organized as an inquiry into characteristics of teaching science in an elementary school. The intervention of using yourself as a learning laboratory involved students in conducting systematic inquiry into their own learning throughout each course by using scientific habits of mind to investigate what and how they were learning. They gathered, recorded, organized, analyzed, and synthesized data about their own responses to all course events and communicated them to the entire group. Thus, the strategy was inextricable from other structural aspects of each course.

Theoretical Framework

The theoretical framework reported here links diverse literature bases that reflect and support the grounded theory emerging from this study. The grounded theory indicated using yourself as a learning laboratory, when embedded in a course organized as an inquiry with specified action foci, contributed to helping participants mitigate their resistance to teaching through inquiry. The emergent grounded theory also indicated that enroute to embracing inquiry, learners experienced identifiable stages resembling stages of grief after a major loss. The following sections include literature addressing each of these and other related factors reviewed in an effort to elucidate and support the emergent grounded theory.

Inquiry in Learning Science

The National Science Education Standards (NSES; National Research Council [NRC], 1996) indicate science teacher preparation should focus on learning science content through inquiry, partial and full, and "provide opportunities for teachers to learn and use various tools and techniques for self-reflection" (p. 68). Resistance to learning science and science teaching through inquiry, especially full inquiry, is common among preservice students in classes teaching methods of science for the elementary grades (Yeotis et al., 1998). Many of these students have never had the opportunity to experience authentic scientific (full) inquiry and have not themselves been successful learners of science in schools. It has been reported that their lack of success often leads to science anxiety and negative attitudes toward science teaching (Barnes & Spector, 1999). "Prospective teachers who have not experienced the tone and substance of scientific inquiry in meaningful ways cannot be expected to catalyze in their students what the teachers themselves have never actually experienced" (Barnes & Spector, p. 3). The role of such experience in learning, particularly with full inquiry, is apparent in experiential learning theory.

Experiential Learning Theory

Kolb (1984) identified a four-stage learning cycle including experience, reflection, abstract conceptualization, and action. The cycle begins with the concrete experience. The second step is reflective observation where the learner reviews the experience and understands its value, both cognitively and emotionally, and shares these data with others. In the third step, the learner uses abstract conceptualization

to connect the experience with past experiences and knowledge, generalizing features of the experience into lasting concepts and rules. For the fourth step in the experiential learning process, the learner tests the veracity of these new concepts by applying them to new actions and experiences. Learning increases when people choose to reflect on their experiences. Kolb's model is philosophically consistent with Novak's (1998) definition of learning: the integration of thinking, feeling, and acting. Novak's theory of education proposes empowering learners (in this case, preservice teachers) to take charge of their own meaning making from experiences by integrating thinking, feeling, and acting. Reflection is an integral part of this process of making meaning that facilitates changes in mental models comprising a person's cognitive framework.

Reflection

Reflection is a deliberate, voluntary process for learning. Senge, Kleiner, Roberts, Ross, and Smith (1994) described reflection as "slowing down our thinking processes to become more aware of how we form our mental models" (p. 237). They further stated,

> *In cognition, the term [mental models]refers to both the semipermanent, tacit, "maps" of the world which people hold in their long term memory, and the short term perceptions which people build up as part of their everyday reasoning processes . . . Changes in short term everyday mental models, accumulating overtime will gradually be reflected in changes in long term, deep-seated beliefs. (p. 237)*

Each person's cognitive framework is composed of many mental models accumulated during one's lifetime and is, therefore, idiosyncratic. In the process of full inquiry (NRC, 1996), systematic reflection on one's own learning usually reveals questions for further exploration or inconsistencies with previously held mental models (e.g., models held by some preservice teachers from their personal experience as students about what will or will not work for science teaching). These inconsistencies and need for extensions stimulate questions for further investigation and, subsequently, learning. The self-directed cycle of reflection, questioning, gathering data, evaluating performance, and making adjustments constitutes the process of autonomous learning, or "the ability to undertake all or most of the design of (one's) own learning, to evaluate performance, and to make adjustments accordingly" (Moore & Kearsly, 1996, p. 205).

Autonomous Learning

Linn (1998) indicated that a tension exists between providing students with explanations and enabling them to become autonomous learners. "Tension exists between the explicitness of directions given to students to do an inquiry task, directions that are too detailed can serve as a 'cookbook' encouraging them to