

THE ROLE OF PRIOR BELIEFS, REFUTATIONAL TEXT,
INTRINSIC AND EXTRINSIC GOALS, AND
EXTRINSIC REWARD STRUCTURE
IN THE CONCEPTUAL CHANGE
OF PRESERVICE TEACHERS

By

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This dissertation is dedicated
to my parents, who have contributed
equally, but in very different ways,
to my successes as a student
and a person.

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Previous research has demonstrated that a refutational text challenging the commonly held conception that extrinsic reinforcement is a more effective strategy for motivating learning successfully facilitated conceptual change in preservice teachers. The purpose of this study was to extend this prior research by examining whether a motivational variable -- teachers' intrinsic goal orientation -- and a contextual variable -- a controlling reward structure -- moderated the effect of the text on preservice teachers' conceptual change.

A sample of 188 undergraduate students enrolled in two upper- and one lower-division foundations of education courses read a refutational or nonrefutational text about motivation, received a controlling or noncontrolling

extra credit reward structure, and completed a pre- and posttest instrument that measured their beliefs about motivating students. The conceptual change measure was separated into an intrinsic and extrinsic subscale to allow for a more specific analysis of the nature of conceptual change.

ANCOVAs using intrinsic goal orientation, text type, and reward structure as independent variables, pretest scores as a covariate, and posttest scores as the dependent variable revealed that (a) pretest beliefs were a significant covariate in the model, and (b) text type, goal orientation, and reward structure interact in significant ways to affect conceptual change. Particularly, post hoc analyses revealed that a controlling reward structure had a significant positive effect on conceptual change on the intrinsic and extrinsic subscale scores of students with low intrinsic goal orientations; however for students with higher intrinsic goal orientations, a controlling reward structure appeared to undermine conceptual change. In the absence of a controlling reward structure, having a higher intrinsic goal orientation had a positive effect on conceptual change for both subscales. It was also found that regardless of goal orientation, providing participants with refutational text and a conditional reward structure most effectively facilitated conceptual change on the extrinsic subscale. Lastly, the observed conceptual change remained on the intrinsic scale scores and increased on the extrinsic scale scores after a 1-week delay.

CHAPTER 1

INTRODUCTION

Statement of the Problem

Unlike a course in history, geology, or physics, the content in a teacher education course involves familiar life experiences (Leean, 1979). In fact, students entering preservice teacher programs have spent 12-14 years in school settings, during which time a great deal of implicit knowledge about teaching and learning is constructed based on their personal experiences as students (Lortie, 1975; Pintrich, 1990). With this prior knowledge, teachers construct "naïve theories," which are often deeply engrained and highly robust, and that serve as a basis for evaluating new theories and ideas about teaching (Holt-Reynolds, 1992). The personal history-based beliefs of preservice teachers serve as interpretive frameworks (Piaget, 1974) or cognitive representations into which new knowledge about teaching and learning can be integrated. Although well-entrenched beliefs sometimes provide useful frameworks for the learner, they may conflict with information presented in education courses that is based on current theory and research in educational psychology (Pintrich, 1990; Salisbury-Glennon & Stevens, 1999).

For example, for several decades behavioral theories of learning have dominated the field of education. Recently, however, a decade of cognitive research challenging behavioristic perspectives of learning (Case & Bereiter,

1984; Cohen & Ball, 1990; Resnick, 1983; Shuell, 1986) has prompted a shift in thinking toward constructivism. According to a constructivist perspective, what a student learns results from the interaction between what is brought to the learning situation and what is experienced while in it (Stofflett, 1994). Herrmann (1993) argued that traditional behavioral teaching methods and evaluative techniques still predominate in schools and in teacher preparation programs. If this is true, then teacher candidates cannot be expected to spontaneously generate a pedagogy (e.g., constructivism) they have never personally experienced (Stoddart, Stofflett, & Gomez, 1992). This may help explain why so many preservice teachers hold more structured behaviorist epistemologies (Ball, 1989; Ball & Feiman-Nemser, 1988; Hollingsworth, 1989).

Indeed, research has shown that student teachers often think of teaching as telling and of learning as memorization (Calderhead & Robson, 1991; Wubbels, Korthagen, & Broekman, 1991). Jones and Vesilin (1995) reported that student teachers tend to think of classroom management as controlling their students. Further, in a recent study by Salisbury-Glennon, Stevens, and Duffy (in progress) undergraduate education majors tended to view extrinsic motivators (e.g., prizes, stickers, candy, or free time) as more effective means of motivating students than intrinsic motivators (e.g., choice, autonomy, interest, and challenge). This viewpoint contradicts certain currently held beliefs by most theorists doing research in the field of motivation (Connell & Wellborn, 1991; Deci & Ryan, 1985, 1987; Lepper & Greene, 1975). Beliefs such as these along with attitudes, beliefs, values, assumptions, and habits held by teacher candidates are

most likely constructed throughout their personal involvement as students in behaviorist classrooms (Herrmann, 1993; Lortie, 1975; Pintrich, 1990).

Preservice teachers' personal conceptions could exert a powerful influence on what they learn and accept as valid knowledge in teacher education courses (Kagan, 1992). Furthermore, if personal experienced-based conceptions about teaching, learning, classroom management, and motivation are not exposed and addressed, preservice teachers may perpetuate them in their own classrooms (Salisbury-Glennon & Stevens, 1999). If these statements are true, then it should be the responsibility of teacher educators to uncover beliefs held by preservice teachers, which have been acquired through years of experience as students, that may interfere with the learning of new teaching and learning techniques (Pintrich, 1990).

Following a constructivist tradition, this would require teacher educators to assess students' entering beliefs and cognitive representations in relevant areas and attempt to utilize instruction that facilitates conceptual change (Pintrich, 1990). However, this is no easy task. Recognizing pre-existing beliefs is the first step in making them an explicit object of discourse, yet pre-existing knowledge is often hard to explicate or diagnose (Pintrich, Marx, & Boyle, 1993). The difficulty in facilitating conceptual change is compounded by the negative attitudes many preservice teachers hold toward theory presented to them in teacher education courses, which leads them to ignore the contribution that such theories could make towards practice or to view them as counterproductive to good practice (Lasley, 1980; Sanders & McPeck, 1976).

According to Stofflett and Stoddart (1994), many preservice and even in-service teachers continue to hold on to their "naïve theories" about teaching and learning, probably because the traditional didactic instruction used in so many teacher preparation courses fails to challenge or improve student pre-conceptions (Salisbury-Glennon, 1999). Didactic approaches (e.g., lectures) typically involve students as passive learners rather than as the type of active constructors of knowledge necessary for conceptual change (Herrmann, 1993). Indeed, a large body of research from the past 20 years has demonstrated that traditional approaches to teacher education have had little impact on teachers' prior beliefs and conceptions (Bird, Anderson, Sullivan, & Swindler, 1993; Gomez & Stoddart, 1991; Hollingsworth, 1989; Holt-Reynolds, 1992; Knowles & Holt-Reynolds, 1991; McDiarmid, 1989; Zeichner & Tabachnick, 1985; Zeichner, Tabachnick, & Densmore, 1988) that strongly influence their practice (Buchmann, 1989; Bullough, 1989; Hollingsworth, 1989, 1989; Lortie, 1975; Stoddart, 1991; Zeichner et al., 1988).

The literature on conceptual change (Pintrich et al., 1993; Posner, Strike, & Boyle, 1993; Posner, Strike, Hewson, & Gertzog, 1982; Strike & Posner, 1985; West & Pines, 1985) identifies pedagogical strategies to help teacher educators overcome the difficulty posed when students' entering beliefs serve as barriers to conceptual change. These conceptual change techniques are grounded in constructivist developmental theory (Piaget, 1970, 1974, 1985), which asserts that assimilation and accommodation are the processes of conceptual change. One such pedagogical strategy involves the use of refutational texts that attempt

to create cognitive conflict by acknowledging the learner's existing conceptions and contrasting them with the more scientifically accepted conception (Guzzetti, Williams, Skeels, & Wu, 1997). Researchers in reading education (Alvermann & Hague, 1989; Alvermann & Hynd 1989; Maria & MacGintie, 1987), science education (Roth, 1986; Guzzetti et al., 1997; Guzzetti, Snyder, Glass, & Gamas, 1993), and teacher education (Salisbury-Glennon and Stevens, 1999) have been successful at demonstrating significant conceptual change in readers of refutational versus nonrefutational (regular) texts.

Refutational texts were designed to incorporate a popular model of conceptual change proposed by Strike and Posner (1985) and Posner et al. (1982). These authors stated that when encountering knowledge that challenges existing concepts, students sometime assimilate the information by incorporating existing knowledge or schemes. Often, however, the new information cannot be grasped easily using existing cognitive representations. In these cases, existing concepts must be revised or reorganized via the process of accommodation. How existing information and knowledge structures are either replaced or restructured to accommodate new information is at the heart of the Conceptual Change Model (CCM) of Posner et al. and Strike and Posner.

The CCM specifies the four conditions necessary for successful conceptual change. The learner must (a) experience dissatisfaction with the current conception, (b) understand the new conception, or view it as intelligible, (c) find the new conception plausible, or at least consistent with other knowledge, and (d) believe that the new concept has potential for suggesting a fruitful

research [or teaching] program. These conditions necessitate activation and examination of students' prior knowledge (made up of current cognitive representations derived from past experiences), often referred to as the learner's conceptual ecology.

The components included in the original CCM represent what Pintrich et al. (1993) called a "cold" model of conceptual change because it only includes the requisites of conceptual change if conceptual change is viewed as a strictly cognitive process that operates exclusively on rationality. This model fails to account for individual differences in conceptual change among learners. For example, the model is not sufficient for explaining why some students do not choose to activate or examine their current conceptions in all situations. In response to this criticism, Strike and Posner (1992) revised their theory and now suggest that a wider range of factors, such as motives and goals, should be included in a learner's conceptual ecology. These variables may affect conceptual change in ways that are not always viewed as "rational," and they may interact with prior conceptions and other components, such as classroom context in complex and dynamic ways.

Pintrich et al. (1993) have elaborated on this notion and posited a "hot," or less rational, model for conceptual change. In this hot model, the authors suggested that individual differences in motivational constructs (e.g., goals, interest, values, epistemic beliefs, self-efficacy, control beliefs, and affective components) and cognitive constructs (e.g., knowledge, cognitive learning strategies, problem-solving, metacognition, and self-regulation strategies)

mediate the process of conceptual change. Likewise, they hypothesized that certain classroom contextual factors (e.g., teacher behavior and task, reward, and goal structures) can moderate the relationship between student motivation and conceptual change. Pintrich et al. argued that cognitive, motivational, and classroom factors interact with the four conditions of conceptual change (dissatisfaction, understanding, plausibility, and fruitfulness) in dynamic, non-linear ways.

Researchers in the area of motivation have already empirically demonstrated significant relationships between cognitive (knowledge, thinking, learning, and metacognitive strategies), motivational (expectancy, value, affect), and contextual constructs (task characteristics, instructional processes) and various achievement outcomes in elementary, secondary, and postsecondary students. In fact, Pintrich and Schrauben (1992) provided a mediational model to explain the dynamic interaction of these variables, namely that contextual factors affect motivational beliefs, which in turn have significant effects on academic performance through their impact on cognitive engagement and strategy use.

For example, Connell and Wellborn (1991) and Deci and Ryan (1987) reported that teacher behavior that is perceived as controlling, or learning tasks that are perceived as controlling, can inhibit students' learning, performance, and motivational outcomes in the classroom via their effects on student motivation, attributions, and beliefs about learning. Information that is freely sought and acquired without external control is usually experienced as more interesting, enjoyable, and personally significant. By the same token, extrinsic rewards and

controls placed on learning tasks and performance can create pressure that will be detrimental to motivation, stifle creativity, and hinder enjoyment of the task if the student perceives the rewards as controlling (Deci, Nezlek, & Sheinman, 1981; Lepper & Greene, 1975; Ryan, 1982). Information that is acquired under external control (e.g., grades, rewards) may cease to be processed further once the outcome is obtained (Amabile, 1983). Furthermore, Amabile suggested that pressure combined with an external focus can interfere with higher level processing of information, resulting in rote learning strategies and less conceptual integration.

Thus, research in the area of motivation has added much to our understanding of classroom factors and learner variables that can affect achievement outcomes in the classroom. However, Pintrich et al. (1993) argued that there are a number of unresolved problems with the conceptual change model. In particular, they stated that although the research in motivation has added to our understanding of classroom learning, "what remains to be developed is a program of research that specifically investigates two critical features of the conceptual change model . . . the nature and function of motivation, and classroom contextual factors" (p. 191). A thorough review of the literature supports their claim that, to date, no empirical research has been conducted to examine the relationships between motivational and classroom variables and conceptual change. That, then, is the basis for this study.

Purpose of the Study

Previous research has demonstrated that a refutational text challenging the commonly held conception that extrinsic reinforcement is a more effective strategy for motivating learning successfully facilitated conceptual change in preservice teachers. The purpose of this study was to extend this prior research by examining whether a motivational variable – teachers' intrinsic goal orientation – and a contextual variable – a controlling reward structure – moderated the effect of the text on preservice teachers' conceptual change.

Definitions

Definitions of the constructs under investigation should be explicated before proceeding:

1. Conceptual change refers to the accommodation of new information through the replacement or restructuring of existing information. In the present study, conceptual change was measured by changes from pre- to posttest in teachers' beliefs about motivating students.
2. Intrinsic goal orientation refers to the learner's reasons or purpose for engaging in a learning task. Particularly, individuals who are intrinsically motivated are engaging in a learning task for the purposes of interest, challenge, mastery, or conceptual understanding of the knowledge presented. It is assumed that goal orientation is a cumulative representation of an individual's academic goals shaped by experiences in past learning environments.

3. Refutational text follows a conceptual change model in that it presents a commonly held prior conception, refutes it by explaining why it is not a scientifically acceptable concept, and provides a credible, coherent explanation that supports the scientific conception.
4. Nonrefutational text does not follow the conceptual change model but attempts to inform readers without any effort to refute prior conceptions.
5. Reward structure refers to how the reward (i.e., extra credit) was acquired by the participant. Two reward structures were compared: (a) a controlling reward structure in which participants were led to believe that receiving extra credit was contingent upon their performance on the posttest and (b) an uncontrolling reward structure in which participants were led to believe that extra credit was not contingent upon their performance on the posttest, but would be delivered merely for participation in the study.

Therefore, in the present study, the following questions were investigated so that a better understanding of individual differences in conceptual change and a more complete model of conceptual change among preservice teachers may be realized:

1. Is intrinsic goal orientation, which is a result of past experience, related to agreement with items on the pretest measure of conceptual change?
Specifically, are participants with higher intrinsic goal orientations more likely to agree that the intrinsic motivation strategies are a good way to motivate kids than participants with lower intrinsic goal orientations?

2. Is a refutational text more effective in inducing conceptual change than a nonrefutational text?
3. Does a controlling reward structure limit conceptual change in comparison to a noncontrolling reward structure?
4. Do students with an intrinsic goal orientation toward learning have greater conceptual change than students with a less intrinsic goal orientation?
5. Is there an interaction between refutational text, reward structure, and intrinsic goal orientation? A particular question of interest is whether a controlling reward structure will have a differential effect on conceptual change for students who have low vs. high intrinsic goal orientation.
6. Does conceptual change remain after a 1-week delay?

Hypotheses

Based on previous research in the field of motivation and the suggestions of Pintrich et al. (1993) for research on conceptual change using a hot model, the following hypotheses were empirically tested:

1. Students' goal orientation will significantly predict their initial agreement to the items on the pretest measure of conceptual change. Specifically, having a higher intrinsic goal orientation will be positively correlated with believing that the intrinsic items are good ways of motivating students. Having a lower intrinsic goal orientation will be positively correlated with believing that the extrinsic items are good ways of motivating students.

2. Students who read refutational texts on motivation theory will have significantly higher scores on conceptual change than students who read nonrefutational texts.
3. Students who are administered a controlling reward structure will have lower conceptual change scores than students who administered a noncontrolling reward structure.
4. Students with an intrinsic goal orientation will have higher conceptual change scores than students with a less intrinsic goal orientation.
5. There will be an interaction between refutational text, reward structure, and intrinsic goal orientation. Particularly, the controlling reward structure situation will have a differential effect on conceptual change for students who are less vs. more intrinsically oriented. In other words, a controlling reward structure will not significantly affect conceptual change for participants who are more intrinsically motivated. However, a controlling reward structure will be more salient to participants who are less intrinsically motivated, and subsequently negatively affect their conceptual change.
6. Conceptual change will remain after a 1-week delay.

Significance of the Study

A major goal of teacher education should involve inducing conceptual change in preservice teachers (Pintrich, 1990). It has been demonstrated that preservice teachers hold misconceptions, which if not challenged, can affect classroom practice (Salisbury-Glennon & Stevens, 1999). It is not enough to merely activate students' prior knowledge. Furthermore, many who possess

learning and thinking strategies do not always choose to use them or cognitively engage in the task. Researchers in the area of motivation have provided a wealth of information on various motivational constructs and their relationships to cognition, context, and achievement outcomes. By carefully analyzing and specifying the conditions necessary for conceptual change using a constructivist approach, researchers (e.g., Posner et al., 1982) have challenged traditional views about teaching and learning. This research has made it possible for others (e.g., Pintrich et al., 1993) to posit a hot model of conceptual change, which could help teacher educators create more effective conceptual change pedagogy. However, before this can be accomplished, more empirical research must be conducted on motivational and classroom contextual factors that affect conceptual change. Therefore, the present study attempts to advance our understanding of the relationships between these factors and conceptual change in preservice teachers.

Refutational text, based on models of conceptual change, may be a useful tool for teacher educators to use when confronted with preservice teachers who hold pre-existing conceptions that contradict newer, more scientifically accepted theories about learning. Indeed, Salisbury-Glennon and Stevens (1999) demonstrated that refutational text had positive effects on college students' conceptual change and that conceptual change was related to their use of self-regulated learning strategies. However, their study did not examine how individual differences in motivational constructs (e.g., self-efficacy, task value, goal orientation, control beliefs, test-anxiety, interest) affect teachers' beliefs or

conceptual change. Moreover, no study has been conducted to examine how a common classroom contextual variable (reward structure) may affect conceptual change in preservice teachers who read refutational texts. The present study attempted to explore these factors using refutational texts as a method for inducing conceptual change. Consequently, findings from this study may also add to our knowledge about the efficacy of using refutational texts to facilitate conceptual change among preservice teachers.

Limitations of the Study

The present study attempted to examine the effects of a reward structure on conceptual change in preservice teachers who read refutational or nonrefutational texts. Participation in the study was voluntary, so all subjects were offered exactly 1% extra credit to a course grade for their completion of the study. Offering extra credit for participation posed a limitation to the study in that students who were not motivated to improve their course grades did not participate. As it turned out, 201 students were given the opportunity to participate. All 201 students began the study. However, 10 dropped out after Phase One and 3 participants' questionnaires were uncodable, making for a total sample size of 188 students. Once in the study, participants were assigned either a controlling (performance-based) or noncontrolling (nonperformance-based) reward structure, in the form of an additional 1% extra credit. Providing half of the participants the opportunity to earn an additional 1% through good performance, while providing the other half with unconditional extra credit, should have induced a particularly controlling situation for the former subjects. Studies in which

teachers have imposed controlling task or reward structures reported an undermining of student intrinsic motivation and a mastery learning orientation (Ames, 1992; Ryan, Connell, & Deci, 1985). Moreover, evaluation procedures that focus on external rewards can foster a performance goal orientation where the learner focuses on obtaining the reward versus gaining a conceptual understanding of the content (Ames, 1992; Elliott & Dweck, 1988; Grolnick & Ryan, 1987). It was of interest to observe whether an extra 1% of a total course grade was "controlling" enough to produce the effects typically found in these studies.

Salisbury-Glennon and Stevens (1999) demonstrated an empirical link between strategy use and conceptual change, without the consideration of learners' motivational orientations or contextual factors. The present study attempted to demonstrate empirical links between motivational and contextual variables and conceptual change, without the consideration of strategy use. Therefore, before a complete model of conceptual change can be realized, studies should be designed to include the concurrent examination of all the factors (motivation, context, cognition) that have potential to affect conceptual change. Moreover, as the present study provided correlational evidence about the relationships among variables, it could not provide evidence for cause/effect relationships between motivational constructs and conceptual change. The present study did provide preliminary data regarding the importance of including goal orientation and reward structure in future research on conceptual change.

CHAPTER 2

REVIEW OF THE LITERATURE

Introduction

In this chapter, the following literature will be discussed. First, common beliefs held by preservice teachers are identified, and explanations are presented as to why prior beliefs are often so resistant to change. Second, the original model of cold conceptual change of Strike and Posner (1985) and Posner et al. (1982) is presented followed by reasons why teacher preparation programs fail to induce conceptual change. Third, recent literature that suggests the need for a hot model of conceptual change is presented. This literature is based on the theoretical and empirical research in the field of motivation that has demonstrated relationships between motivational constructs and achievement-related outcomes. Next, research related to classroom contextual variables, particularly controlling reward structures and their effects on intrinsic motivation, is discussed. Last is a review of studies that have established the efficacy of using refutational text to facilitate conceptual change.

Teachers' Conceptions and Their Resistance to Change

Theories of Conceptual Change

As stated in Chapter 1, teachers often hold personal experience-based beliefs about good teaching and learning that may be highly resistant to change and interfere with good pedagogy. Because of this, it has become a goal of some

researchers in the field of teacher education to find effective techniques for facilitating conceptual change in preservice teachers. Researchers in the area are applying theory and methods presented in the literature on conceptual change to address the issue of conceptual change in teachers. These conceptual change techniques are centered on confronting people's naïve beliefs in hopes of replacing them with more scientifically held conceptions.

First, it is necessary to understand why prior beliefs are often so difficult to change. McCloskey (1983) has argued that people develop remarkably well-articulated naïve theories of scientific phenomena on the basis of everyday experience. Motivated to understand the world around them, they construct naïve theories and conceptual frameworks to provide explanations for how the world operates. Experiences (including prior schooling) provide sources of data that shape and reinforce those beliefs, making them very difficult to change. A number of studies have demonstrated the existence of naïve theories among science students regarding Newtonian physics (McCloskey, Caramazza, & Green, 1980); gravity (Champagne, Klopfer, & Anderson, 1980); motion (Clement, 1983); sunlight and heat (Alvermann, Smith, & Readence, 1985); electrical flow, force, and biological concepts (Osborne & Freyberg, 1985). Stahl, Hynd, Montgomery, and McClain (1997) demonstrated the presence of student misconceptions regarding historical events (e.g., the "discovery" of America by Christopher Columbus). The overwhelming evidence from these studies indicates that students not only lack scientific information, but also hold misconceptions

that affect the manner in which they try to understand problems they encounter in science classrooms.

Kuhn (1989) argued that some students' misconceptions tend to be very powerful and are more than a simple set of false beliefs. In many areas, they can negate direct evidence students observe in experimental classroom settings. Some researchers (see Kuhn, 1989, for a review) argued that because knowledge is constructed primarily from unguided, uncontrolled observation, most students lack a coordinated, consistent, and complete conceptual system for understanding the world. Other researchers have argued more strongly that many students' conceptual systems are not merely fragmented and unconnected, but altogether "incorrect" connected, complete, and well-organized conceptual systems (Carey, 1985; Carey & Smith, 1993). In any case, the previous studies show that students bring considerable erroneous information to science classes, which must be unlearned before appropriate conceptual systems about science can be acquired. Unfortunately, because students' incorrect conceptual systems are the result of a life's worth of personal, unguided observations of the world, these systems may be strongly held and difficult to change.

Common Teacher Conceptions

Like science students, preservice teachers construct conceptual systems about teaching and learning based on their experiences with formal and informal educational systems (Herrmann, 1993; Holt-Reynolds, 1992; Lortie, 1975; Pintrich, 1990). Research on teacher education suggests that student teachers

have spent thousands of hours in an apprenticeship of observation (Lortie, 1975), which leads to the development of a body of values, commitments, orientations, and practices (Calderhead & Robson, 1991). Holt-Reynolds (1992) stated that "preservice teachers have spent considerable time and energy in their lives as students attempting to make sense out of and account for their experiences as learners in specific subject-matter contexts" (p. 343). The results are typically a set of generalizations or beliefs based on references to themselves in the role of students. Moreover, preservice teachers use these experiences to "check" the validity of the research-based principles presented in teacher-education courses (Holt-Reynolds, 1992).

To foster conceptual change, teacher educators must recognize the power of preservice teachers' prior experiences. Research has shown, for instance, that teachers' personal understanding of subject matter content exerts a powerful influence on the instructional methods they use in their classrooms (Grossman, 1989; Shulman, 1986; Wilson, Shulman, & Richert, 1987; Wilson & Wineburg, 1988). Many teachers are seriously deficient in their understanding of the subject matter they teach because they have learned science content through the same ineffective traditional methods that reformers of teacher education are trying to replace (Neale & Smith, 1989; Smith, 1987). Subsequently, using similar techniques, they often "transmit" the same misunderstandings to their students.

In a similar manner, teachers' personal understanding of pedagogy, which is also shaped through their experience as students, will exert a powerful influence on their instructional methods (Buchmann, 1989; Bullough, 1989;

Hollingsworth, 1989; Lortie, 1975; Stoddart, 1991; Zeichner et al., 1988). Even though more than a decade of cognitive research has challenged behavioristic perspectives of learning (Case & Bereiter, 1984; Cohen & Ball, 1990; Resnick, 1983; Shuell, 1986) in favor of using constructivist approaches, most preservice teachers have spent 12-14 years as students in classrooms taught by teachers holding behavioral theories of learning and motivation (Herrmann, 1993). This means that many preservice teachers enter preparation programs holding beliefs contradictory to more current beliefs about good teaching.

Moreover, research has clearly demonstrated that many preservice teachers hold behaviorist epistemologies (Ball, 1989; Ball & Feiman-Nemser, 1988; Hollingsworth, 1989). For example, research has demonstrated that student teachers often think of teaching as telling and of learning as memorization (Calderhead & Robson, 1991; Wubbels et al., 1991). Research by Jones and Vesilin (1995) reported that student teachers tend to think of classroom management as controlling their students. Further, a recent study by Salisbury-Glennon et al. (in progress) demonstrated that undergraduate education majors tend to view extrinsic motivators (e.g., prizes, stickers, candy, or free time) as more effective means of motivating students than intrinsic motivators (e.g., choice, autonomy, interest, and challenge). This viewpoint contradicts currently held beliefs by the majority of theorists doing research in the field of motivation (Connell & Wellborn, 1992; Deci & Ryan, 1985, 1987; Lepper & Greene, 1975).

In sum, teachers' prior beliefs can exert a powerful influence on what they learn and accept as valid knowledge (Kagan, 1992). If misconceptions are not exposed and addressed, preservice teachers may perpetuate them in their own classrooms (Salisbury-Glennon & Stevens, 1999). Knowing that naïve theories are so resistant to change, teacher educators can borrow from models of conceptual change to develop more effective pedagogy (Pintrich, 1990).

The Original, "Cold" Model of Conceptual Change

Models of conceptual change are grounded in constructivist developmental theory (Piaget, 1970, 1974, 1985), which states that assimilation and accommodation are the processes of conceptual change. Piaget's theory implies that students will construct interpretations of newly learned material by assimilating it into already existing schemes or changing those existing schemes to accommodate the new information. If students cannot use pre-existing knowledge to interpret new information (i.e., assimilation), then existing concepts must be replaced or reorganized via the process of accommodation. How existing information and knowledge structures are replaced or reconstructed to accommodate new information is at the heart of conceptual change models. Conceptual Change Model (CCM) asserts that before students can be expected to abandon or unlearn deeply held misconceptions, teachers must identify these misconceptions and directly confront their students with new ideas (Osborne & Freyburg, 1985; Pintrich et al., 1993; Posner et al., 1982; Strike & Posner, 1985) that appear more intelligible, more plausible, and more fruitful than old, incorrect beliefs.

Posner et al. (1982) identified four conditions necessary for meaningful conceptual change to occur. Unless students (and teachers) have sufficient reason to abandon naïve beliefs, it is unlikely that a radical change will occur. One condition is dissatisfaction with current conceptions. Dissatisfaction can occur if students cannot interpret new experiences or solve problems in terms of the preexisting conception, or if the conception's implications are unacceptable, or if the misconception is inconsistent with knowledge in other areas. In these instances, the individual cannot make sense of something with his/her current conceptual system (Strike & Posner, 1985). Strike and Posner (1985) point out that ideas cannot function psychologically unless the student can internally represent them, within a context of other ideas. Therefore, a second condition is that new conceptions must be intelligible or comprehensible to the student. Clearly, students will feel little need to replace existing beliefs with new beliefs that seem to have even less explanatory power. A concept can also become intelligible with the help of metaphors, analogies, images, or exemplars, which allow the individual to borrow frameworks from other contexts (Strike & Posner, 1985).

A third condition is that new conceptions must be plausible or consistent with other knowledge. A conception can become initially plausible if one finds it consistent with one's current assumptions about knowledge or if it is consistent or analogous to other theories, knowledge, or past experiences of the individual. Plausibility may also occur if a student can create images for the conception that match his/her sense of what the world is or could be like or if he/she finds the

new conception capable of solving problems and resolving analogies. In essence, plausibility increases the chances that new beliefs will be related in a meaningful way to existing knowledge structures and used in future reasoning (Strike & Posner, 1985). The final condition is that the new conception must appear fruitful; that is, a person will become committed to a conception if it leads to new insights and discoveries and if it is useful in interpreting experiences, solving problems, and, in certain cases, meeting spiritual or emotional needs. "A new conception will appear fruitful to the extent that students are aware of, can generate, or can understand novel practical applications or experiments which the new conception suggests" (Strike & Posner, 1985, p. 221). In the case of teachers, a new theory should have the potential for the discovery and use of effective teaching practices.

On the basis of these conditions, Nusbaum and Novick (1982) proposed a threefold strategy for changing naïve beliefs. Teachers must first use assessments to reveal and understand student preconceptions. Engaging students in activities that reveal their naïve beliefs and affording them opportunities to publicly express their ideas clearly and concisely can accomplish this. Second, teachers should create conceptual conflict with students' misconceptions by demonstrating an event that exposes weaknesses in current beliefs and by encouraging student discussion and generation of alternative explanations for the phenomena. Last, the teacher should actively encourage the development of revised or new knowledge. Teachers can facilitate cognitive accommodation by providing further support, new information, and elaboration of

existing information that will help students restructure their ideas about the situation in question.

Why Teacher Preparation Programs Fail to Induce Conceptual Change

How often are strategies like Nussbaum and Novick's (1982) used in traditional teacher education programs? Herrmann (1993) suggested that "the underpinnings of teacher preparation – attitudes, conceptions, beliefs, values, assumptions, and habits – have not changed much; that they are still rooted in behaviorism and that this is subtly undermining efforts to create conceptual change" (p. 2). Feiman-Nemser (1990) argued that for nearly two decades teacher preparation has been dominated by a behavioristic paradigm whereby teacher education has been viewed as a competency- and performance-based enterprise. Stofflett and Stoddart (1994) argued that traditional didactic instruction (e.g., lectures) is still predominantly used in many teacher preparation courses. Didactic approaches typically involve students as passive learners, not as the active constructors of knowledge necessary for conceptual change (Herrmann, 1993).

Indeed, a large body of research from the past 20 years has demonstrated that traditional approaches to teacher education have had little impact on teachers' prior beliefs and conceptions (Bird, et al., 1993; Gomez & Stoddart, 1991; Hollingsworth, 1989; Holt-Reynolds, 1992; Knowles & Holt-Reynolds, 1991; McDiarmid, 1989; Zeichner & Tabachnick, 1985; Zeichner et al., 1988). Other barriers to conceptual change may include teachers' negative attitudes toward theory presented to them in teacher education courses (Lasley, 1980;

Sanders & McPeck, 1976), perhaps due to a failure of teacher educators to demonstrate their practical application; exposure to diverse and often conflicting messages about educational theories and methods (Fenstermacher, 1994); and an unwillingness to "counter" the culture of teaching that reinforces traditional methods (Calderhead & Robson, 1991).

Herrmann (1993) pointed out that more recently teacher educators are attempting to use more constructivist approaches in preparation courses and that teacher preparation is beginning to be viewed as a process of conceptual change with more emphasis being placed on approaches designed to challenge teachers' prior conceptions and beliefs (Posner et al., 1982). Likewise, preservice and inservice teachers increasingly are being challenged to "change their conceptions and beliefs through self-reflection about their own practice, understanding and transforming research findings and theories, and reflective discourse with colleagues about problems and reflections (Mayer & Brause, 1991). It should be noted that although certain approaches with more constructivist components involve students in more active ways (e.g., cooperative learning groups, simulations, case studies), they still might not induce conceptual change unless they also include components that assess and challenge students' prior conceptions.

The Need for a "Hot" Model of Conceptual Change

In 1985, Posner et al. pointed out that, in addition to the four conditions necessary for conceptual change, an individual's conceptual ecology, or current cognitive resources, will influence the accommodation of a new conception. At

that time they identified the features of a conceptual ecology to be anomalies, analogies and metaphors, exemplars and images, past experiences, epistemological commitments, metaphysical beliefs and concepts, knowledge in other fields, and competing conceptions. Overall, their original theory only accounted for rational, cognitive variables of the learner and is thus considered by many to be a cold model of conceptual change. However, in 1992, Strike and Posner wrote an article entitled "A Revisionist Theory of Conceptual Change," in which they stated that major modifications are required of their original theory. Namely, they stated that their original theory was overly rational and that "A wider range of factors needs to be taken into account in attempting to describe a learner's conceptual ecology. Motives and goals and the institutional and social sources of them need to be considered" (p. 148).

In their 1993 article entitled "Beyond Cold Conceptual Change: The Role of Motivational Beliefs and Classroom Contextual Factors in the Process of Conceptual Change," Pintrich et al. elaborated on Strike and Posner's (1992) notion that a less rational or hot model is needed to adequately investigate conceptual change. In particular, they noted that cognition-only models of student learning fail to adequately explain why students do not always activate or transfer their prior knowledge appropriately in different learning situations. To address this issue, Pintrich et al. presented a conceptual analysis of the relations between motivational, contextual, and cognitive factors and conceptual change. They based their analysis on findings from research in the field of motivation, which has already demonstrated empirical links between cognitive (knowledge,

thinking, learning and metacognitive strategies), motivational (expectancy, value, affect), and contextual constructs (task characteristics, instructional processes) and various achievement outcomes in elementary, secondary, and postsecondary students. They use the empirical relationships established from the motivation research to hypothesize relationships about the factors affecting conceptual change.

Pintrich and Schrauben (1992) summarized the research in motivation using a multivariate, dynamic, and contextual framework for describing the effects of cognition, context, and motivation on achievement. Their general finding was that students who hold positive motivational beliefs will be more likely to become cognitively engaged in learning in a deeper, more self-regulating way than students who do not hold these beliefs. However, they found that these positive motivational beliefs did not directly influence academic performance but did so indirectly by leading to increased cognitive engagement, which is directly linked to academic performance. Concerning the role of contextual factors, Pintrich and Schrauben (1992) hypothesized that task characteristics (content, product, procedures, resources) and instructional processes (teaching methods, teaching behavior, grading practices) also have an indirect effect on achievement by way of their effect on student motivational and cognitive components. From this research, indirect but significant relationships have been established between motivation, cognition, and context and academic performance.

On the basis of these findings, Pintrich et al. (1993) identified the following classroom contextual factors that can influence conceptual change: task

structures (authentic, challenging), authority structures (optimal choice, optimal challenge), evaluation structures (improvement-based, mistakes as positive), classroom management (use of time, norms for engagement), teacher modeling (scientific thinking, scientific dispositions), and teacher scaffolding (cognition, motivation). They identified the following motivational factors as important to conceptual change: mastery goals, epistemic beliefs, personal interest, utility value, importance, feelings of self-efficacy, and control beliefs. Likewise, relevant cognitive factors included: selective attention, activation of prior knowledge, deeper processing (elaboration, organization), problem finding and solving, metacognitive evaluation and control, and volitional control and regulation. They argued that all of these factors could influence each other in dynamic ways and ultimately interact with the conditions (dissatisfaction, intelligibility, plausibility, fruitfulness) necessary for conceptual change.

Using this model, Pintrich et al. hypothesized specific relationships between motivational, cognitive, and contextual constructs and conceptual change. For instance, findings from research on interest (Eccles, 1983; Hidi, 1990; Hidi & Baird, 1988; Krapp, Hidi, & Renniger, 1992; Pintrich, 1989; Pintrich & Garcia, 1991; Renniger, Hidi, & Krapp, 1992; Schiefele, 1991) indicate that individual interest (a relatively enduring preference that develops slowly over time for certain topics, subject areas, or activities) and situational interest (an emotional state brought about by situational or text-based stimuli) can both affect strategy use, performance, and “have profound effects on cognitive functioning and the facilitation of learning” (Hidi, 1990, p. 565). Individual interest positively

affected text comprehension (Fransson, 1977) and resulted in a higher degree of cognitive organization in college students' knowledge structures (Schiefele & Krapp, 1988). Situational, text-based interest also positively affected comprehension and learning (see Hidi & Baird, 1986, for a review).

Besides interest in a domain or text, how important and useful one finds a task (i.e., task value) can affect student motivation, cognitive engagement, and subsequent performance (Eccles, 1983; Pintrich, 1994; Pintrich & Garcia, 1991). Specifically, these studies have demonstrated that students who valued the subject more were more likely to report using more self-regulatory strategies and to think critically about course material. Shell, Murphy, and Bruning (1989) found a positive relationship between college students' beliefs about the importance of reading skills for different outcomes in life and reading comprehension performance. Considering the findings from researchers investigating interest and task value, Pintrich et al. (1993) hypothesized a positive correlation between conceptual change and interest, importance, and value constructs, although they suggest that empirical research should be conducted to determine whether these constructs are necessary for conceptual change.

Pintrich (1989) found that internal control beliefs, internal attributions concerning one's ability to influence outcomes in the environment (sometimes called self-determination), were positively related to the use of many cognitive and self-regulatory strategies. Students in his study who were high in internal control (those who believed that their behavior and effort influenced their performance) were also more likely to perform better on exams, lab reports,

papers, and final course grades. Fabricius and Hagan (1984) and Kurtz and Borkowski (1984) showed that internal control beliefs were associated with cognitive engagement. Using these findings, Pintrich et al. (1993) hypothesized that perceptions of how much control students have over their learning may have implications for the process of conceptual change. For instance, students with external control beliefs might be less willing to try to actively resolve encountered discrepancies between their prior knowledge and new information.

The motivational construct self-efficacy, or individuals' beliefs about their performance capabilities in a particular domain (Bandura, 1982, 1986; Schunk, 1985), has been empirically linked to cognitive engagement, use of cognitive and self-regulatory strategies, and performance on exams, papers, seatwork, and course grades in a number of studies (Schunk, 1985, 1989; Paris & Oka, 1986; Pintrich & DeGroot, 1988, 1990a, 1990b; Pintrich & Schrauben, 1992). Interestingly, in applying the concept of self-efficacy to a model for conceptual change, Pintrich et al. (1993) posited that self-efficacy could be construed in two ways. In a traditional learning/performance framework, self-efficacy represents students' confidence in their ability to do a particular task. Within the framework of conceptual change, however, this could translate into students' confidence in their ability to use thinking and learning strategies and other cognitive task effectively to change their ideas through integration and synthesis of divergent conceptions. In this case, higher self-efficacy would lead to increased conceptual change, as much of the conceptual change literature is based on the notion of destabilizing students' confidence in their prior conceptions by introducing

contradictory data, ideas, or theories. On the other hand, Pintrich et al. (1993) argued that, in a conceptual change model, self-efficacy could translate into students' confidence in their own ideas and conceptions. In this case, higher levels of self-efficacy may inhibit conceptual change. Empirical research must be done to explore the relationships between self-efficacy and conceptual change; obviously, how self-efficacy is defined and measured is important.

Test anxiety is a negative cognitive and emotional response to a testing situation that includes negative thoughts (worry) about performance while taking an exam (Liebert & Morris, 1967). These negative thoughts can interfere with task related processing and strategy use because they compete for limited processing resources (Benjamin, McKeachie, Lin, & Holinger, 1981; McKeachie, 1984; Wine, 1971), thereby undermining academic performance (McKeachie, 1984). This affective component has been linked more consistently to detrimental performance in achievement situations than almost any other individual difference variable (Hill & Wigfield, 1984). Therefore, Pintrich et al. (1993) hypothesized that test anxiety should have a detrimental or inhibiting effect on conceptual change, as well.

Reward Structure, Intrinsic Motivation, and Conceptual Change

Harter (1981) distinguished between intrinsically motivated students, those who offer intrinsic rationales such as mastery, challenge, learning, and curiosity from students who are more oriented to extrinsic considerations such as grades, rewards, and approval from others. Theorists such as Deci and Ryan (1985) have asserted that behaviors such as pursuing tasks on one's own initiative,

maintaining focus and attention on tasks, engaging in meaningful learning, and persisting in the face of failure can be optimized when individuals are intrinsically motivated. Elliott and Dweck (1988) found that students who adopt a more intrinsic orientation may not only try harder or persist longer, but also may recruit more effective learning strategies. Ames and Archer (1988) found that classrooms characterized by mastery goals seemed to facilitate the use of more learning strategies and an adaptive motivational pattern. Other findings from research on goal orientation beliefs (Ames, 1992; Dweck & Elliott, 1983; Dweck & Leggett, 1988; Harter, 1981; Nicholls, 1984; Pintrich & Schrauben, 1992; Pintrich & DeGroot, 1990a, 1990b; Pintrich & Garcia, 1991), demonstrated that students who adopted an intrinsic, mastery orientation versus an extrinsic, performance-orientation towards learning were more likely to engage in deeper cognitive processing and use more metacognitive and self-regulatory strategies.

These findings suggest that teachers should attempt to foster an intrinsic goal orientation in their students. Intrinsic motivation is most likely facilitated when two conditions exist: (a) an individual has a sense of self-determination, or a belief that one has choices and can regulate the course of one's life, and (b) an individual has a sense of competence, or a belief that one is capable of executing tasks successfully (Deci & Ryan, 1985, 1987). Deci and Ryan's (1987) concept of self-determination is similar to Connell and Wellborn's (1991) concept of autonomy or agency and parallels deCharms' (1976) notion of an origin. Autonomy or agency refers to one's attributions or beliefs that he/she can exert control over one's behavior and environmental factors. Self-determination,

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CHAPTER 3

RESEARCH METHODOLOGY

Introduction

In this chapter, the design of the study is described. The first section restates the purpose and hypotheses to be tested. The second section discusses the selection of the research participants. The third section describes the refutational text and reward structure interventions. The fourth section describes the procedures for the study. The instrument that will be used to measure motivational constructs of interest, the Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich, Smith, Garcia, and McKeachie, 1993), and the conceptual change measure are described in the fifth section. Finally, the data analysis is discussed.

Purpose and Hypotheses

The purpose of this study was to examine the relationship between intrinsic goal orientation, beliefs, and conceptual change in preservice teachers. Also, the manipulation of a classroom contextual factor present in college classrooms (a controlling, or performance-based reward structure) was examined for its effects on conceptual change.

Based on previous research in the field of motivation and the suggestions of Pintrich et al. (1993) for research on conceptual change using a hot model, the following hypotheses were empirically tested:

1. Students' intrinsic goal orientation will be significantly positively correlated with students' scores on the pretest measure of intrinsic beliefs and significantly negatively correlated with their scores on the pretest measure of extrinsic beliefs.
2. Students who read refutational texts on motivation theory will have significantly higher scores on conceptual change than students who read nonrefutational texts.
3. Students with an intrinsic goal orientation will have higher conceptual change scores than students with a less intrinsic goal orientation.
4. Students who are administered a controlling reward structure will have lower conceptual change scores than students who are not reinforced for their performance.
5. There will be an interaction between refutational text, reward structure, and intrinsic goal orientation. Particularly, the controlling reward structure situation will have a differential effect on conceptual change for students who are less vs. more intrinsically oriented. In other words, a controlling reward structure would not significantly affect conceptual change for participants who are more intrinsically motivated. However, a controlling reward structure will be more salient to participants who are less intrinsically motivated and subsequently significantly negatively affect their conceptual change.
6. Conceptual change will remain after a 1-week delay.

Research Participants

Participants consisted of approximately 200 undergraduate students enrolled in educational psychology courses in the teacher education department at the University of Florida. Courses from which participants were sought included one section of a first-year, introduction to education course and two sections of two upper division courses, one in child development and one in adolescent development. The department requires that students take an introduction to education course during their first year, if they are planning to enter the teacher preparation program. Participants from this class may include students interested in becoming elementary or secondary education teachers. The child development course is a required component of the elementary preparation program and is usually taken in the last 2 years of the program. Students interested in becoming secondary teachers do so by completing a bachelor's degree in a subject matter (e.g., biology, history, English, math) and fulfilling requirements for either a minor or master's degree in education. The adolescent development course is a required component of secondary preparation program and is also usually taken in the last 2 years of the program. Courses were chosen based on accessibility and willingness on the part of the instructor to participate. Participants were asked to volunteer their participation in exchange for the opportunity to acquire extra-credit points from their instructor in the course.

Interventions

Text Type

The materials used to study conceptual change consisted of two texts written by Salisbury-Glennon and Stevens (1999) about current conceptions in the field of motivation. In the first text, a refutational style following a conceptual change approach, was used to address misconceptions about motivation. This text was designed specifically to address readers' prior conceptions about motivation by contrasting them with more scientifically accepted conceptions. In this case, the text contrasts the reinforcement view of motivation, which was found to be prevalent among educational psychology students (Salisbury-Glennon et al., in progress), with the intrinsic view of motivation. Refutational texts that have been written by researchers in reading education (Alvermann & Hague, 1989; Alvermann & Hynd, 1989; Maria & MacGinitie, 1987) and science education (Roth, 1986; Guzzetti et al., 1993, 1997) have been successful at inducing conceptual change in learners.

The second text used was a nonrefutational (regular) text that simply described the intrinsic view of motivation without contrasting it with the reinforcement view. In this way, the prior knowledge of its readers was not addressed, and a conceptual change model was not followed. Both the refutational and nonrefutational texts are of similar lengths (573 and 568 words, respectively) and levels of readability (Flesch Grade level 15.5 for both, and Flesch Reading Ease, 33.1 and 32.9 respectively). The refutational texts can be found in Salisbury-Glennon and Steven's (1999) article.

Reward Structure

Reward structure was conveyed privately to students in cover letters (Appendixes C & D). Specifically, the participants in the "noncontrolling reward" group were told that in addition to the 1% extra credit promised in the informed consent, they would receive an additional 1% upon the completion of the study. Thus, the second 1% was not contingent on the students' performance in this group. The participants in the "controlling reward" group were told that in addition to the 1% extra credit promised in the informed consent, they now had the opportunity to earn an additional 1% extra credit if their answers on the conceptual change measure closely reflected the expert opinions stated in the passage. For this group, the second 1% was contingent on their performance. Studies in which teachers have imposed controlling task or reward structures report an undermining of student intrinsic motivation and a mastery learning orientation (Ames, 1992; Ryan et al., 1985). Moreover, evaluation procedures that focus on external rewards can foster a performance goal orientation where the learner focuses on obtaining the reward versus gaining a conceptual understanding of the content (Ames, 1992; Elliott & Dweck, 1988; Grolnick & Ryan, 1987). It was of interest to observe whether an extra 1% of a total course grade was "controlling" enough to produce the effects typically found in these studies.

Procedures

Participants were recruited from the classes of five teacher educators by offering them the opportunity to receive extra credit in the form of 1 - 2% of their

total course grade, to be given by the instructor of the courses sampled. The experimenter visited the classrooms of the volunteer participants on three occasions, over a 3-week period.

Phase One

On the first occasion, they were asked to sign an informed consent (Appendix A) and to fill out a demographic information sheet (Appendix B), the MSLQ, and the 20-item conceptual change measure, which served as a pretest.

Phase Two

One week later, they were randomly assigned to read either a refutational or nonrefutational text about motivation. Half of the participants in each group were also privately assigned to either a controlling or noncontrolling reward structure.

Phase Three

One week after Phase Two, participants completed the conceptual change measure again, as a delayed posttest. (Appendix E)

Instruments

Intrinsic and Extrinsic Goal Orientation

The instrument used to measure the motivational constructs of interest was the Motivated Strategies for Learning Questionnaire (MSLQ) designed and validated by Pintrich, Smith, Garcia, and McKeachie (1993). The MSLQ is a self-report, Likert-scale (1 = not true of me to 7 = very true of me) instrument designed to assess college students' motivational orientations and strategy use for a college course. McKeachie, Pintrich, Lin, and Smith (1986) presented the

theoretical framework that underlies the MSLQ, which is based on a general cognitive view of motivation and learning. The MSLQ consists of two sections, a motivation section, and a learning strategies section. Only the motivation section will be used in the present study.

Typically, the instrument is used to explore relationships between various cognitive, motivational, and achievement outcomes. However, for the purposes of the present study involving conceptual change, the items from each scale (except test anxiety) were revised (reworded) to assess students' motivational orientations within a conceptual change context. Because participants were recruited from different education courses, consisting of different subject matter, the researcher felt it would be more useful to study students' motivational orientations towards learning in the particular content area or object of conceptual change presented in the refutational text, which in this case is research in the field of motivation.

Specific items were adapted from various instruments used to assess student motivation, cognitive strategy use, and metacognition (e.g., Eccles, 1983; Harter, 1981; Weinstein, Schulte, & Palmer, 1987). The motivation section consists of 31 items, made up of six subscales: intrinsic goal orientation, extrinsic goal orientation, task value, control beliefs, self-efficacy for learning and performance, and test anxiety. The subscales can be used together or singly. Validity and reliability data have been collected on the MSLQ since 1986. The instrument has been continually revised based on statistical and psychometric analyses, including internal consistency coefficient computation and correlations

with academic performance and aptitude measures. Factor analysis was also used to guide scale construction, resulting in exclusion of some of the items from the scales because of a lack of correlation or stable factor structure.

The intrinsic goal orientation subscale ($\alpha = .74$) consists of four items and measures a student's perception of the degree to which she is engaging in a learning task for reasons such as challenge, curiosity, and mastery rather than as a means to an end. The items from this subscale were used in the present study to gather data on goal orientation. However, these items remained embedded within the larger motivation section, so that the similarity of the five intrinsic motivation items did not sensitize the students to the author's hypotheses. The extrinsic goal orientation subscale ($\alpha = .62$) consists of four items and complements the intrinsic goal orientation subscale. This subscale measures a student's perception of the degree to which she is engaging in a learning task as a means to an end or for reasons such as grades, rewards, performance, evaluation by others, and competition.

The task value subscale ($\alpha = .90$) is made up of six items and measures how interesting, important, and useful the student believes the task is. However, because these items are completed prior to the students' reading of the text-material, they are most likely a measure of an internal orientation of the individual that has developed over time towards the subject of motivation (Hidi, 1990; Prenzel, 1988; Renninger, 1990; Renninger & Wozniak, 1985; Schiefele, 1991). Hence, the MSQI is not a measure of situational or text-based interest, which results from interaction with stimuli in the situation or text (Anderson, Shirey,

Wilson, & Fielding, 1987; Hidi, 1990; Hidi & Baird, 1986, 1988; Kintsch, 1980; Schank, 1979). To gather data on situational interest, the participant should be given an item *after* reading the text to assess the students' perceived interest in the refutational (or nonrefutational) text. Likewise, participants' perceived importance and utility of the text they read could be assessed in this manner.

The control of learning beliefs subscale ($\alpha = .68$) includes four items and attempts to measure the degree to which students believe that their own efforts rather than external factors (e.g., teacher) will make a difference in their learning. The expectancy, or self-efficacy for learning and performance, subscale ($\alpha = .93$) comprises eight items designed to measure student performance expectations and judgments about their skills and ability to accomplish a task. Lastly, the test anxiety subscale ($\alpha = .80$) measures the cognitive and emotional components associated with anxiety that can negatively affect expectancies and performance. Because there seemed to be no valid way to measure anxiety related to reading refutational texts, the five test-anxiety items were the only ones not reworded to make them more specific to the conceptual change context.

Conceptual Change

Conceptual change was measured with an instrument designed by Salisbury-Glennon and Stevens (1999) using a format derived from the conceptual change literature in physics (e.g., Alvermann & Hind, 1989). The instrument consists of 20 items, written as short scenarios, on motivation theory. Ten of the scenarios depict a teacher using a reinforcement (extrinsic) view of motivation and 10 depict a teacher using an intrinsic view of motivation.

Participants were asked to respond to each item by indicating to what degree they believed that the method of motivation in the scenario was a good way to motivate students. To provide a more precise and specific measure of the type of conceptual change that occurred, the conceptual change measure was divided into two scales: an intrinsic subscale consisting of the 10 intrinsically oriented items, and an extrinsic subscale consisting of the 10 extrinsically oriented items.

Cronbach's alpha reliability estimates were calculated for the conceptual change measure. The internal consistency coefficient for the entire 20-item scale was .70. Internal consistency coefficients for the extrinsic and intrinsic subscales were .81 and .77, respectively. The 20 scenarios can be found in Salisbury-Glennon and Steven's (1999) article.

Statistical Analyses

Three separate analyses of the data were performed: (a) to identify relationships between goal orientation and initial beliefs about motivation, a Pearson's bivariate correlation analysis was conducted between goal orientation and each pretest subscale, (b) to examine the relationships between motivational constructs, the interventions, and conceptual change, on each subscale, two separate analysis of covariance procedures (ANCOVAs) were performed. Intrinsic goal orientation and the interventions (type of text and type of reward structure) were entered into the model as independent variables or predictors, beliefs on the pretest were entered as the covariate, and beliefs on the posttest was the outcome or dependent variable, (c) to examine whether the observed changes in conceptions from pre- to posttest remained after 1 week, separate

paired samples t-tests were conducted for each subscale, whereby means from the posttest and delayed-posttest measures were compared.

CHAPTER 4

RESULTS

Previous research has demonstrated that a refutational text challenging the commonly held conception that extrinsic reinforcement is a more effective strategy for motivating learning successfully facilitated conceptual change in preservice teachers. The purpose of this study was to extend this prior research by examining whether a motivational variable -- teachers' intrinsic goal orientation -- and a contextual variable -- a controlling reward structure -- moderated the effect of the text on preservice teachers' conceptual change.

Descriptive Statistics

The sample in this study comprised 188 students enrolled in educational psychology courses in the teacher education department at the University of Florida. Students were sampled from two upper division courses, one in child development and one in adolescent development, and from one first-year, introductory education course. Ninety-two of the subjects were pursuing elementary education degrees at the time of the study. Ninety-six were pursuing a degree in a subject area (e.g., math, history, English), while acquiring a minor in education. Only 113 participants were certain they wanted to enter the teaching profession upon graduation. Twenty-one males and 167 females completed the study.

The mean responses of participants in this sample on the intrinsic motivation subscale of the MSLQ were slightly higher ($M = 5.24$, $SD = 0.83$) than the general education students' responses ($M = 5.05$, $SD = 1.09$), found in the MSLQ manual ($N = 380$) (Pintrich, et al., 1993). This indicates that the sample of students in this study had slightly higher intrinsic goal orientations than the Pintrich et al. sample of University of Michigan college students.

Initial Group Differences

Participants were assigned to one of four treatment groups: Group 1 (refutational text, conditional reward structure), Group 2 (nonrefutational text, conditional reward structure), Group 3 (refutational text, unconditional reward structure), or Group 4 (nonrefutational text, conditional reward structure). There were no initial significant differences among the groups in intrinsic goal orientation, $F(3, 188) = 0.34$, $p = 0.80$. Similarly, there were no initial differences among the groups on their responses to the intrinsic items on the conceptual change measure (pretest), $F(3, 188) = 0.09$, $p = 0.97$, or on their responses to the extrinsic items on the pretest, $F(3, 188) = 1.58$, $p = 0.20$ (see Table 1).

On the pretest, the students' scores on the intrinsic scenarios were higher ($M = 3.83$, $SD = 0.60$) than their scores on the extrinsic items ($M = 3.30$, $SD = .69$). However, inasmuch as the means were obtained from a Likert scale that ranged from 1 to 5, these scores show that there was moderate agreement among the participants that both intrinsic and extrinsic means are good ways of motivating students.

Table 1

Means and Standard Deviations for Groups on Intrinsic and Extrinsic Subscales from Pre- to Post- to Delayed Posttest

Scale	Group (text type / reward structure)			
<u>Intrinsic items</u>				
	Refutational/ controlling (N = 44)	Nonrefutational/ controlling (N = 49)	Refutational/ noncontrolling (N = 45)	Nonrefutational/ noncontrolling (N = 50)
<u>M(pre)</u>	3.81	3.86	3.83	3.80
<u>SD(pre)</u>	0.50	0.58	0.59	0.72
<u>M(post)</u>	4.23	4.12	4.04	4.09
<u>SD(post)</u>	0.56	0.55	0.73	0.57
<u>M(delay)</u>	4.20	4.13	4.04	4.16
<u>SD(delay)</u>	0.59	0.60	0.72	0.56
<u>Extrinsic items</u>				
<u>M(pre)</u>	3.26	3.48	3.24	3.20
<u>SD(pre)</u>	0.65	0.64	0.76	0.68
<u>M(post)</u>	2.46	3.15	2.72	2.79
<u>SD(post)</u>	0.74	0.80	0.92	0.84
<u>M(delay)</u>	2.40	3.07	2.68	2.71
<u>SD(delay)</u>	0.82	0.91	0.98	0.88

Tests of Hypotheses

Hypothesis #1

Hypothesis #1 of this study was that students' intrinsic goal orientation would be significantly positively correlated with initial agreement on the intrinsic conceptual change items (pretest measure) and significantly negatively

correlated with initial agreement on extrinsic conceptual change items. Results of a Pearson's bivariate correlation procedure showed that intrinsic goal orientation was significantly positively correlated with intrinsic beliefs on the pretest ($r = .243$, $p = .001$) and significantly negatively correlated with extrinsic beliefs on the pretest ($r = -.213$, $p = .003$). Therefore, Hypothesis #1 was accepted.

Hypothesis #2

Hypothesis #2 of this study was that participants who read refutational texts would have greater conceptual change than those who read nonrefutational texts. Two separate 3-way ANCOVAs were conducted, one for each subscale. Intrinsic goal orientation, text type, and reward structure were independent variables; pretest scores were entered as a covariate, and posttest scores on the conceptual change measure was the dependent variable. Original ANCOVA models for each subscale included all 2- and 3-way interactions. However, the 3-way interactions were not significant for the intrinsic scale, $F(1,187) = 0.11$, $p = 0.74$, or the extrinsic scale, $F(1,187) = 0.72$, $p = 0.40$. The 3-way interactions were then removed and the model was reduced and reanalyzed. Significant 2-way interactions were found in these analyses, so there was no need to reduce the model further.

Results of the ANCOVA for conceptual change on the intrinsic subscale revealed that the pretest covariate was significantly related to posttest scores, $F(1,188) = 74.55$, $p = 0.00$, and that the variables explained approximately 38% of the variance in posttest scores ($R^2 = 0.38$). However, there were no main

effects or interactions involving text type, $F(1,187) = 1.83$, $p = 0.18$ (see Table 2).

Hypothesis #2 was rejected for the intrinsic subscale.

Results of the analysis of differences on the extrinsic subscale revealed that the pretest covariate was significantly related to posttest scores, $F(1,187) = 210.23$, $p = 0.00$, and that the variables explained approximately 61% of the variance in posttest scores ($R^2 = 0.61$). There was no significant main effect of text type, $F(1,187) = 0.22$, $p = 0.64$, on the extrinsic subscale (see Table 3); however, text type was involved in a significant 2-way interaction. Therefore, the effect of text type was analyzed as part of a significant interaction with reward structure.

Table 2
Analysis of Covariance for Intrinsic Subscale

Source	Type III Sum of Squares	df	Mean Square	F	p-value
Corrected Model	26.40 ^a	7	3.77	16.10	0.00
Pretest	17.47	1	17.47	74.55	0.00**
Text Type (TT)	0.43	1	0.43	1.83	0.18
Goal Orientation (GO)	1.11	1	1.11	4.75	0.03*
Reward Structure (RS)	1.54	1	1.54	6.56	0.01**
TT X RS	0.40	1	0.40	1.69	0.19
TT X GO	0.49	1	0.49	2.07	0.15
RS X GO	1.35	1	1.35	5.76	0.02*
Error	42.18	180	0.23		
Corrected Total	68.58	187			

^a. Adjusted R Squared = .38

* $p \leq .05$

** $p \leq .01$.

Hypothesis #3

The third hypothesis was that participants who were more intrinsically motivated would have more conceptual change than those who were less intrinsically motivated. Results of the ANCOVA analysis for the extrinsic subscale did not reveal a significant main effect of goal orientation, $F(1,187) = 2.06$, $p = 0.15$. The analysis did reveal a significant main effect of goal orientation for the intrinsic subscale, $F(1,187) = 4.75$, $p = .031$ (see Tables 2 and 3). However, the effect was analyzed as part of a significant interaction with reward structure.

Table 3

Analysis of Covariance for Extrinsic Subscale

Source	Type III Sum of Squares	df	Mean Square	F	p-value
Corrected Model	83.99 ^a	7	11.20	40.40	0.00
Pretest	62.43	1	62.43	210.23	0.00**
Text Type (TT)	0.07	1	0.07	0.22	0.64
Goal Orientation (GO)	0.61	1	0.61	2.06	0.16
Reward Structure (RS)	1.53	1	1.53	5.14	0.02*
TT X RS	1.67	1	1.67	5.63	0.02*
TT X GO	0.30	1	0.30	1.02	0.31
RS X GO	1.39	1	1.39	4.68	0.03*
Error	53.46	180	0.30		
Corrected Total	137.442	187			

^a. Adjusted R Squared = .61

* $p < .05$

** $p < .01$

Hypothesis #4

Hypothesis # 4 was that participants who were administered a conditional extrinsic reward structure would have lower conceptual change scores than students who were given an unconditional reward structure. Results of the ANCOVA analysis revealed significant main effects of reward structure for both the intrinsic, $F(1,187) = 6.56$, $p = 0.01$, and extrinsic, $F(1,187) = 5.14$, $p = 0.02$, subscales. However, since reward structure was also involved in significant 2-way interactions on both subscales (see Tables 2 and 3), effects were analyzed accordingly.

Hypothesis #5

The last hypothesis of this study was that there would be an interaction between refutational text, reward structure, and intrinsic goal orientation. Particularly, the author predicted that the controlling reward structure would have a differential effect on conceptual change for students who were less rather than more intrinsically oriented. In other words, a controlling reward structure would not significantly affect conceptual change for participants who were more intrinsically motivated. However, a controlling reward structure would be more salient to participants who were less intrinsically motivated and subsequently negatively affect their conceptual change.

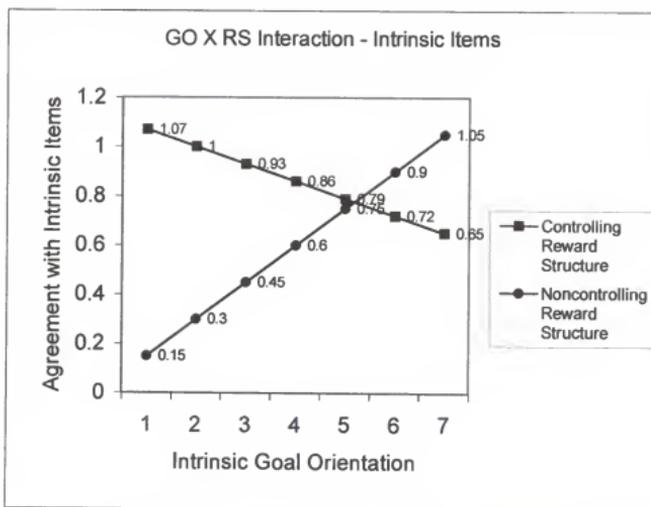
The 3-way ANCOVAs were examined for significant interactions among the variables. For the intrinsic subscale, there was a significant 2-way interaction between intrinsic goal orientation and reward structure, $F(1,187) = 5.76$, $p = 0.02$ (see Table 2). Because intrinsic goal orientation was a continuous variable,

interactions were examined by observing the slopes and intercept differences between the groups for their scores on the conceptual change measure.

The intercept difference was 1.14, such that overall the group that received the controlling reward structure scored significantly higher on the intrinsic items (i.e., exhibited higher agreement) than the group that received the noncontrolling reward structure. An interaction effect was observed; the slope of the controlling reward structure group was -0.07 and the slope of the noncontrolling reward structure group was 0.15 (see Figure 1).

Figure 1

Goal Orientation X Reward Structure Interaction for Intrinsic Items



SD = 0.60

The findings were that when intrinsic goal orientation was at its lowest (1), participants who experienced the controlling reward structure agreed more with the intrinsic items on the conceptual changes measure than did participants who experienced the noncontrolling reward structure, by a mean difference of 0.92 (see Table 4).

Table 4

Mean Agreement Differences for Both Subscales (Controlling vs. Noncontrolling)

Goal Orientation	<u>Agreement on Intrinsic Items</u>	<u>Agreement on Extrinsic Items</u>
	Mean Difference (Controlling - Noncontrolling)	Mean Difference (Controlling - Noncontrolling)
1	0.92	-0.82
2	0.70	-0.60
3	0.48	-0.38
4	0.26	-0.16
5	0.04	0.06
6	-0.18	0.28
7	-0.40	0.50

$$\underline{SD}(\text{intrinsic}) = 0.60$$

$$\underline{SD}(\text{extrinsic}) = 0.69$$

Therefore, the controlling reward structure appeared to facilitate more conceptual change for participants having lower intrinsic goal orientations. Furthermore, when intrinsic goal orientation was at its highest (7), participants who experienced the controlling reward structure agreed less with the intrinsic items on the conceptual change measure than did the participants who experienced the noncontrolling reward structure, by a mean difference of -0.40. In this case, the controlling reward structure appeared to undermine conceptual change for participants having higher intrinsic goal orientations. In cases where the controlling reward structure was not present, having high intrinsic goal orientation made conceptual change more likely. Those with the lowest intrinsic goal orientations and who were not administered a controlling reward structure exhibited the least amount of conceptual change overall. These results provide support for Hypothesis #5 on the intrinsic subscale.

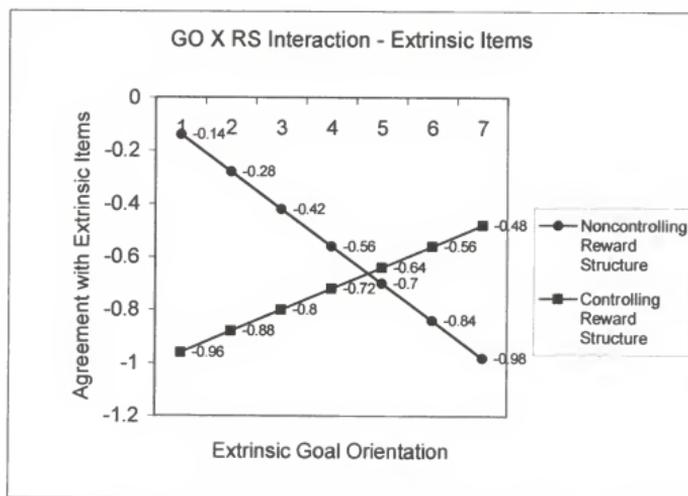
Analyses on the extrinsic subscale revealed two significant 2-way interactions, one between text type and reward structure, $F(1,187) = 5.63$, $p = 0.02$, and one between goal orientation and reward structure, $F(1,187) = 4.68$, $p = 0.03$ (see Table 3). Further examination of the significant 2-way interaction between goal orientation and reward structure for the extrinsic subscale also required comparison of the slopes and intercept differences between the groups regarding their scores on the conceptual change measure.

The intercept difference was -1.04, such that the participants who received the controlling reward structure scored significantly lower on the extrinsic items than the participants who received the unconditional reward structure. In other

words, those that received the controlling reward structure came to agree less with the extrinsic items on the posttest than did those who received the noncontrolling reward structure. This finding further supports the effect of reward structure on conceptual change. An interaction effect was observed, such that the slope of the controlling reward structure group was 0.08 and the slope of the noncontrolling reward structure group was -0.14 (see Figure 2).

Figure 2

Goal Orientation X Reward Structure Interaction for Extrinsic Items



SD = 0.69

The findings were that when intrinsic goal orientation was at its lowest (1), the participants who experienced the controlling reward structure agreed less with the extrinsic items on the conceptual change measure than did the participants who experienced the noncontrolling reward structure, by a mean difference of -0.82 (see Table 4). Therefore, the controlling reward structure appeared to facilitate more conceptual change for participants having lower intrinsic goal orientations. Furthermore, when intrinsic goal orientation was at its highest (7), the participants who experienced the controlling reward structure agreed more with the intrinsic items on the conceptual change measure than did the participants who experienced the noncontrolling reward structure, by a mean difference of 0.50. In this case, like with the intrinsic items, the controlling reward structure appeared to undermine conceptual change for students having higher intrinsic goal orientations. In cases where the controlling reward structure was not present, having high intrinsic goal orientation made conceptual change more likely. Those with the lowest intrinsic goal orientations and who were not administered a controlling reward structure, exhibited the least amount of conceptual change overall. These results also support hypothesis #5.

Further examination of the significant 2-way interaction between text type and reward structure on the extrinsic subscale using post hoc *t*-test analyses revealed that the refutational text/controlling reward structure group's mean scores were significantly lower on (i.e., they agreed less with) the extrinsic items on the posttest than all the other groups' (see Table 5). These results provide support for Hypothesis #5 on the extrinsic items. Particularly, regardless of goal

orientation, the combination of applying a controlling reward structure when providing a refutational text was significantly more effective in producing conceptual change than were the other situations studied. Moreover, refutational text did not produce the expected effects when not combined with an extrinsic reward structure.

Hypothesis #6

To examine whether the observed changes in conceptions from pre- to posttest remained after 1 week, separate paired samples t -tests were conducted for each subscale to compare means from the posttest and delayed-posttest measures. Results show that the conceptual change demonstrated on the intrinsic items from the pre- to posttest measures remained in the delayed-posttest measure. Specifically, mean agreement with the intrinsic items after the treatment (on the posttest) was 4.12. Mean agreement with those items after 1 week (on the delayed-posttest) was 4.13. Therefore, conceptual change remained, but there were no further significant gains 1 week later, $t = -0.56$, $p = 0.57$.

Results of t -tests for the extrinsic subscale indicate a different pattern. Mean agreement with the extrinsic items after the treatment (on the posttest) was 2.79. However, mean agreement with those items after 1 week (on the delayed-posttest) decreased significantly, to 2.72, $t = 2.04$, $p = 0.04$ (see Table 4). This indicates that further gains were made in conceptual change on the extrinsic items 1 week after treatment was completed. Hypothesis #6 was accepted for both subscales.

Table 5

Post Hoc Pairwise Comparisons for Text Type X Reward Structure Interaction

Groups	Mean Difference	<u>t</u>	<u>p</u> -value	
1	2	-0.26	-2.27	0.02*
	3	-0.48	-4.21	0.00**
	4	-0.36	-3.22	0.00**
2	1	0.26	2.27	0.02*
	3	-0.22	-1.93	0.06
	4	-0.10	-0.91	0.37
3	1	0.48	4.21	0.00**
	2	0.22	1.93	0.06
	4	0.12	0.29	0.29
4	1	0.36	3.22	0.00**
	2	0.10	0.91	0.37
	3	0.12	-1.05	0.29

* $p \leq .05$ ** $p \leq .01$

CHAPTER 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

Previous research has demonstrated that a refutational text challenging the commonly held conception that extrinsic reinforcement is a more effective strategy for motivating learning successfully facilitated conceptual change in preservice teachers. The purpose of this study was to extend this prior research by examining whether a motivational variable -- teachers' intrinsic goal orientation -- and a contextual variable -- a controlling reward structure -- moderated the effect of the text on preservice teachers' conceptual change. The following research questions were investigated:

1. Is intrinsic goal orientation, which is a result of past experience, related to initial agreement with items on the conceptual change instrument?
Specifically, are participants with higher intrinsic goal orientations more likely to agree that the intrinsic items are a good way to motivate kids than participants with lower intrinsic goal orientations?
2. Is a refutational text more effective in inducing conceptual change than a nonrefutational text?
3. Does a controlling reward structure limit conceptual change in comparison to no controlling reward structure?
4. Do students with an intrinsic goal orientation to learning have greater

conceptual change than students with a less intrinsic goal orientation?

5. Is there an interaction between refutational text, reward structure, and intrinsic goal orientation? A particular question of interest is whether a controlling reward structure will have a differential effect on conceptual change for students who have low vs. high intrinsic goal orientation.
6. Does conceptual change remain after a 1-week delay?

A sample of 188 undergraduate students enrolled in two upper and one lower division foundations of education courses read either a refutational or nonrefutational text about motivation, received either a controlling or noncontrolling extra credit reward structure, and completed a pre- and posttest instrument that measured their beliefs about motivating students. The conceptual change measure was separated into two subscales, intrinsic and extrinsic, to allow for a more specific analysis of the nature of conceptual change. The four groups within the 2 X 2 design were not significantly different on either the dependent or independent variables before the interventions. Results of a Pearson's correlation analyses revealed that goal orientation significantly predicted participants' initial beliefs about motivation on a pretest.

ANCOVAs using intrinsic goal orientation, text type, and reward structure as independent variables, pretest scores as a covariate, and posttest scores as the dependent variable revealed that (a) pretest beliefs were a significant covariate in the model, and (b) text type, goal orientation, and reward structure interact in significant ways to affect conceptual change. Particularly, post hoc analyses revealed that a controlling reward structure had a significant positive

effect on conceptual change regarding the intrinsic and extrinsic items for students with low intrinsic goal orientations, producing more and less agreement, respectively; however for students with higher intrinsic goal orientations, a controlling reward structure appeared to undermine conceptual change. In the absence of a controlling reward structure, having a higher intrinsic goal orientation had a positive effect on conceptual change for both subscales. It was also found that regardless of goal orientation, providing participants with refutational text and a conditional reward structure most effectively facilitated conceptual change on the extrinsic subscale. Lastly, the observed conceptual change remained and increased on the extrinsic scale scores after a 1-week delay.

Conclusions

Significance of Goal Orientation for Teacher Beliefs

Research on teacher beliefs has posited that many preservice teachers enter preparation programs holding behavioristic epistemologies (Ball, 1989; Ball & Feiman-Nemser, 1988; Hollingsworth, 1989) that are contradictory to current beliefs about good teaching derived from cognitive psychology. Specifically, a recent study by Salisbury-Glennon et al. (in progress) demonstrated that undergraduate education majors tend to view extrinsic motivators as more effective means of motivating students than intrinsic motivators. The present study partially supported this finding in that, on the pretest, participants in the present sample believed that extrinsic means were about as effective as intrinsic means when motivating students.

Other research has shown that teachers' personal understanding of subject matter content (Grossman, 1989; Shulman, 1986; Wilson et al., 1987; Wilson & Wineburg, 1988) and pedagogy (Buchmann, 1989; Bullough, 1989; Hollingsworth, 1989; Lortie, 1975; Stoddart, 1991; Zeichner et al., 1988) exerts a powerful influence on the instructional methods they use in their classrooms. Such beliefs, conceptual systems, values, and commitments about teaching and learning are constructed through thousands of hours spent in learning environments (Calderhead & Robson, 1991; Herrmann, 1993; Holt-Reynolds, 1992; Lortie, 1975; Pintrich, 1990). Because these belief systems are reinforced on many occasions, they are often difficult to change (Kuhn, 1989; McCloskey, 1983). Furthermore, Salisbury-Glennon and Stevens (1999) argued that, if misconceptions are not exposed and addressed, preservice teachers may perpetuate them in their own classrooms.

Kagan (1991) argued that teachers' prior beliefs exert a powerful influence on what they learn and accept as valid knowledge. Like beliefs, goal orientations are acquired through experience in past learning situations, particularly school and home environments. Whether the students' environment encourages mastery, challenge, learning, and curiosity or emphasize grades, rewards, and social comparisons will result in their developing a mastery or a performance goal orientation, respectively (Amabile, 1983; Connell & Wellborn, 1991; Deci & Ryan, 1987; Deci et al., 1981; deCharms, 1976; Koestner et al., 1984; Lepper & Green, 1975; Lepper & Hodell, 1989; Ryan, 1982). Like personal belief systems, individuals' goal orientations may affect preservice teachers' choice of methods

for motivating students. As this study demonstrated, participants' goal orientations significantly predicted their beliefs about how to motivate students in the classroom. It is interesting that one's personal goals regarding learning situations may influence beliefs about appropriate ways to motivate others.

Significance of Text Type for Conceptual Change

The texts in the study were of two kinds. The nonrefutational (regular) text presented the scientific conception of intrinsic motivation and the refutational text presented the intrinsic view while directly contrasting it with the extrinsic view. Both texts, therefore presented similar information regarding intrinsic motivation theory; however, only the refutational text followed a conceptual change model and provided explicit information on the scientifically held conceptions of extrinsic motivation. The success of the refutational texts in changing teachers' conceptions about the extrinsic items is most likely due to its incorporation of the principles of a conceptual change model deemed necessary for conceptual change (Pintrich et al., 1993; Posner et al., 1982; Strike & Posner, 1985). Characteristics of the refutational text necessitated the activation and examination of students' prior knowledge.

The differing content may explain why text type was a significant variable in conceptual change on the extrinsic and not the intrinsic subscales in the present study. Theoretically, text type should not be responsible for observed differences in conceptual change among readers on the intrinsic subscale because both texts provided the reader with similar information about intrinsic motivation, whereas the refutational text provided the reader with information

about intrinsic and extrinsic motivation. Therefore, it seems probable that differences between the groups on the extrinsic subscale reflect the differing content of the texts (the refutational readers explicitly acquired information about the adverse effects of extrinsic motivation), whereas differences between the groups on the intrinsic items might be due to something other than differing text content in that area (both groups acquired similar information about the positive effects of intrinsic motivation).

The present study demonstrated that text type had a positive effect on conceptual change for the extrinsic subscale, although it showed significant effects only when combined with a conditional extra credit reward structure. It is very interesting that a main effect for text type was not observed, especially for the extrinsic items, considering the research substantiating the effectiveness of refutational texts - and the research on these texts in particular (Salisbury-Glennon & Stevens, 1999). Although refutational text may be a powerful tool in promoting conceptual change, it appears that for some students, those who are less intrinsically motivated, an incentive in the form of a controlling external reward structure must be in place before they are motivated to learn from refutational text. It is somewhat disconcerting that the opportunity to earn an extrinsic reward was necessary for conceptual change in this sample of preservice teachers.

It may seem hasty to conclude that the participants in this sample were not attempting to learn the material for its intrinsic rewards, although evidence suggests that when extrinsic rewards were not made available, participants did

not utilize the refutational texts for conceptual change. In effect, refutational text lost its power to induce conceptual change when an external reward structure was not offered. This may indicate that students in the present study have become dependent on extrinsic rewards for learning such that they did not engage in careful reading of the text when they did not have the opportunity to be rewarded for what they learned. This finding calls for teacher educators to question whether the average preservice teacher possesses genuine interest or holds a mastery orientation when it comes to material presented in their own education courses. The finding that in the absence of refutational text, intrinsic goal orientation facilitated conceptual change supports the motivation literature.

All in all, these finding suggests that the original four components of the cold model of conceptual change may not be sufficient for inducing conceptual change. The proper motivation had to be in place for students in this sample to utilize the text properly. Thus, these results provide support for the necessity of a hot model, whereby other variables (e.g., motivational, contextual) are considered to explain individual differences in conceptual change.

Significance of Goal Orientation and Reward Structure for Conceptual Change

Research in motivation suggests that a conditional extrinsic reward structure that is perceived controlling may undermine conceptual change. The interactions observed in this study seem to support these predictions. Students who were the least intrinsically motivated demonstrated higher degrees of conceptual change when given an extrinsic reward structure, perhaps because they did not perceive the reward structure as controlling. On the other hand,

conceptual change was undermined for students who were highly intrinsically motivated to learn, perhaps because they perceived the reward structure to be more controlling than those less intrinsically motivated. Furthermore, Amabile (1983) suggested that pressure combined with an external focus could interfere with higher level processing of information, resulting in rote learning strategies and less conceptual integration. An external focus did not appear to interfere with the ability of less intrinsically oriented students' to use refutational text for conceptual change. This suggests that the students' perception of the reward structure, which may be a function of their goal orientation, is important in determining whether the reward structure will facilitate or hinder conceptual change. In any case, the findings of this study support the notion that goal orientation and reward structure interact in significant ways to affect conceptual change.

These findings are impressive, considering that the conditional reward structure consisted of only 1% extra credit added to students' final course grades. The author was interested in whether 1% was "controlling" enough to produce detrimental effects on conceptual change. Although in this case, it appears that 1% was not "too controlling" for some students, this does not suggest it was uncontrolling. This reward structure obviously affected motivation to a significant degree to have produced such large effects on conceptual change in combination with the refutational text, and it appeared to undermine conceptual change in students who were highest in intrinsic goal orientation. This implies that reward structure is an important contextual variable that should be

considered when examining conceptual change, as well as when examining the effects of refutational texts on conceptual change.

This study also demonstrated that goal orientation is a potentially important variable to consider when studying conceptual change. For both subscales, intrinsic goal orientation facilitated conceptual change when a conditional reward structure was not present. That is, in the absence of the conditional reward structure, participants' motivational goal orientation or their intrinsic desire to master the material for its own sake had a significant positive effect on conceptual change.

The results of this study complement findings from Salisbury-Glennon and Steven's (1999) study that also found certain learner variables to play a role in conceptual change. They investigated the metacognitive and self-regulatory strategies that preservice teachers used who experienced relatively large change in their conceptions in the absence of refutational text. Results from their study indicated that there was a significant difference in the frequency of use of five out of nine self-regulating learning strategies between high and low changers. Their study supports the idea that refutational text is effective in facilitating conceptual change in preservice teachers and that students who do not have a refutational text at their disposal can compensate and still achieve conceptual change by using self-regulated strategies. Their study showed the influence of contextual factors (style of text) and cognitive components (strategy use) on conceptual change. The study at hand illuminates the influence of another contextual factor

(reward structure) and a motivational component (goal orientation) on conceptual change.

Summary of Conclusions

Support for a Hot Model of Conceptual Change

Pintrich et al. (1993) and Strike and Posner (1992) posited that a hot model, one that considers motivational, contextual, and cognitive factors, is necessary to adequately investigate conceptual change. The present study investigated three such factors, text type, goal orientation, and reward structure. The results of the present study provided support for a hot model of conceptual change in the following ways.

1. Goal orientation is significant to conceptual change in that, in the absence of a controlling reward structure, participants' intrinsic goal orientation had a positive effect on conceptual change for both subscales. Thus, preservice teachers' personal goal orientations should be considered when attempting to understand conceptual change.
2. Text type is significant to conceptual change, although ultimately its effectiveness relies on the context of the learning environment, particularly the reward structure presented.
3. Controlling reward structure had a positive effect on conceptual change for students having low goal orientations, and it appeared to undermine conceptual change in students with higher intrinsic goal orientations. Therefore, goal orientation and reward structure interact in significant ways to affect conceptual change.

4. The conceptual change facilitated by the refutational text appeared to prevail 1 week later, suggesting that observed conceptual change from these texts may be long lasting.

Implications for Teacher Education

1. Knowing that preservice teachers' personal goal orientations might affect their beliefs about teaching and motivating students, teacher educators should attempt to increase students' awareness of their goal orientations, how they might have been shaped through their experiences in extrinsically oriented learning environments, and how they might affect their teaching and motivational methods in their own classrooms.
2. Knowing that preservice teachers enter their preparation programs holding naïve beliefs or misconceptions about ways to motivate students, teacher educators should attempt to challenge these beliefs using a conceptual change model, so that the preservice teachers will not apply these naïve beliefs in their classrooms. Refutational texts appear to be a successful and practical means of facilitating conceptual change in students with high or low intrinsic motivation, especially when combined with a conditional reward structure.
3. Teacher educators should be aware of the possible interaction between goal orientation and reward structure. Particularly, a conditional reward structure like the one in the study appeared to significantly affect conceptual change in positive ways and did not undermine conceptual change for students with low intrinsic goal orientations. However, there is a possibility that even a small

controlling reward structure may undermine conceptual change in students with high intrinsic goal orientations. Also, in the absence of a conditional reward structure, students who are more intrinsically goal oriented may experience more conceptual change. Likewise, students with less intrinsic goal orientation may experience less conceptual change if not given the opportunity to receive an extrinsic reward. These findings further support the first implication, which calls for teacher educators to engage in discourse with their preservice teachers about their personal goal orientations.

Recommendations for Future Research

Based on the findings and limitations of this study, suggestions for future research are as follows:

1. Researchers in teacher education should identify other common experience-based conceptions that preservice teachers enter preparation programs holding, such as views regarding parental involvement, effectiveness of learning strategies, or self-efficacy when educating minority or low-ability students, or handling classroom discipline problems. Once important misconceptions in their theories have been identified, refutational texts should be developed and empirically validated to facilitate conceptual change in these areas.
2. Once developed, the characteristics of refutational texts should be examined more thoroughly to see whether certain characteristics make them more effective than others. For instance, is there an optimal text length? If readers are told the text was written by experts vs. novice teachers, or researchers vs.

teachers, does this affect the amount of conceptual change they produce?

Are refutational texts as effective when they deal with issues teachers hold particularly strong personal beliefs about, such as race or religion?

3. Amabile (1983) suggested that information that is acquired under external control (e.g., grades, rewards) may cease to be processed further once the outcome is obtained. In the present study, conceptual change induced by the combination of refutational text and controlling reward structure appeared to remain 1 week later. It is important to investigate whether effects persist, especially in those students who were less intrinsically motivated. Results suggested the possibility that greater conceptual change occurred (at least on the extrinsic items) after the delay. Studies focusing on delayed follow-up situations should investigate whether those who read refutational texts had longer-lasting change, or if variables such as reward structure and goal orientation determine whether the change is temporary or more long lasting.
4. Although items on the conceptual change measure were applied in nature, in the form of hypothetical scenarios about what "to do" in the classroom with students, it is questionable whether participants' responses to the questionnaire are indicative of future behavior. Further research is needed to determine whether the reading of refutational texts affects teachers' behavior in their own classrooms.
5. This study suggests that personal goal orientation may be related to preservice teachers' behavior when motivating students. It would be of interest to examine whether attempts to explicitly change preservice teachers'

goal orientations might produce changes in their beliefs about motivating students.

6. This study provided support for an interaction between goal orientation and reward structure. The reward structure used in this study was minimal and consisted of only 1% of students' final grades. This type of reward structure had differential effects on conceptual change depending on participants' goal orientation. Studies should be conducted to examine whether reward structures based on a larger number of points might affect conceptual change in similar ways.
7. This study examined the effects of one motivational (goal orientation) and two contextual variables (text type and reward structure) on conceptual change. A study by Salisbury-Glennon (1999) examined the effects of cognitive and self-regulatory learning strategies on conceptual change. To obtain a more complete model of conceptual change and to understand its dynamic nature, a comprehensive study including all relevant variables should be designed and analyzed using path analyses. The following research questions should also be addressed: Are individual perceptions of the subject matter (individual interest, value, utility) related to conceptual change? Do individual perceptions of the text (text-based interest, value, utility) affect conceptual change? Is conceptual change affected by control of learning beliefs? Does a positive sense of self-efficacy affect conceptual change? Is test anxiety detrimental to conceptual change?

APPENDIX A - INFORMED CONSENT

Project Title: Preservice Teachers' Beliefs About Motivation

Please read this consent document carefully before you decide to participate in this study.

Purpose of the research study:

I am conducting a study to investigate preservice teachers' thoughts and attitudes about their education courses and about their preferences for motivating students.

What you will be asked to do in the study:

There are three phases to this study. In the first phase, I will ask you to complete a questionnaire that concerns your attitudes about your College of Education coursework and a course in motivation. I will also ask you to answer a 20-item questionnaire regarding ways to motivate students. I will then ask you to return to this room one week later, to participate in the second phase of the study. The third phase will take place two weeks after the second phase. During the second and third phases, you will complete two more questionnaires regarding motivation. **Please note:** Discussing any part of the study may jeopardize its validity and your opportunity to receive extra credit.

Time required: It will take approximately 15 minutes to complete each phase of the study.

Risks: none.

Benefits: You will read passages written by experts in the field of motivation.

Compensation:

Your participation in this study is completely voluntary. There is no penalty for not participating. A minimum of 1% extra credit will be added to your final course grade (by your respective instructor) for participation in this study. However, you will only receive extra credit if you participate in all three phases of the study. Partial credit cannot be given for partial participation.

Confidentiality:

Your informed consent will be immediately removed from the rest of the questionnaire and the questionnaire will then be assigned a code number, making it impossible to connect your name to a survey. Your identity will be kept confidential to the extent provided by law and your responses will not be revealed to your instructor. Your instructor will be notified of your participation in the following way: You will be asked to sign a separate "sign-in sheet" after you have completed each phase of the study. Your instructor will only be notified of your participation if you complete the study.

Right to withdraw from the study:

You have the right to withdraw from the study at anytime without consequence to your final course grade. However, if you withdraw before the study is complete, you will not receive the extra credit.

Whom to contact if you have questions about this study:

If you have any questions about this research project, please contact me (352) 392-0728 EXT. 282.

Whom to contact about your rights in the study:

UFIRB office, Box 112250, University of Florida, Gainesville, FL 32611-2250: phone: (352)392-0433.

Principal Investigator: Dawn M. Kutza, M.Ed., Educational Psychology

Agreement:

I have read the procedure described above for this study and I voluntarily agree to participate in all three phases of the study. I have received a copy of this description.

Name (Print): _____

Signature of participant: _____

Date: _____

APPENDIX B - DEMOGRAPHIC INFORMATION SHEET

Demographic Information

1. Gender (circle one) *Male* *Female*
2. What year did you graduate from high school? _____
3. Class level (circle one)
Freshman *Sophomore* *Junior* *Senior* *Graduate*
4. Please indicate your current academic major(s): _____
5. Ethnic background (circle one)
African-American *Asian-* *Caucasian* *Hispanic* *Other*
Or Black *American* *or Spanish*
6. How many hours per week do you work for pay? _____
7. How many college level courses have you had that addressed the subject of *motivation*? _____
8. How many classes are you taking this term? _____
9. Are you planning on a career in teaching? (circle one)
yes *no* *uncertain*
10. If so, what grade level do you plan on teaching? _____

APPENDIX C – NONCONTROLLING REWARD STRUCTURE COVER LETTER

Phase Two

Dear Participant,

Thank you for participating in Phase One of my study!

In Phase Two, I ask that you first read the following passage regarding current theoretical conceptions of motivation held by experts in the field of educational psychology. When you are finished, please return your passage to me and I will give you a 20-item questionnaire to answer based on what you have just read. When you are finished, return the questionnaire to me and sign the sign-in sheet.

Phase Two should take you approximately 15 minutes to complete.

Please note:

**** In addition to the 1% extra credit mentioned in the informed consent, you will receive an additional 1% to your final course grade from your instructor upon completion of all three phases of the study.**

Remember, discussing any part of the study may jeopardize its validity and your opportunity to receive extra credit points. Thank you 😊

Sincerely,

Dawn M. Kutza

APPENDIX D - CONTROLLING REWARD STRUCTURE

Phase Two

Dear Participant,

Thank you for participating in Phase One of my study!

In Phase Two, I ask that you first read the following passage regarding current theoretical conceptions of motivation held by experts in the field of educational psychology. When you are finished, please return your passage to me and I will give you a 20-item questionnaire to answer based on what you have just read. When you are finished, return the questionnaire to me and sign the sign-in sheet.

Phase Two should take you approximately 15 minutes to complete.

Please note:

****** As mentioned in the informed consent, you will each receive 1% extra credit to your final course grade upon completion of this study. However, those participants whose answers on this questionnaire most closely reflect the expert opinions stated in the passage you are about to read will receive an additional 1% to your final course grade from your instructor.

Remember, discussing any part of the study may jeopardize its validity and your opportunity to receive extra credit points. Thank you☺

Sincerely,

Dawn M. Kutza

APPENDIX E - PHASE THREE COVER LETTER

Phase Three

Dear Participant,

Thank you for participating in Phases One and Two of my study!

In Phase Three, I once again ask that you answer the motivational questionnaire. I am asking you to complete it for a *third* time because I would like to know if your beliefs about motivation have changed since you have had a chance to reflect on your participation in this study.

Thank you very much for your participation. I will notify your instructor immediately that you have completed the study. Please check with your instructor regarding the extra credit you have earned. I hope you have a great semester!

Sincerely,

Dawn M. Kutza

REFERENCES

Amabile, T. (1983). The social psychology of creativity. New York: Springer Verlag.

Ames, C. (1992). Classrooms: Goals, structures, and student motivation. Journal of Educational Psychology, 84, 261-271.

Ames, C., & Archer, J. (1988). Achievement goals in the classroom: Student learning strategies and motivation processes. Journal of Educational Psychology, 80, 260-267.

Anderson, R. C., Shirey, L. L., Wilson, P. T., & Fielding, L. G. (1987). Interestingness of children's reading material. In R. E. Snow & M. J. Farr (Eds.), Aptitude, learning, and instruction. Vol. 3: Conative and affective process analyses (pp. 287-299). Hillsdale, NJ: Hillsdale, NJ: Erlbaum.

Alvermann, D. E., & Hague, S. A. (1989). Comprehension of counter-intuitive science text: Effects of prior knowledge and text structure. Journal of Educational Research, 82, 197-202.

Alvermann, D. E., & Hynd, C. R. (1989). Effects of prior knowledge activation modes and text structure of nonscience majors' comprehension of physics. Journal of Educational Research, 83, 97-202.

Alvermann, D. E., Smith, L. C., & Readence, J. E. (1985). Prior knowledge and the comprehension of compatible and incompatible text. Reading Research Quarterly, 20, 420-436.

Baird, W., & Hidi, S. (1984, April). The effect of factual importance on recall from naturally occurring school texts. Paper presented at the meeting of the American Educational Research Association, New Orleans.

Ball, D. L. (1989). Breaking with experience in learning to teach mathematics: The role of the preservice methods course (Issue Paper 89-10). East Lansing, MI: Michigan State University, National Center for Research on Teacher Education.

Ball, D. L., & Feiman-Nemser, S. (1988). Using textbooks and teachers' guides: A dilemma for beginning teachers and teacher educators. Curriculum Inquiry, 18, 401-423.

Bandura, A. (1982). Self-efficacy mechanisms in human agency. American Psychologist, 37, 122-148.

Bandura, A. (1986). Social foundations of thought and action: A social cognitive theory. Englewood Cliffs, NJ: Prentice-Hall.

Benjamin, M., McKeachie, W. J., Lin, Y. G., & Holinger, D. P. (1981). Test anxiety: Deficits in information processing. Journal of Educational Psychology, 73, 816-824.

Bennett, N., & Carre, C. (1993). Learning to teach. London: Routledge.

Berlyne, D. E. (1974). Concluding observations. In D. E. Berlyne (Ed.), Studies in the new experimental aesthetics (pp. 175-180). New York: Wiley.

Bird, T. Anderson, L. M., Sullivan, B. A., & Swindler, S. A. (1993). Pedagogical balancing acts: Attempts to influence prospective teachers' beliefs. Teaching and Teacher Education, 9, 253-267.

Buchmann, M. (1989, March). Breaking from experience in teacher education: When is it necessary? How is it possible? Paper presented at the meeting of the American Research Association, San Francisco.

Bullough, R. V. Jr. (1989). First year teacher: A case study. New York: Teachers College Press.

Calderhead, J., & Robson, M. (1991). Images of teaching: Student teachers' early conceptions of classroom practice. Teaching and Teacher Education, 7, 1-8.

Carey, S. (1985). Conceptual change in childhood. Cambridge: MIT Press.

Carey, S., & Smith, C. (1993). On understanding the nature of scientific knowledge. Educational Psychologist, 28, 235-251.

Case, R., & Bereiter, C. (1984). From behaviorism to cognitive development: Steps in the evolution of instructional design. Instructional Science, 13, 141-158.

Champagne, A. B., Klopfer, L. E., & Anderson, J. H. (1980). Factors influencing the learning of classical mechanics. American Journal of Physics, 48, 1074-1079.

Clark, C. M., & Peterson, P. L. (1986). Teachers' thought processes. In M. C. Wittrock (Ed.), Handbook of research on teaching (3rd ed.). New York: Macmillan.

Clement, J. (1983). A conceptual model discussed by Galileo and used intuitively by physics students. In D. Gentner & A. L. Stevens (Eds.), Mental models (pp. 206-251). Hillsdale, NJ: Erlbaum.

Cohen, D. K., & Ball, D. L. (1990). Policy and practice: An overview. Educational Evaluation and Policy Analysis, 12, 233-240.

Connell, J., & Wellborn, J. (1991). Competence, autonomy, and relatedness: A motivational analysis of self-system processes. In R. Megan & L. Stroufe (Eds.), Self-processes and development (pp. 43-78). Hillsdale, NJ: Erlbaum.

deCharms, R. (1968). Personal causation: The internal affective determinants of behavior. New York: Academic Press.

Deci, E. (1971). Effects of externally mediated rewards on intrinsic motivation. Journal of Personality and Social Psychology, 18, 105-115.

Deci, E., & Ryan, R. (1985). Intrinsic motivation and self-determination in human behavior. New York: Plenum Press.

Deci, E., & Ryan, R. (1987). The support of autonomy and the control of behavior. Journal of Personality and Social Psychology, 53, 1024-1037.

Dweck, C. S., & Elliott, E. S. (1983). Achievement motivation. In E. M. Heatherington (Ed.), Handbook of child psychology: Vol. 4. Socialization, personality, and social development (pp. 643-691). New York: Wiley.

Dweck, C. S., & Leggett, E. L. (1988). A social-cognitive approach to motivation and personality. Psychological Review, 95, 256-273.

Deci, E., Nezlek, J., & Sheinman, L. (1981). Characteristics of the rewarder and intrinsic motivation of the rewardee. Journal of Personality and Social Psychology, 40, 1-10.

Eccles, J. (1983). Expectancies, values and academic behaviors. In J. T. Spence (Ed.), Achievement and achievement motives (pp. 75-146). San Francisco: Freeman Press.

Elliott, E., & Dweck, C. (1988). Goals: An approach to motivation and achievement. Journal of Personality and Social Psychology, 54, 5-12.

Fabricius, W. V., & Hagen, J. W. (1984). Use of causal attributions about recall performance to assess metamemory and predict strategic memory behavior in young children. Developmental Psychology, 20, 975-987.

Feiman-Nemser, S. (1990). Teacher preparation: Structural and conceptual alternatives. In W. R. Houston, M. Haberman, & J. Sikula (Eds.), Handbook of research on teacher education, (pp. 212-233). New York: Macmillan.

Fenstermacher, G. D. (1986). Philosophy of research on teaching: Three aspects. In M. C Wittrock (Ed.), Handbook of research on teaching (3rd ed., pp. 37-49). New York: Macmillan.

Fransson, A. (1977). On qualitative differences in learning: IV. Effects of motivation and test anxiety on process and outcome. British Journal of Educational Psychology, 47, 244-257.

Garner, R., Gillingham, M. G., & White, C. S. (1989). Effects of "seductive details" on macroprocessing and microprocessing in adults and children. Cognition and Instruction, 6, 41-57.

Gomez, M. I., & Stoddart, T. (1991). Learning to teach writing: The balancing of personal and professional perspectives. In R. Clift & C. Everson, (Eds.). Focal points: Qualitative inquiries into teaching (pp. 71-90). Washington, DC: American Educational Research Association.

Grolnick, W., & Ryan, R. (1987). Autonomy in children's learning: An experimental and individual difference investigation. Journal of Personality and Social Psychology, 52, 890-898.

Grossman, P. L. (1989). Learning to teach without teacher education. Teachers College Record, 91, 191-208.

Guzzetti, B. J., Snyder, T. E., & Glass, G. V. (1992). Promoting conceptual change in science: Can texts be used effectively? Journal of Reading, 35, 642-649.

Guzzetti, B. J., Snyder, T. E., Glass, G. V., & Gamas, W. W. (1993). Promoting conceptual change in science: A comparative meta-analysis of interventions from reading education and science education. Reading Research Quarterly, 28, 116-159.

Guzzetti, B. J., Williams, W. O., Skeels, S. A., & Wu, S. M. (1997). Influence of text structure on learning counterintuitive physics concepts. Journal of Research in Science Teaching, 34, 701-719.

Halliday, J. (1996). Back to good teaching, diversity in tradition. London: Cassell.

Harter, S. (1981). A new self-report scale of intrinsic versus extrinsic orientation in the classroom: Motivational and informational components. Developmental Psychology, 17, 300-312.

Harter, S., & Guzman, M. (1986). The effects of perceived cognitive competence and anxiety on children's problem-solving performance, difficulty level choices, and preference for challenge. Unpublished manuscript, University of Denver.

Herrmann, B. (1993). Building professional contexts for learning for preservice and inservice teachers and teacher educators: Reflections, issues and questions. ERIC Document Reproduction Service No. ED364 835.

Hidi, S. (1990). Interest and its contribution as a mental resource for learning. Review of Educational Research, 60, 549-571.

Hidi, S., & Baird, W. (1983, November). Types of information in school texts and their effect on children's recall. Paper presented at the National Reading Conference, Austin, TX.

Hidi, S., & Baird, W. (1986). Interestingness – A neglected variable in discourse processing. Cognitive Science, 10, 179-194.

Hidi, S., & Baird, W. (1988). Strategies for increasing text-based interest and students' recall of expository texts. Reading Research Quarterly, 23, 465-483.

Hidi, S., Baird, W., & Hildyard, A. (1982). That's important, but is it interesting? Two factors in text processing. In A. Flammer & W. Kintsch (Eds.), Discourse processing (pp. 63-75). Amsterdam: North Holland.

Hidi, S., & McLaren, J. (1991). Motivational factors and writing: The role of topic interestingness. European Journal of Psychology of Education, 6, 187-197.

Hill, K., & Wigfield, A. (1984). Test anxiety: A major educational problem and what can be done about it. Elementary School Journal, 85, 105-126.

Hollingsworth, S. (1989). Prior beliefs and cognitive change in learning to teach. American Educational Research Journal, 26, 160-189.

Holt-Reynolds, D. (1992). Personal history-based beliefs as relevant prior knowledge in course work. American Educational Research Journal, 29, 325-349.

Hynd, C., & Alvermann, D. E. (1986). Prior knowledge activation in refutation and non-refutation text. In J. A. Niles & R. V. Lalik (Eds.), Solving problems in literacy: Learners, teachers, and researchers, Thirty-fifth Yearbook of the National Reading Conference (pp. 55-60). Rochester, NY: National Reading Conference.

Jones, M. G., & Vesilind, E. (1995). Preservice teachers' cognitive frameworks for class management. Teaching and Teacher Education, 11, 313-330.

Kagan, D. M. (1992). Professional growth among preservice and beginning teachers. Review of Educational Research, 62, 129-169.

Kintsch, W. (1980). Learning from text. Cognition and Instruction, 3, 87-108.

Knowles, J. G., & Holt-Reynolds, D. (1991). Shaping pedagogies through personal histories in preservice teacher education. Teachers College Record, 93, 87-113.

Koestner, R., Ryan, R., Bernieri, F., & Holt, K. (1984). Setting limits on children's behavior: The differential effects of controlling vs. informational styles on intrinsic motivation and creativity. Journal of Personality, 52, 233-248.

Krapp, A., Hidi, S., & Renninger, K. A. (1992). Interest, learning, and development. In K. A. Renninger, S. Hidi, & A. Krapp (Eds.), The role of interest in learning and development (pp. 3-25). Hillsdale, NJ: Erlbaum.

Kuhn, D. (1989). Children and adults as intuitive scientists. Psychological Review, 96, 674-689.

Kurtz, B. E., & Borkowski, J. G. (1984). Children's metacognition: Exploring relations among knowledge, process, and motivational variables. Journal of Experimental Child Psychology, 37, 335-354.

Lasley, T. J. (1980). Preservice teacher beliefs about teaching. Journal of Teacher Education, 31, 38-41.

Liebert, R., & Morris, L. (1967). Cognitive and emotional components of test anxiety: A distinction and some initial data. Psychological Reports, 20, 975-978.

Leean, C. (1979). Foundations of education: Making the known unknown. Journal of Teacher Education, 30(3), 5-6.

Lepper, M., & Greene, D. (1975). Turning play into work: Effects of adult surveillance and extrinsic rewards on children's intrinsic motivation. Journal of Personality and Social Psychology, 31, 479-486.

Lepper, M., & Hodell, M. (1989). Intrinsic motivation in the classroom. In C. Ames & R. Ames (Eds.), Research on motivation in education (Vol. 3, pp. 73-105). New York: Academic Press.

Lortie, D. (1975). Schoolteacher: A sociological study. Chicago: University of Chicago Press.

Mandler, G. (1982). The structure of value: Accounting for taste. In M. S. Clark & S. T. Fiske (Eds.), Affect and cognition (pp. 3-36). Hillsdale, NJ: Erlbaum.

Maria, K., & MacGintie, W. (1987). Learning from texts that refute the reader's prior knowledge. Reading Research and Instruction, 26, 222-238.

Mayer, J. S., & Brause, R. S. (1991). The never-ending Cycle of Teacher Growth. In R. S. Brause & J. S. Mayer (Eds.), Search and re-search: What the inquiring teacher needs to know. New York: Falmer Press.

McCloskey, M. (1983). Naïve theories of motion. In D. Gentner & A. L. Stevens (Eds.), Mental models (pp. 71-94). Hillsdale, NJ: Lawrence Erlbaum.

McCloskey, M., Caramazza, A., & Green, B. (1980). Curvilinear motion in the absence of external forces: Naïve beliefs about the motion of objects. Science, 210, 1139-1141.

McDiarmid, G. W. (1989). What do prospective teachers learn in their liberal arts courses? (Issue Paper 89-108). East Lansing: Michigan State University, National Center for Research on Teacher Education.

McKeachie, W. J. (1984). Does anxiety disrupt information processing or does poor information processing lead to anxiety? International Review of Applied Psychology, 33, 187-203.

McKeachie, W. J., Pintrich, P. R., Lin, Y. G., & Smith, D. (1986). Teaching and learning in the college classroom: A review of the research literature. Ann Arbor, MI: The University of Michigan National Center for Research to Improve Postsecondary Teaching and Learning.

Meece, J. L. (1991). The classroom context and children's motivational goals. In M. Maehr & P. Pintrich (Eds.), Advances in motivation and achievement (Vol. 7, pp. 261-286). Greenwich, CT: JAI Press.

- Mosenthal, P. (1983). Defining classroom writing competence: A paradigmatic perspective. Review of Educational Research, 52, 217-251.
- Neale, D., & Smith, D. (1989, April). Implementing conceptual change teaching in primary science. Paper presented at the meeting of the American Educational Research Association, San Francisco, CA.
- Nicholls, J. (1984). Achievement motivation: Conceptions of ability, subjective experience, task choice, and performance. Psychological Review, 91, 328-346.
- Nussbaum, J., & Novick, N. (1982). Alternative frameworks, conceptual conflict, and accommodation: Toward a principled teaching strategy. Instructional Science, 25, 261-290.
- Osborne, R., & Freyberg, R. (1985). Learning science. Portsmouth, NH: Heinemann.
- Paris, S. G., & Oka, E. (1986). Children's reading strategies, metacognition, and motivation. Developmental Review, 6, 25-56.
- Piaget, J. (1970). Piaget's theory. In P. M. Mussen (Ed.). Carmichael's manual of child psychology (3rd ed). New York: Wiley.
- Piaget, J. (1974). Understanding causality. New York: W. W. Norton.
- Piaget, J. (1985). The equilibration of cognitive structures. Chicago: University of Chicago Press.
- Pintrich, P. R. (1989). The dynamic interplay of student motivation and cognition in the college classroom. In C. Ames & M. Maehr (Eds.). Advances in motivation and achievement: Motivation-enhancing environments (Vol. 6, pp. 117-160). Greenwich, CT: JAI Press.
- Pintrich, P. R. (1990). Implications of the psychological research on student learning and college teaching for teacher education. In R. Houston (Ed.), The handbook of research on teacher education (pp. 826-857). New York: Macmillan.
- Pintrich, P. R. (1994). Student motivation in the college classroom. In K. Prichard & R. McLaran Sawyer (Eds.), Handbook of college teaching (pp. 23-43). Westport, CT: Greenwood Press.
- Pintrich, P. R., & DeGroot, E. (1988). Motivation and metacognition in different academic settings. Paper presented at the International Congress of Psychology, Sydney, Australia.

Pintrich, P. R., & DeGroot, E. (1990a). Motivational and self-regulated learning components of classroom academic performance. Journal of Educational Psychology, *82*, 33-40.

Pintrich, P. R., & De Groot, E. (1990b, April). Quantitative and qualitative perspectives on student motivational beliefs and self-regulated learning. Paper presented at the meeting of the American Educational Research Association, Boston.

Pintrich, P. R., & Garcia, T. (1991). Student goal orientation and self-regulation in the college classroom. In M. Maehr & P. R. Pintrich (Eds.), Advances in motivation and achievement: Goals and self-regulatory processes (Vol. 7, pp. 371-402). Greenwich, CT: JAI Press.

Pintrich, P. R., Marx, R. W., & Boyle, R. (1993). Beyond "cold" conceptual change: The role of motivational beliefs and classroom contextual factors in the process of conceptual change. Review of Educational Research, *63*, 167-199.

Pintrich, P. R., & Schrauben, B. (1992). Students' motivational beliefs and their cognitive engagement in classroom academic tasks. In D. Schunk & J. Meece (Eds.), Student perceptions in the classroom, (pp. 149-183). Hillsdale, NJ: Erlbaum.

Posner, G., Strike, K., Hewson, P., & Gertzog, W. (1982). Accommodation of a scientific conception: Toward a theory of conceptual change. Science Education, *66*, 211-227.

Prenzel, M. (1988, April). Task persistence and interest. In U. Schiefele (Chair), Content and Interest as Motivational Factors in Learning. Symposium conducted at the meeting of the American Educational Research Association, New Orleans.

Renninger, K. A. (1990). Children's play interests, representation, and activity. In R. Fivush & J. Hudson (Ed.), Knowing and remembering in young children (pp. 127-165). Norwood, NJ: Ablex.

Renninger, K. A., Hidi, S., & Krapp, A. (1992). The role of interest in learning and development. Hillsdale, NJ: Erlbaum.

Renniger, K. A., & Wozniak, R. H. (1985). Effect of interest on attentional shift, recognition, and recall in young children. Developmental Psychology, *21*, 624-632.

Resnick, L. B. (1983). Mathematics and science learning: A new conception. Science, *220*, 477-478.

Roth, K. J. (1986). Conceptual change learning and student processing of science texts. (Research Service No. 167). East Lansing, MI: Michigan State University, Institute for Research on Teaching.

Ryan, R. M. (1982). Control and information in the intrapersonal sphere: An extension of cognitive evaluation theory. Journal of Personality and Social Psychology, 43, 450-161.

Ryan, R., Connell, J., & Deci, E. (1985). A motivational analysis of self-determination and self-regulation in education. In C. Ames & R. Ames (Eds.), Research on motivation in education (Vol. 2, pp. 13-51). New York: Academic Press.

Salisbury-Glennon, J. D., & Stevens, R. J. (1999). Addressing preservice teachers' conceptions of motivation. Teaching and Teacher Education, 15, 741-752.

Salisbury-Glennon, J. D., Stevens, R. J., & Duffy, J. (2000, in progress). Conceptions in an introductory educational psychology course.

Sanders, J. T., & McPeck, J. E. (1976). Theory into practice or vice versa? Comments on an educational antinomy. The Journal of Educational Thought, 10, 188-193.

Schiefele, U. (1991). Interest, learning, and motivation. Educational Psychologist, 26, 299-323.

Schiefele, U., & Krapp, A. (1988, April). The impact of interest on qualitative and structural indicators of knowledge. Paper presented at the meeting of the American Educational Research Association, New Orleans.

Schank, R. C. (1979). Interestingness: Controlling inferences. Artificial Intelligence, 12, 273-297.

Schunk, D. (1985). Self-efficacy and school learning. Psychology in the Schools, 22, 208-223.

Schunk, D. (1989). Social cognitive theory and self-regulated learning. In B. Zimmerman & D. Schunk (Eds.), Self-regulated learning and academic achievement: Theory, research, and practice (pp. 83-110). New York: Springer-Verlag.

Shell, D., Murphy, C., & Bruning, R. (1989). Self-efficacy and outcome expectancy mechanisms in reading and writing achievement. Journal of Educational Psychology, 81, 91-100.

Shirey, L. S., & Reynolds, R. E. (1988). Effect of interest on attention and learning. Journal of Educational Psychology, 80, 159-166.

Suell, T. J. (1986). Cognitive conceptions of learning. Review of Educational Research, 56, 411-436.

Shulman, L. (1986). Those who understand: Knowledge growth in teaching. Educational Researcher, 15(2), 4-14.

Smith, D. (1987). Primary teachers' misconceptions about light and shadows. In J. Novak (Ed.), Proceedings of the Second International Seminar: Misconceptions and educational strategies in science and mathematics, Cornell University, Ithaca, NY.

Stahl, S. A., Hynd, C. R., Montgomery, T., & McClain, V. P. (1997). "In fourteen hundred and ninety two, Columbus sailed the ocean blue": Effect of multiple document readings on student attitudes and misconceptions. National Reading Research Center, Reading Research Report No. 82, 9-21.

Stoddart, T. (1991). Learning to teach English and mathematics in an alternative route to teacher certification. The Curriculum Journal, 2, 259-281.

Stoddart, T., Stofflett, R. T., & Gomez, M. L. (1992, April). Breaking the didactic teaching-learning-teaching cycle: Reconstructing teachers' knowledge. Paper presented at the meeting of the American Educational Research Association, San Francisco, CA.

Stofflett, R. T. (1994). The accommodation of science pedagogical knowledge: The application of conceptual change constructs to teacher education. Journal of Research in Science Teaching, 31, 787-810.

Stofflett, R. T., & Stoddart, T. (1994). The ability to understand and use conceptual change pedagogy as a function of prior content learning experience. Journal of Research in Science Teaching, 31, 31-51.

Strike, K. A., & Posner, G. J. (1985). A conceptual change view of learning and understanding. In L. H. T. West & A. L. Pines (Eds.), Cognitive structure and conceptual change (pp. 211-231). New York: Academic Press.

Strike, K. A., & Posner, G. J. (1992). A revisionist theory of conceptual change. In R. Duschl & R. Hamilton (Eds.), Philosophy of science, cognitive psychology, and educational theory and practice (pp. 147-176). Albany, NY: SUNY.

Weinstein, C. E., Schulte, A., & Palmer, D. R. (1987). The Learning and Study Strategies Inventory. Clearwater, FL: H & H Publishing.

West, L., & Pines, A. (1985). Cognitive structure and conceptual change. New York: Academic Press.

Wilson, S. M., Shulman, L. S., & Richert, A. E. (1987). "150 different ways" of knowing: Representations of knowledge in teaching. In J. Calderhead (Ed.), Exploring teachers' thinking (pp. 77-92). Eastbourne, England: Cassell.

Wilson, S. M., & Wineburg, S. S. (1988). Models of wisdom in teaching history. Phi Delta Kappan, 70, 90-98.

Wine, J. D. (1971). Test anxiety and direction of attention. Psychological Bulletin, 76, 92-104.

Wubbels, T., Korthagen, F. A. J., & Broekman, H. (1991). Pedagogical subject matter knowledge in secondary mathematics teacher education: Characteristics of strategies for change. Paper presented at the meeting of the American Educational Research Association, Chicago.

Zeichner, K., & Tabachnick, B. R. (1985). The development of teacher perspectives: Social strategies and institutional control in the socialization of beginning teachers. Journal of Education for Teaching, 11, 1-25.

Zeichner, K., Tabachnick, B. R., & Densmore, K. (1987). Individual instructional and cultural influences on the development of teachers' craft knowledge. In J. Calderhead (Ed.), Exploring teachers' thinking (pp. 1-20). Eastbourne, England: Cassell.

BIOGRAPHICAL SKETCH

Dawn Michelle (Shuler) Kutza was born on November 30, 1972, in Peru, Indiana. She was an only child and remained in Peru until she graduated from Peru High School in 1991.

Dawn received a Bachelor of Science in psychology from Indiana University, Bloomington, in 1995. As her focus of study there was animal behavior and learning, she worked many hours in the laboratories of Drs. Eliot Hearst and William Timberlake performing learning experiments with rats and pigeons. While at Indiana, Dawn became a resident assistant for the Division of Housing. She graduated Phi Beta Kappa.

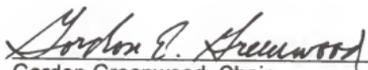
Dawn spent one year after graduation enjoying "big city" life in Philadelphia, Pennsylvania. She then moved to pursue a Ph.D. in educational psychology at the University of Florida, Gainesville. She financed her way through graduate school by working as a Hall Director for the Division of Housing and by teaching the following lower- and upper-division courses for the Department of Educational Psychology: learning and cognition, lifespan development, educational psychology, child development, and adolescent development.

In 1998, Dawn was nominated by the College of Education as Outstanding Graduate Student of the Year. She was the educational psychology department's

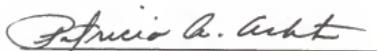
Outstanding Graduate Student Teacher Nominee in 1999. She also received several awards for her contribution to students living in the residence halls, including Outstanding Student Leader for the Tolbert Area, Student Government Advisor of the Year, and Presidential Recognition for Outstanding Student Contributions. She is a member of the American Educational Research Association.

Dawn met her husband, who is pursuing a Master of Science degree in geology, at the University of Florida in 1998. In 2000, she received a Ph.D. in educational psychology from the Educational Psychology Department, College of Education, of the University of Florida. In the fall, Dawn plans to continue her commitment to teaching and advising preservice teachers as a member of the psychology faculty of Austin Peay State University in Clarksville, Tennessee.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.


Gordon Greenwood, Chair
Professor of Educational Psychology

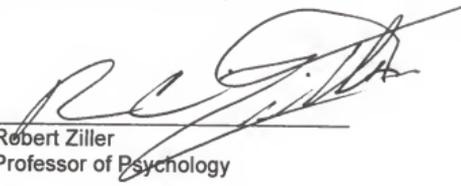
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Patricia A. Ashton
Professor of Educational Psychology

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.


David Miller
Professor of Educational Psychology

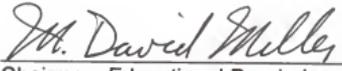
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Robert Ziller
Professor of Psychology

This dissertation was submitted to the Graduate Faculty of the College of Education and to the Graduate School and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

August 2000



M. David Melley
Chairman, Educational Psychology



Ben F. Kelms
Dean, College of Education

Dean, Graduate School