop.

Haines (2002) describes a program at Towson University that focuses on getting prospective teachers into actual classrooms as soon as possible. During the second semester of the certification process, students in the program spend one afternoon a week teaching a small group of middle or secondary school students, under the joint supervision of a teacher at the school and their university professor. An important part of this afternoon is spent in reflection and discussion with their peers and their professor at the end of the day. In subsequent semesters, their role in teaching at the school expands, reaching a full-blown student teaching assignment by the fourth and final semester. In this system, the student teachers already know the school well (and people at the school know them) by the time they are fully responsible for a class. Graduating students evaluated the program using a Likert-style questionnaire and brief written comments. Generally, students praised the program, claiming that the early field experiences helped them to make many connections between what they learned in their preservice classes and the actual process of classroom teaching. Haines closes by calling for a system for teachers similar to that for physicians, engineers, and other professionals, where novices can learn from experienced practitioners in a real setting. Similar to calls for science teachers to have students “do science as scientists do,” Haines calls for teacher educators to have their students teach as full-time teachers do, to test ideas in actual classrooms.

Continuing the “practice what you preach” theme, Pierce and Kalkman (2003) attempted to make their educational psychology classes at Northern Illinois University more learner-centered by letting prospective teachers have more of a say in their curriculum. The authors claim that teaching is a profession where novices bring in a tremendous number of preconceived notions about how “experts” should behave, based on their experiences as students. They want their students to reflect on those preconceptions and see how well they match up with educational research. The course is structured so that students directly experience in their preservice training some of the

teaching and learning techniques that they are studying for future use in their own classrooms. Students reflect on these techniques and their personal experiences in group discussions and personal journals, thus working to place education theory in a concrete context. Students are given the freedom to alter some of the course assignments to suit their individual personalities and interests. This gives the students a sense of ownership in the curriculum, and adds a cachet of relevance to the assignments. Pierce and Kalkman express the hope that this process will encourage the prospective teachers to become more self-directed learners. However, they present no evidence that these traits developed, nor do they include any feedback from students.

L'Anson, Rodrigues, & Wilson (2003) describe an attempt to use microteaching as a tool for promoting critical reflection. This is not the microteaching decried by Grankvist (1996), however: instead of presenting lessons to their cohorts, the student teachers give several short lessons to a group of secondary school students. These sessions are videotaped, and many individuals – the student teacher, other student teachers, a mentor teacher in the school, and the professors – view the lessons and offer critiques. The professors facilitate a great deal of discussion and interaction, to encourage the student teachers to reflect on the lessons. The authors noticed that many of the student teachers matured during the process, crossing a number of “thresholds” in terms of what they were most concerned about. First was a “pre-critical” threshold, where the student teachers reflected primarily on technique and “survival” in presenting their lessons. Prior to this threshold, the student teachers often did not think much beyond the lesson they completed, and the next lesson they had to present. Many of the student teachers advanced to the “internalized” threshold, where they began to focus on how their past lessons tied together, and how they could best learn from their past mistakes. A few students moved to the “hypothetical” threshold, where they became concerned with activities in the future, and how they could adapt to situations they had not yet encountered. The focus was on making connections between the past and the future.

These “thresholds” seen by L’Anson, et al. parallel the developmental stages of Fuller (1969) and Fuller and Bown (1975), as teachers shift from worrying about survival skills to worrying about the quality of their teaching. Apparently the field experience afforded by this version of microteaching, and the time and support for critical reflection, helped the student teachers develop into more mature educators. L’Anson, et al. interviewed the student teachers about their experiences and the effects that the microteaching had on their development. Most of the student teachers said that they were happy to have the teaching experience afforded by the microteaching, and felt that so much feedback from so many different sources helped them improve. They also appreciated the opportunities to reflect on their teaching and use their mistakes to grow as teachers. Many cited the videotaping as especially helpful, as it helped them see things from their pupils’ perspective.

At the University of Arizona, Talanquer and Morgan (2005) initiated a program to help student teachers think about teaching and learning in a more analytic fashion. They noticed that student teachers relied too much on personal feelings and beliefs to guide what they did in the classroom, and established superficial standards for student success, such as whether or not the students appeared to be enjoying themselves. The prospective teachers were assigned to spend one period a day in a classroom with a mentor teacher. During this time, they were challenged to study the classrooms as a reporter would, looking for evidence that would allow them to make conclusions about three things: level of teacher planning, level of student achievement, and alignment of class activities with larger educational goals. The student teachers summarized their “findings” in a series of ersatz newspaper articles, which were evaluated and discussed in peer groups. The authors report that the students developed their data gathering and writing abilities, but no evidence is presented to support this assertion. Also, there is no evidence that feedback was solicited from the student teachers.

Mentoring has become a very popular way to assist novice teachers in acclimating to their school environment after their preservice education. In a 1995 study, Abell, et al.

analyzed data from interviews with first-year teachers and their mentors. The teachers and mentors spanned a wide variety of subjects and grade levels taught. The results revealed a number of roles played by the mentors, with some playing multiple or changing roles:

- A parent figure, who must balance being helpful with letting the novice teacher “grow” by making mistakes
- A support system, helping the new teacher acquire “survival skills” and avoid pitfalls in the unfamiliar environment of the school
- A colleague who grows with the new teacher
- A “scaffolder” who provides models for how to teach

Abell, et al. (1995) also discovered three essential qualities of mentors that help make the mentoring process successful for all involved. First, the mentor must see mentoring as his or her professional duty, and an opportunity to pass on knowledge to the “next generation.” The mentor must not be in a position to evaluate the novice teacher in any way; the mentor’s role must be that of a helper, not an authority figure. Finally, the mentor must cultivate an atmosphere of mutual respect and trust. Obviously, these characteristics are intertwined, and could provide a model not just for mentors of first-year teachers in schools, but also for university professors and host teachers in preservice programs.

Subsequent reports about successful mentoring programs support the basic findings of Abell, et al. (1995). Melancon (2002) describes a program with a “mass mentoring” element, where new teachers come together once a month to hold group discussion, and to get advice and materials from expert teachers. In addition, the new teachers had “shared planning periods” every day for group discussions. Each teacher was also assigned a personal mentor, to aid in reflection, to help the new teacher be aware of administrative tasks, and to be a source of encouragement. Texley (1996) notes that

novice teachers are frequently assigned the most difficult classes, and new science teachers have the extra burden of having to become acquainted with new laboratory facilities. A good mentor who knows about the school and is willing to help is therefore usually essential to the new science teacher's success. In return, the new teachers can enrich their mentors and their schools with new ideas and technical knowledge. This theme of mentoring enriching both participants is echoed in the report of Wetzel, et al. (1996), who discuss a two-week workshop designed to help new teachers and their mentors learn how to integrate technology with their teaching. In the process of teaching each other about these new methods, the novices and the mentors reported learning a great deal. The authors propose that providing opportunities for teachers to teach each other is a "critical dynamic" for training teachers. Barker (2000) emphasizes, however, that this strategy can only work in an atmosphere of mutual respect. In a report on a study of mentors and science teacher "trainees" at the Institute of Education in London, Barker notes that little can be accomplished in the mentoring relationship when mentors are overbearing and dictate how the trainee should teach. At the other extreme, situations where a mentor feels that he or she has little to contribute to an experienced trainee are not productive either. Collegial cooperation – where the trainee is active in preparing teaching strategies, and the mentor offers encouragement and advice – is more effective and mutually beneficial for developing meaningful laboratory activities and sound strategies for conveying difficult subjects.

In an in-depth case study, Zucherman (1999) tells the story of "Carole," a first-year teacher, and her relationship with her mentor "Janice." Carole began the school year feeling "overwhelmed" and very concerned about teaching a subject with which she had little experience. Carole was able to observe her mentor's classes in the unfamiliar subject, and used Janice's techniques as a model. However, she did not feel that she had to exactly duplicate Janice's work, because Janice was open to Carole's ideas and did not try to dictate to her. This combination of having a model and yet having room to experiment gave Carole confidence, and she found herself needing her mentor's model less and less. As the semester went on, Carole found her concerns shifting from "how do

we do things” to “how can we make things better” – a development in line with the stages of Fuller and Bown (1975). The next semester, Carole was ready to return the favor, as Janice was teaching a subject in which Carole was well versed. Carole was very pleased at the opportunity to “give something back” to her mentor.

We see in Carole and Janice’s relationship many points of correspondence with the findings of Abell, et al. (1995). Janice clearly saw a responsibility to pass on her knowledge and experience to Carole. She took pains to make her schedule compatible with Carole’s, so that she could be close at hand. Janice described her multifaceted role as “caregiver, fellow learner, and buddy,” with no evaluative component. Finally, Carole and Janice clearly had a great deal of mutual respect. Both appreciated the difficulty of teaching, and realized that any problems a novice teacher faces are due to the difficulty of the task, and not any inadequacies on the part of the teacher. Zucherman stresses that mentors must see the potential of new instructors, and be willing to work to realize that potential. The story of Carole and Janice provides a solid model for mentoring relationships that preservice host teachers would do well to emulate.

Mentoring relationships do not need to be one-on-one situations. Bambino (2002) presents three examples of “critical friends groups.” These are groups of teachers, some novice, some experienced, who meet to assist each other in critical reflection, problem-solving, and curriculum development. As the name “critical friends” implies, the members of the groups are equals, and listen to and aid each other as peers. One group assisted a member in making an alternative assessment strategy for an Earth Science class more academically rigorous. Another group comprised of teachers from all disciplines at a school worked together to develop a portfolio assessment system for all students at their school. A third group assisted a colleague with a discipline problem by providing alternate viewpoints and helping the teacher see the problem from a new perspective. Bambino notes that critical friends groups create a sense of community and aid and abet improvement through critical reflection.

As promising as mentoring programs may seem, they are in-service programs, and thus are subject to the whims of administrative decisions and funding. Ingersoll (2000) notes that less than half of all teachers engage in some kind of induction program upon becoming a full-time teacher. Zeichner (2003) warns that teacher induction programs are constantly endangered by budget cuts. Indeed, the President of the National Science Teachers Association (Padilla, 2005) reports that only 19 states in the U. S. have mandated induction and mentoring programs for beginning teachers, and of those, only 10 provide even partial funding, with the funding burden on the uncertain shoulders of local districts. Therefore, many teachers will not be able to rely on in-service mentoring programs to help them in the first semesters. If induction programs do fade in importance, preservice education may be the only formal assistance that novice teachers have to help them transition to full-time teaching.

Sanders (2004) identifies three new preservice programs that he sees as being on the “leading edge” of teacher training. A program at Purdue University focuses on developing programs in engineering education in secondary schools, with special emphasis on introducing young women and minorities to the possibilities of engineering. The prospective teachers in the program are supported in their efforts to develop courses in engineering suitable for secondary school students. At the University of Georgia the focus is on middle school science and mathematics. Each science and mathematics content course in the preservice program is connected to a methods course in how to teach that subject. The program provides a wide variety of clinical and field experiences for the prospective teachers to practice and experiment.

Sanders most extensively describes the third of his “leading edge” programs: the UTeach program at The University of Texas at Austin, a joint venture of the university’s College of Education and College of Natural Science. The emphasis in the UTeach program is on providing early and frequent field experiences to provide a context for the pedagogical techniques studied in the education courses. Students in the program earn a degree in science, with a curriculum nearly identical to students intending to go on to

graduate research. Students in the program are giving lessons in actual elementary school classrooms within six weeks of starting the program. As students progress in the program, they move from student teaching in elementary schools, to middle schools, and finally to secondary schools, regardless of their future plans. They begin with simple lessons, and gradually increase their responsibility until they can take on multiple courses in their final semester. These extensive field experiences are a distinguishing feature and a great strength of the program. Great care is taken to integrate methods and theory classes with the field experiences. The program also provides ample opportunities for reflection on and discussion about the field experiences. Another strength of the UTeach program is the extensive collaboration of program directors with master teachers from nearby school districts: these teachers played a major role in developing the program, and enrich the program by serving as teacher trainers and mentors. Some of these mentors even continue working with graduates of the program as they make the transition to full-time teachers.

No formal research has yet been conducted in conjunction with the UTeach program, but private communications with people involved in the program (LaTurner, 2005; Marder, 2005) indicate that graduates of the program have had success thus far in their careers, and regard the program highly. For example, almost 94% of UTeach program graduates passed the state teacher certification exam on the first attempt. In addition, during the first five years of the program's existence, almost 93% of graduates had entered, or were seeking to enter, the teaching profession. More importantly, nearly 80% of the program graduates had remained in the teaching profession after five years, an impressive retention rate when compared to the statistics of Ingersoll and Smith (2003). The UTeach program is ripe with promise for teacher education – and with possibilities for research.

The Current Study

While these recent programs are innovative and have shown promising results, they remain the exceptions rather than the rule. All in all, the picture looks bleak for science teacher education. It appears that most teachers acquire the majority of their teaching skills outside of formal training, and then too often by a process of trial and error. The current study will seek to gather more information about the "lived reality" of the beginning teacher, and about beginning teachers' perceptions of how well they have been prepared by preservice education. This study is different from many of the studies above in both its breadth and its narrowness. The goal of this project will be to survey simultaneously the importance of various needs and the success of preservice preparation in providing for those needs, all seen through the eyes of the novice teachers. The study will focus narrowly on secondary teachers of science, and on the first year of teaching.