

# **Chapter 1 -- The Problem**

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### **Introduction**

In recent years, cries for reform in education in general, including science education, have come from many directions. Indeed, science education has been in an almost constant state of "crisis" since the 1970's. One aspect of this multi-faceted "crisis" that should be of concern to teacher educators is a perceived shortage of qualified, competent science teachers at the secondary level. In the 1990's, 61% of high schools reported difficulties in finding qualified science teachers (National Science Teacher Association, 2000). The percentage jumped to 95% in urban areas (Council of Great City Schools, 2000).

Ingersoll (2001) and Ingersoll and Smith (2003) do not lay the blame for this shortage upon the "usual suspects" of increased student enrollments or the "graying" of the teacher community and its attendant retirements. Rather, they see the cause as attrition in the ranks of newer teachers. Ingersoll and Smith (2003) estimate that between 40 and 50 percent of teachers leave the profession in the first five years. Boe, Bobbitt, and Cook (1997) note that high attrition rates for beginning teachers are even higher for teachers in the fields of science, mathematics, and special education.

Ingersoll and Smith (2003) liken increased efforts to recruit new teachers to pouring increased amounts of water into a bucket riddled with holes. Until the "holes" of teacher attrition are plugged, efforts such as aggressive recruiting and alternative certification will do little to ease the teacher shortage. In an effort to ferret out the causes of attrition, Ingersoll and Smith compiled survey data on over 2,000 teachers who were leaving the teaching profession, and a slightly smaller number who were moving to another school, inquiring as to why they were changing jobs. Respondents could give more than one reason. Many cited layoffs or personal and family concerns, situations that teacher education cannot be reasonably expected to address. However, almost 39 percent of respondents reported that they were going into a profession other than teaching (that

they presumably found more appealing) and almost 29 percent simply said that they were dissatisfied with teaching. When further pressed for reasons, members of this last group cited some situations that again teacher education cannot be expected to address, such as poor salary (78.5%) and poor administrative support (26.1%). On the other hand, substantial percentages reported concerns such as student discipline problems (34.9%) and poor student motivation (17.0%).

While teacher education may not be able to solve these seemingly eternal problems of education, they might be reasonably expected to better equip teachers to deal with these sources of frustration that may be driving teachers from the profession. Haines (2002) asserts that one good way to stem the tide of teacher attrition is to improve preservice preparation. There is a clear need to extend the concerns of reform beyond the pre-college classroom and into the colleges and universities where science teachers are trained. Yager, Lutz, and Craven (1996) propose that general science education reform must be accompanied by reform in science teacher education. Sanders (2004) agrees strongly with this proposal, stating (p. 7)

Changing teaching is the single most powerful way to improve science and mathematics competency in the United States – and the responsibility for doing so rests squarely on the shoulders of the institutions that educate and train teachers.

The National Commission on Mathematics and Science Teaching for the 21<sup>st</sup> Century (2000) characterizes better teacher education and training as a “lever for change” (p. 13) that is inextricably linked to improving the quality of science and mathematics teaching as a whole. How can we inform efforts to adapt science teacher education to this “age of reform?”

## **Background**

Suggestions for reforming all aspects of science education, including teacher education have come from many groups, from private associations (AAAS), to government agencies (NSF). Where do these entities get their ideas about where and how reform should be accomplished? Czerniak and Lumpe (1996) report a variety of sources: professional scientists, professors of science education, administrators in higher education, and government officials. While there is strength in this diversity of viewpoints, there is a serious weakness in the fact that most of these individuals have only peripheral contact with the pre-college science classroom. The only ones that even come close are professors of science education, most of whom have experience in public school teaching. These credentials must be viewed with care, however. In a survey of teacher education programs in New England, Barrow (1988) reports that the vast majority of teacher educators have been away from public school teaching for over five years. Amazingly, most of the people who are informing and shaping reform in science education have no first-hand knowledge of the modern science classroom. The people who do possess this first-hand knowledge, classroom teachers, are conspicuous by their reduced presence in -- or outright absence from -- reform efforts. This paucity of teacher input into reform may be a major contributing factor in the repeated failures of past reform efforts (Cuban, 1990).

## **Statement of the Problem**

In their work, Doing Naturalistic Inquiry, Erlandson, Harris, Skipper, and Allen (1993) assert that (p. 49) "The problem statement in naturalistic research is not a question or even an objective, but rather ... an expression of a dilemma or situation that needs to be addressed for the purposes of understanding and direction."

The need for reform in all aspects of science education and the lack of classroom teacher input into these reforms certainly qualifies as the "dilemma or situation that needs to be addressed" mentioned above.

Furthermore, to cite Lincoln and Guba (1985), a problem is a state of affairs that (1) begs for additional understanding, (2) identifies the need for choosing between alternative courses of action, or (3) leads to undesirable consequences. The first definition is most relevant to this study. The "state of affairs that begs for additional understanding" is the situation of the classroom teacher, particularly the beginning science teacher who seems in many cases to be continually teetering on the edge of giving up the teaching profession. Reform efforts need information about the "lived reality" of the novice science teacher in order to reform science teacher education in a meaningful and lasting way. This research project is proposed as a small step in the direction of channeling the input of classroom teachers into improving science teacher education. To this end, the following "problem statement" is proposed:

In what ways do secondary science teachers believe they have been prepared by their preservice teacher education program to meet the important needs of their first year of teaching?

### **Purpose of the study**

In addressing the problem stated above, this study seeks to inform the practice of science teacher education by discovering the needs of first year teachers, and those teachers' opinions of how well their preservice experience has helped them meet those needs. The purpose of the study is not to evaluate, criticize, or condemn any particular science teacher education program. Rather, this study intends to investigate the "lived reality" of the novice teacher, to see their preservice education through their eyes. In the process, this study hopes to discover the felt needs of prospective teachers, and to find out how well those prospective teachers feel they were prepared by their preservice education

programs. It is hoped that the information gleaned from this study will assist science teacher educators in the continual improvement of their programs. Well-informed preservice programs may help prevent beginning teachers from being "shocked" by their initial classroom experience, and as a result increase job satisfaction and decrease early teacher attrition.

### **Research questions to be answered**

In order to properly address the research problem and fulfill the project's stated purpose, this study will focus on gathering two types of information. The first focus will be on which needs, defined as skills or bodies of knowledge relating to teaching, are important to teachers in their first year of teaching. Second, the study will seek to find out how teachers perceive their preservice education programs, specifically how well they feel the program has prepared them to be teachers. Therefore, this study will ask the following specific research questions:

RQ1 What needs are important to the first-year teacher?

RQ2 In what ways do teachers think their preservice program has prepared them (or failed to prepare them) to meet these needs?

### **Hypotheses/Objectives**

As this is a descriptive study, the research questions do not lend themselves to traditional initial hypotheses. Working from a phenomenological perspective, it is expected that hypotheses will emerge from the study through an inductive process.

In harmony with research questions, the descriptive objectives of this study are as follows:

1. To discover the needs of first-year teachers
2. To discover the importance of those needs in the first year
3. To discover teachers' perceptions of the ways in which they have been prepared by their pre-service programs

### **Assumptions**

This study assumes that classroom teachers are important, and perhaps the ultimate, sources for the answers to the research questions above. Concrete experience has made teachers into experienced authorities on the skills and knowledge they need to teach successfully. Similarly, teachers are well-qualified, perhaps best-qualified, to evaluate how well their preservice programs have prepared them to meet the challenges of their first year teaching. While such assumptions may at first seem obvious, the low instance of teacher input into recent reform efforts demands that they be specifically identified and mentioned.

Another strong assumption is that a descriptive study utilizing qualitative methods is an effective and useful way of discerning the needs that are important to first-year teachers and how well their preservice experience has prepared them for teaching. The gathering of large-scale qualitative data will provide breadth to the overall study, and make it more useful to science educators outside the specific setting of the study. The use of qualitative methods in a smaller-scale component will add depth to the study, providing the data with rich context and detail. Understanding the "lived reality" of the first-year teacher is important to a meaningful understanding of their needs. Qualitative methods will assist in discovering this reality.

This study also assumes that the first semester of teaching is an important time in the career of a science teacher, and therefore that a study of this time has potential to inform science teacher education. This assumption is based on evidence discussed in Chapter 2 that the start of a science teacher's career is a time of great change and

challenge. It is assumed that these changes and challenges influence whether or not a science teacher will remain in the profession, a matter that should be of concern to teacher educators.

### **Rationale/Theoretical Base**

As mentioned earlier, most of the recent reform efforts have given short shrift to input from classroom teachers (Czerniak & Lumpe, 1996), an ironic situation since classroom teachers possess firsthand knowledge of the challenges and problems reform movements must address. Even one of the most comprehensive and inclusive of reform programs, Project 2061, counts very few classroom teachers among its participants. Yet, studies have shown (McLaughlin, 1990; Tobin, Tippins, & Gallard, 1994) that it is difficult to enact lasting classroom change without the input of classroom teachers. Bybee (1993, p.144) asserts that the classroom teacher is the "decisive component" in science education reform. Further, Cuban (1990) contends that one reason for the consistent failure of reform efforts (enlisting hue and cry for yet more reform) may be the exclusion of teachers' voices from the reform process.

In their article calling for a general intensification of research in science education, Adams and Tillotson (1995) are critical of many previous attempts to "study" classroom teachers. They propose one very good reason why past research may have been less than useful (p. 442):

Often prospective and beginning teachers are viewed as objects to be studied, rather than as collaborators in an endeavor to develop common understandings between researchers and practitioners. The extant research... does not contribute to the enhancement of science teacher education per se... Genuine communication about the nature of the teaching enterprise ought to be a serious goal.



Fuller and Bown (1975) echo this sentiment (p. 34):

Researchers tend to discover unflattering things about teachers... No wonder research has little impact on the teacher. She finds it both useless and alien... All in all, teachers do not feel much helped by research and researchers. The research base, an ever-present help in time of need for other professions, is not the teacher's friend.

Grankvist (1996) expresses the opinion that educational research must be conducted and reported in a way that is attuned to the needs of practitioners in the field, not tailored to other education researchers. He feels that classroom teachers have an opinion of education research that is apathetic at best – and hostile at worst – because so little effort is made to both speak to them and hear their voices. He maintains that incorporating educational research into preservice and in-service training can improve these unfavorable attitudes, so long as student teachers and classroom teachers are treated as equal partners in the enterprise. Such efforts can help to more closely link theory with practice. Both theory and practice cannot help but be improved by bridging this gap.

Clearly, more constructivist approaches to research are needed to help us hear teachers' voices and understand better the "lived reality" of teaching. Kelly (1993) asserts that teacher education should be intimately linked with educational research. The external study of education must aid and abet internal reflection on the part of teacher educators. Kelly maintains that educational practice needs to be informed by studies that seek to discover the realities of the teacher's practice, and that focus on what student teachers actually receive from the education curriculum, which may be very different from what the teacher educator intends. The research described in the third chapter will attempt to address this need.

The transition from college to professional life often chronologically parallels the transition into adulthood. Therefore, we may be able to apply some principles of adult

education to science teacher education. Malcolm Knowles (1980) is often credited with coining the term "andragogy" to distinguish the education of adults from the education of children (pedagogy), although Brookfield (1986) notes its use much earlier. Knowles outlined what he saw as the major differences between andragogy and pedagogy in his 1980 book, The Modern Practice of Adult Education. For example, Knowles asserted that as children become adults, they become more self-directed in their learning, and increasingly look to their learning for practical applications to their adult lives. With these adult characteristics in mind, Knowles suggested that the learner should drive adult education, with the educator acting primarily as a facilitator.

More recent thinkers in adult education have backed off somewhat from Knowles' extreme stance. Brookfield (1986) points out that Knowles' assertions are not universal: children can be self-directed and practically-minded at an early age, and such traits may be discouraged even in adults by certain cultural circumstances. Monette (1977, 1979) contends that an approach to adult education that relies entirely on students' needs runs the risk of turning the adult educator into a mere service technician, and the classroom into a learning "cafeteria." Brookfield (1986) warns that a totally student-centered curriculum can deny educators the right to challenge students, and denies students the ability to benefit from the instructor's knowledge and experience. A totally instructor-centered curriculum is not an answer either, however. Brookfield (1986) warns us that such a curriculum will "offer narrowly focused, elitist courses... and attract learners whose preferences and prejudices match those of the programmer. (p. 98)." He advocates a balance in adult education between what learners feel they need (the "felt needs" of Monette (1979)) and what experienced professionals feel learners will need ("prescribed needs"). Brookfield touts the inclusion of learners' experiences in adult education curriculum as a "given." This study will attempt to discover these experiences of first-year teachers in an attempt to inform science teacher education.

In a seminal theoretical work, Abraham Maslow (1970) constructed a "hierarchy" of essential human needs, ranging from "basic needs" focusing on physical survival, and

extending through safety needs, relationship needs, esteem needs, up to the highest-level needs for understanding, self-fulfillment, and aesthetic satisfaction. According to Maslow's theory, people usually will not concern themselves with needs at the "top" of the hierarchy if their more basic needs are not being met. Veenman (1984) sees this theory as highly applicable to teachers (p. 165):

Needs such as security, affiliation, and self-esteem must be satisfied first before beginning teachers can behave as autonomous or self-actualized persons and respond more adequately to the realities of their circumstances in order to perform a successful and satisfying job.

If the very important basic needs of teachers are not being met by entities such as their preservice education, their school system, or their community, then teachers may simply not be able to focus on matters higher up the "ladder" that outside agents of reform consider important. Therefore, if reform efforts do not deal first with the basic felt needs of teachers, they may be doomed to failure. By consulting with classroom teachers, we may be able to construct a "hierarchy of needs" for beginning teachers that can inform science teacher education and increase the likelihood of success for future reform efforts. Teachers' voices are vital to discovering and providing for these needs.

### **Importance of study**

Many recent reform efforts have not consulted classroom teachers before making their recommendations. Yet, teachers are instrumental to enacting lasting change at all levels of education. As demonstrated in Chapter 2, most studies of teacher needs from teacher perspectives either do not specifically deal with science teachers, have a 10-20 year vintage, or both. Also, most studies of teachers' needs do not focus on the first year. This study has the potential to inform the practice of modern science teacher education, as teacher educators strive to prepare new teachers for the challenges they will face.

## **Definition of terms**

*Need* – As Monette (1977) points out, the term "need" has become muddled from a high degree of use in educational research; the definition of the term is unstable. This study slightly modifies one of the alternatives offered by Monette, defining a need as a particular skill or body of knowledge relating to the task of teaching. While all of the "needs" addressed in this study are believed to be important to successful teaching, it is understood that all needs are not necessarily equally important.

*Preservice program / experience / education* – This term is defined as a period of formal academic training immediately preceding teacher certification, usually (but not always) undertaken at an undergraduate institution. This study employs a definition of preservice education similar to that of Adams and Krockover (1997), encompassing subject-matter coursework, coursework in pedagogical theory, and field experiences teaching in actual classrooms. The emphasis in this study will be on the training of prospective science teachers.

## **Delimitations**

It is hoped that the results of this study will be perceived as useful in as many different contexts as possible. However, the researcher has imposed conditions on the research, which may hamper the applicability of results.

The study is narrowly focused on the particular needs and experiences of teachers of science at the secondary school level in public schools. Readers wishing to apply the results to other academic disciplines, grade levels, or types of schools should do so with caution.

For the sake of convenience, collaborators in this study will be selected from a limited geographical area. As much information will be provided as possible about the

context of the study. However, too many details may compromise the confidentiality of collaborators, which in this case is an overriding concern. Again, readers wishing to apply the results of this study to their situations should do so with care.