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Overcomming Misconceptions in Religious Education: The Effects of Text Structure and Topic Interest on Conceptual Change

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OVERCOMING MISCONCEPTIONS IN RELIGIOUS EDUCATION: THE EFFECTS

OF TEXT STRUCTURE AND TOPIC INTEREST ON CONCEPTUAL CHANGE

by

Seth King

A dissertation submitted in partial fulfillment
of the requirements for the degree

of

DOCTOR OF PHILOSOPHY

in

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(Curriculum and Instruction)

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UTAH STATE UNIVERSITY
Logan, Utah

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ABSTRACT

Overcoming Misconceptions in Religious Education: The Effects of Text

Structure and Topic Interest On Conceptual Change

by

Seth King, Doctor of Philosophy

Utah State University, 2013

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Department: Special Education

The aim of this study was to quantitatively measure refutation text's power for conceptual change while qualitatively discovering students' preference of refutation or expository text structures. This study also sought to examine if religious interest levels predict conceptual change. Participants for this study were 9th, 10th-, 11th-, and 12th-grade seminary students from the private religious educational system of The Church of Jesus Christ of Latter-day Saints (LDS). The study was conducted in two sessions. Session 1 involved pretesting, interventions, and posttesting. Session 2 involved delayed posttesting and participant interviews. Results were predominately measured quantitatively with some qualitative interview analysis added to enrich the study. This research study provides insight into the refutation text effects in LDS religious education. Results of the study showed significant differences in conceptual change between participants reading refutation texts and those reading expository texts. In every case, the refutation text group

performed higher on posttests than did the expository group. Results also showed participant preference toward refutation text structures. Furthermore, the study found significant correlations that verify topic interest as a possible predictor of conceptual change. Insights are valuable in aiding curriculum developers in implementing effective ways to teach doctrinal principles by utilizing refutation text interventions. The advantages of this research study add to educational research and identify areas for improvement and exploration in further research. This study of refutation text effects in religious education also broadens researchers' understanding of refutation text's power for conceptual change in subjects outside of K-12 science. Results of this study are of interest to researchers, teachers, curriculum writers, and LDS seminary teachers and administrators.

(216 pages)

PUBLIC ABSTRACT

Overcoming Misconceptions in Religious Education: The Effects of Text

Structure and Topic Interest On Conceptual Change

by

Seth King, Doctor of Philosophy

Utah State University, 2013

This study quantitatively investigated refutation text's power for conceptual change in Latter-day Saint religious doctrines. The study also examined religious interest levels. Participants for this study were 9th-, 10th-, 11th-, and 12th-grade seminary students from the private religious educational system of The Church of Jesus Christ of Latter-day Saints (LDS). Results of the study showed significant differences in conceptual change between participants' reading refutation texts and those reading expository texts. Refutation texts significantly increased the likelihood of conceptual change when compared to expository texts. Results also showed participant preference toward refutation text structures. Furthermore, the study found significant correlations that verify topic interest as a possible predictor of conceptual change. Results of this study are of interest to researchers, teachers, curriculum writers, and LDS seminary teachers and administrators.

ACKNOWLEDGMENTS

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CHAPTER 1

INTRODUCTION

Introduction

Today's youth face a deepening flood of filth that is vastly becoming torrential as language is coarsening, pornography is infiltrating every medium, and tolerance for unethical behavior is increasing at an alarming rate (Sacks, 2011). President Henry B. Eyring (2004), first counselor in the first presidency of The Church of Jesus Christ of Latter-day Saints, declared, "The spiritual strength sufficient for our youth to stand firm just a few years ago will soon not be enough. Many of them are remarkable in their spiritual maturity and in their faith, but even the best of them are sorely tested and the testing will become more severe" (p. 16). Much of what was religiously considered wrong and spiritually destructive is no longer condemned and may even be admired by many of the rising generation. Swimming upstream to purity against the waves of the world is getting harder and may soon be frighteningly difficult. To stay the tides of filth and remain pure, the youth must increase their understanding and application of the scriptures. Thomas S. Monson (2009), President of The Church of Jesus Christ of Latter-day Saints, proclaimed, "[S]tudy the scriptures…understand them…live accordingly…and you will be able to stand strong" (p. 70).

Problem Statement

To assist youth in learning the scriptures, The Church of Jesus Christ of Latter-day Saints (LDS) established the Seminary and Institute Program in 1914. The program

gives youth the opportunity to enroll in religious education classes that are taught within close proximity to institutions of secondary and higher education. In these classes instructors are to teach the scriptural text (Clark, 1938). However, there is a problem with the quality and quantity of scripture teaching taking place for conceptual change (Webb, 2007). The same problem is observed in other disciplines of K-12 education where instruction involves a diminished use of text for teaching core principles (Sinatra & Broughton, 2011). Students are not grasping the teachings of the text to the point of understanding the beliefs that are promulgated therein (Eyring, 2004). They find themselves succumbing to doctrinal misconceptions of right and wrong and need greater "opportunities to interact and internalize the scriptural text" (Webb, 2007). In a talk directed to Seminary and Institute faculty, President Henry B. Eyring chided, "What we are now doing and have done in the past is not enough, we must raise our sights to get the scriptures down into the hearts of the students…we must look for ways to teach the scriptures better" (p. 14).

Positionality and Personal Context

Correcting students' doctrinal misconceptions is an essential element of religious instruction that moves learners to higher levels of correct understanding. In most religious theologies, the epistemology—beliefs about knowledge and knowing (see Hofer & Pintrich, 1997)—of doctrinal truths are viewed to be simple, certain, and unchanging (Chinn, Buckland, & Samarapungavan, 2011). LDS theology fits this norm, as truth is seen as an eternal construct of things "as they are, as they were, and as they are to come" (D&C 93:24). The present research study views doctrines as factual concepts of LDS

theology that have one correct definition and description. Doctrinal misconceptions are not viewed as differing beliefs, but are seen as an incorrect understanding of true concepts. This view aligns with the teachings of the LDS church (The Church of Jesus Christ of Latter Day Saints, 2008), as changes in conception are required when church members hold misconceptions about LDS doctrinal concepts. Furthermore, doctrinal misconceptions in LDS theology may leave many LDS learners unprepared to represent their faith in a world that challenges the doctrines of deity (Eyring, 2004). Elaine S. Dalton (2008), the president of LDS young women's association, has spoken out on the need to return to virtue and overcome doctrinal misconceptions and false ideas about God's plan of salvation.

Pragmatic interventions using text may be an effective methodology in initiating conceptual change in LDS seminary learners. Conceptual change is the process of restructuring or replacing prior knowledge with new concepts and understanding (Posner, Strike, Hewson, & Gertzog, 1982Vosniadou, 2007;). Some researchers see conceptual change as a restructuring of knowledge by adding fragments of understanding over time (DiSessa, 1993; Inagaki & Hatano, 2008). In contrast, others view the process of conceptual change as a complete replacement of a preconceived concept (Carey, 2009; Chi, 2008). Most researchers agree that conceptual change is a gradual process that involves the addition or deletion of knowledge and beliefs (Chinn & Brewer, 1993; Dole & Sinatra, 1998; Mason, 2007; Vosniadou, 2003). Conceptual change has not yet been defined or researched in LDS theology, but LDS epistemological beliefs about knowledge assert that truth must be completely devoid of misconception or false notion

(Webb, 2007). Therefore, I believe that an entire replacement of false ideas delineates conceptual change in LDS doctrinal understanding.

An instructional intervention shown to be effective in promoting conceptual change is refutation texts. Refutation text is a text structure that states common misconceptions and then repeals those misconceptions with more "scientifically or academically" accepted viewpoints (Hynd, 2001). This type of text structure has proven to be an effective intervention for conceptual change in the discipline of science education (Guzzeti, Snyder, Glass, & Gamas, 1993; Tippett, 2010). Typically a refutation text aims to change a pretargeted conception or belief in favor of another (Diakidoy, Mouskounti, & Ioannides, 2011; Hynd, 2001). Refutation texts are written explicitly to state a common misconception, directly refute that misconception, and then provide the correct scientific viewpoint in a coherent, plausible fashion (Broughton, Sinatra, & Reynolds, 2010). Because of the nature of the structure of the refutation texts, it is likely that the reader's previously formed misconceptions are co-activated in working memory along with the newly presented information. This co-activation of both the misconception and the new information may help the learner see the conflict between the two viewpoints, and thus engage conceptual change process (Kendeou & van den Broek, 2008). It is possible that cognitive co-activating effect of refutation texts may also occur when referenced to doctrinal misconceptions in LDS theology. Furthermore, an investigation into refutation text's effect in learning LDS theology will give insights to this text structures' conceptual change power as religious subject matter often involves deeply rooted misconceptions tied to strong epistemological beliefs.

Conclusion

This researcher intends to investigate the *refutation text effect* in LDS religious education programs. It is hoped that refutation text will be an effective intervention for eradicating common doctrinal misconceptions in LDS seminary students as current research supports refutation text as a means for conceptual change (Broughton et al., 2010; Diakidoy, Kendeou, & Ioannides, 2003; Guzzeti et al., 1993). To date, there have been no investigations into refutation text effects with regards to conceptual change in LDS religious education (see Tippett, 2010, for a comprehensive review of refutation text studies in the last 20 years). Furthermore, little is known about the effects of refutation text in overcoming religious misconceptions that are tied strongly to epistemological beliefs. This is a gap in the literature that this study aims to fill.

It is expected that through this research the researcher may provide insight into the refutation text effect in LDS religious education. It is hoped that such insight may aide curriculum developers in implementing effective ways to teach doctrinal principles from the scriptural text by utilizing refutation text interventions. The advantages of this research study may likely add to educational research and identify areas for improvement and exploration in further research. I also believe that a study of refutation text effects in religious education may broaden researchers understanding of refutation text's power for conceptual change. Results of this study are of interest to researchers, teachers, curriculum writers, and LDS seminary teachers and administrators.

Goals and Research Questions

Doctrinal misconceptions in LDS seminary students have been documented in recent year-end test results within the researcher's present school. In 2012, nearly 55% of students, for example, had misconceptions regarding the symbolic and literal cleansing that takes place during baptism. Students often see baptism as the cleansing agent when in reality LDS doctrine teaches that it is the Spirit of the Lord and his Grace that cleanses (Bednar, 2002). These misconceptions of core doctrines lead to misapplications of religious teachings. Test results further showed that 91.6% of all students have misconceptions on the doctrines of grace and repentance, while 55.5% of students have misconceptions regarding the doctrine of baptism, and 83.3% of students have misconceptions on the doctrines of faith.

One goal of this study is to examine refutation text's power for creating conceptual change in these most common doctrinal misconceptions held by LDS youth. Studies are replete with evidence supporting refutation text as a means for conceptual change in science education (Tippett, 2010), but its effects on conceptual change of religious doctrines/beliefs is yet to be explored. This study will examine whether refutation text has greater conceptual change power than expository text when learning about LDS doctrines. It will also look at student's preferences regarding the refutation text structure compared to traditional text structures when studying LDS doctrines. This information will enrich the refutation text dialogue and add to the existing research investigating the refutation text effect.

A second goal of this study to investigate whether students' interests in religion

are predictors of conceptual change related to core LDS doctrine. Research indicates that greater topic interest correlates with greater attention and engagement during learning interventions (Tobias, 1994). Furthermore, research shows that high topic interest is a predictor of greater conceptual change (Murphy & Alexander, 2008). Researchers have also examined the interplay of topic interest with refutation text interventions for conceptual change (Mason & Gava, 2007). However, the degree to which topic interest in religious education affects conceptual change is an unfilled gap in the present research literature. This study hopes to find answers to this aspect of refutation text for conceptual change to determine if topic interest is a predictor of conceptual change.

Three research questions guided this study.

1. Does the use of refutation text in LDS Religious Education significantly change student's conceptual knowledge of core scriptural doctrines in comparison to expository text?

   a. Does the use of refutation text in LDS religious education change student's conceptual knowledge of faith in comparison to expository text?

   b. Does the use of refutation text in LDS religious education change student's conceptual knowledge of baptism in comparison to expository text?

   c. Does the use of refutation text in LDS religious education change student's conceptual knowledge of grace in comparison to expository text?

2. Do differences in levels of religious interest (high interest, low interest) predict conceptual change?

3.   Which text structure do LDS seminary students prefer when reading LDS doctrine? Refutation text or Expository text?

    a.   Which text structure do LDS students prefer when reading about faith?

    b.   Which text structure do LDS students prefer when reading about baptism?

    c.   Which text structure do LDS students prefer when reading about grace?

Theoretical Lenses

The theoretical framework of a social cognitive/bio-ecological systems theory underwrites the procedures and predicted outcomes of this study. This theory combines the theoretical assumptions of Bandura (1989) and Bronfennbrenner (2001). Bronfenbrenner and Ceci (1994) postulated that students cognitively *rewrite* their conceptual understanding as they interact with bioecological systems. These bioecological systems describe differing layers of the environment that directly and indirectly interact with an individual's life experience (Bronfenbrenner & Ceci, 1994). The theory proposes that meaningful interaction with an intervention in the environment will produce greater impact on individual's cognitive development (Damon & Lerner, 2006).

Bandura's (1989, 1993) social cognitive theory posited that portions of an individual's knowledge acquisition can be directly related to the individual's personal agency and self-efficacy. Self-efficacy represents an individual's beliefs about their capabilities to exercise control over their own level of functioning (Bandura, 1993). These beliefs influence an individual's interest levels and agency as they choose to focus,

behave appropriately, self-motivate, and give attention to the learning interventions presented (Bandura, 1992). The aspects of personal agency and self-efficacy, tied with environmental interactions that shape cognitive development and knowledge change, more fully describe the social cognitive/bio-ecological lens that will guide this study.

For question one, I hypothesize that the majority of students will elicit conceptual change outcomes when presented with the text interventions. Drawing from the theoretical framework described above, I believe that any meaningful intervention in a students' environment may influence their learning and conceptual change. Both expository and refutation text structures will have meaning to various students and I believe that both interventions may produce some conceptual change. Other studies support this hypothesis as well (Guzzeti et al., 1993). Furthermore, the theoretical underpinnings of student agency may also result in some students who choose not to engage in interactions with the text interventions. I assume that these students might be outliers within each doctrinal topic addressed.

I also hypothesize that refutation text structures may produce greater levels of conceptual change in comparison to expository text. I believe that students may engage in refutation text structure interventions more deeply than with expository text interventions as refutation text statements create disequilibrium with their prior beliefs. Studies support this assumption as it has been documented in "think-a-loud" procedures that refutation texts create conflict with prior knowledge that leads to cognitive interaction with the text (Kendeou & van den Broek, 2008). The theoretical assumptions of Bronfenbrenner and Ceci (1994) further support this hypothesis, as meaningful interaction is an essential

component that facilitates cognitive change processes of development.

For question 2, I hypothesize that higher levels of religious interest will predict conceptual change in LDS seminary students. My hypothesis is supported by research (Tobias, 1994) attesting that higher interest is a predictor of greater student engagement. Theoretical assumptions in bioecological systems theory (Bronfenbrenner, 2001) as well as conceptual change literature (Dole & Sinatra, 1998) further support this hypothesis as engagement facilitates cognitive processing for conceptual change.

Question 3 is a qualitative question that will have varying outcomes among participants. I hypothesize that a majority of students will view the refutation text structures more positively than traditional expository text structures. Since refutation text structures are more direct and different, I believe that they will more easily catch the interest of readers (Broughton et al., 2010). Research has also shown that students have preferred refutation text structures in science education over that of expository structures (Hynd, 2001; Mason & Gava, 2007) and I expect the same result to be had in religious education textual statements.

Conclusion

It is imperative that LDS Seminary students gain correct conceptions of core religious doctrines and principles that can enable them to withstand the flood of filth that permeates modern society. Instructional interventions that effectively promote conceptual change must be readily implemented to help these students overwrite doctrinal misconceptions that leave them vulnerable to confusion and deceit. LDS church leaders,

like Elder Eyring (2004), have stated that "what we are now doing and have done [in Seminaries and Institutes]…is not enough...we must look for ways to teach the scriptures better" (p. 14). Refutation text may be one intervention that helps with this goal. This study will seek to examine the power of refutation text in facilitating conceptual change in LDS theology. If refutation text is found to be a viable intervention for conceptual change, then curriculum developers and instructors will have one additional aide to help students increase their understanding and application of the scriptures. Students will be better prepared to have the promise of Church President Thomas S. Monson (2009) fulfilled in their life as he counseled, "Study the scriptures…understand them…live accordingly…and you will be able to stand strong" (p. 70).

CHAPTER 2

LITERATURE REVIEW

Introduction

The process of helping students clearly understand and apply doctrinal concepts while participating in LDS religious classes has always been linked to scriptural texts (Bednar, 2007; Clark, 1938). Conceptual understanding of religious text powerfully correlates with students' actions and beliefs (Webb, 2007). The literature indicates, however, that many students are coming to academic and religious classes with previously constructed background knowledge that deviates from accepted interpretations they should understand and apply (Bandura, 1993, 2001; Bronfenbrenner, 2001; Bronfenbrenner & Ceci, 1994; Murphy & Mason, 2006; Packer, 1982). Therefore, teachers must help students engage in processes of conceptual change for correct knowledge construction and application (Luque, 2003). Conceptual change is the process of restructuring or replacing prior knowledge with new concepts and understanding (Posner et al., 1982; Vosniadou, 2007).

In seeking a medium to facilitate conceptual change, I have chosen to explore the power of refutation text. Current research abundantly documents refutation text as a textual intervention "that may induce conceptual change" (Sinatra & Broughton, 2011), but no studies explore the use of refutation text for conceptual change in religious education. While research supports refutation text as a medium for conceptual change, the social environment and the amount of interaction with the text itself factor in to the

processes of conceptual change (Bandura, 2001; Bronfenbrenner, 2001; Dole & Sinatra, 1998; Guzzeti et al., 1993; Hynd, 2001; Mason & Boscolo, 2004; Sinatra & Broughton, 2011). Therefore, this chapter will review literature to connect refutation text and conceptual change as seen through a theoretical lens of bio-sociological systems theory.

The discussion of this chapter will begin with a description of conceptual change as seen through social cognitive/bio-ecological systems theory. This theory is developed and described by Bandura (1989), and Bronfennbrenner (2001), and will serve as the theoretical lens through which entire study will be viewed in order to situate the use of refutation text as one possible mode for conceptual change in a learner's macro-environment (Bronfenbrenner, 2001; Guzzeti et al., 1993; Sinatra & Broughton, 2011). This section will also review the ways in which researchers define processes of conceptual change and belief change with regard to misconceptions. I will then explore the education studies connected to conceptual change and belief change. Following this section, I will investigate refutation texts and review how researchers have used refutation texts in conjunction with examinations of conceptual change. I will also outline the current uses of text in religious and K-12 education classrooms throughout this review of literature. Finally, the chapter will conclude with discussion on epistemological beliefs about knowledge and how these beliefs influence the effect of refutation text in promoting conceptual change (Chinn et al., 2011; Dole & Sinatra, 1998; Mason & Gava, 2007).

Conceptual Change in Social Cognitive Bio-Ecological Systems Theory

Research shows that students come to school with previously constructed knowledge from their everyday experiences in the physical and social world (Bandura, 1993, 2001; Bronfenbrenner, 2001; Bronfenbrenner & Ceci, 1994; Murphy & Mason, 2006). Conceptual change suggests that students consciously choose to follow learning passageways as they move from misconceptions to more "scientific" conceptions of the world around them (Bandura, 1993; Bronfenbrenner, 2001; Duit, 2002).

The processes of conceptual change entail a restructuring of the learner's misconceptions to align with the accepted scientific perspective (Luque, 2003; Murphy & Mason, 2006; Vosniadou, 2008). Different scholars use the term *misconceptions* with different nuances in the conceptual change literature. Some refer to *misconceptions* as previously constructed information that does not align with academic theoretical realities (Tippett, 2010; Vosniadou & Brewer, 1987). Others agree with Murphy and Mason that the term misconception accounts for all the less sophisticated understanding, knowledge, and beliefs possessed by individuals (Guzzeti et al., 1993; Hynd, 2001). Further, some researchers use the term "belief change" to describe conceptual change (Chinn & Brewer, 1993; Gregoire, 2003; Hynd, 2003). Other researchers criticize the separation of the construct of belief from the construct of knowledge because such a discussion often leaves many in confusion (Hynd, 2003; Southerland, Sinatra, & Mathews, 2001).

Bronfenbrenner and Ceci (1994) postulated that students cognitively *rewrite* their conceptual understanding as they interact with bioecological systems. Their bioecological systems theory views knowledge constructions as occurring within a nested series of

contextual levels in the environment (McDermott, 2007). These nested levels include microsystems, mesosystems, exosystems, macrosystems, and a chronosystem (Paquette & Ryan, 2008). The *proximal processes* of a child in these nested systems, meshed with a child's genetic potential, influences the heritability of the children's conceptual changes throughout their life (Bronfenbrenner & Ceci, 1994). *Proximal processes* are the particular forms of *all* interactions between a bio-psychological human organism and the environment throughout an extended period of time (Bronfenbrenner & Ceci, 1994). These interactions happen during development and may or may not maintain a sense of consistency throughout each contextual level of the environment; however, consistency of interaction is believed to have an impact on cognitive development (Damon & Lerner, 2006).

As mentioned earlier, bioecological systems theory views knowledge construction as occurring within a nested series of five contextual levels. Proximal processes take place in the first nested level called the microsystem. At this level, children experience conceptual development changes in the immediate setting of their experience. Proximal processes include parent-child activities, sibling-child activities, solitary play, child-child activities, and other family, friends, and classroom interactions within their immediate setting (McDermott, 2007). The proximal processes of the microsystem relate to Bandura's social cognitive theory, wherein such learning interactions are described as imitative learning—learning that comes from one's cognitive choice to imitate the behaviors of those around them (Bandura, 1986, 1989; Gredler, 2001).

Proximal processes occur next in the contextual level called the mesosystem. This

system includes interactions of home, religious settings, school, and peer group (Berk, 2000). These interactions are bidirectional, meaning that the school interactions affect home interactions and home interactions affect school interactions. These bidirectional proximal processes may influence the child's conceptual change as they connect experiences in their microsystem that exposes them to new data contradicting their previous understanding (Barton, Drake, Perez, St. Louis, & George, 2004). A child, for example, may be taught something at school that contradicts the teachings or assumptions made in their home. This may lead the child to engage in processes of conceptual change to remedy the conflict of home and school environments. Hence, the conceptions being developed at school are affecting the world of their home environment or vice versa. Furthermore, the child's own contribution to their home and classroom society influences the perceptions of those who interact with them there. In this way the bidirectional nature of these influences begins to shape society as a whole leading to the next contextual level known as the exosystem (Bronfenbrenner, 1990).

The exosystem broadens out into a more extensive interaction of school systems, communities, and media (Paquette & Ryan, 2008). Bandura defined these broad levels of social cognitive interaction as the network of sociostructural influences (Bandura, 2001). This system defines a social structure in which the child does not interact directly with the systems, but the systems' bidirectional influence affects lower contextual systems (Berk, 2000). Hence the exosystem also sculpts society's features and character (Bronfenbrenner & Evans, 2000).

The more comprehensive interactions of society's culture, economy, national

customs, and global concerns make up the macrosystem, which is the outermost layer in the child's influence for conceptual change and "provides a cascading influence throughout the interactions of all other layers" (Paquette & Ryan, 2008, p. 2). This grand contextual layer influences all people in a bidirectional fashion, as is seen in Bandura's (2001) declaration that "people are producers as well as products of social systems" (p. 1).

Bronfenbrenner and Ceci's (1994) first four contextual layers of the individuals' environment in the bioecological theory are similar to Bandura's early descriptions of social cognitive theory, wherein he postulated that social interactions at differing levels of complexity trigger learning (Bandura, 1973, 1979, 1986). However, the next two contextual layers of the bioecological theory, are elements that separate this theory from all others including Bandura's social cognitive theory.

Infused throughout these four context levels is the noncontextual nested system of *time* as it relates to a child's environments (Paquette & Ryan, 2008), which is called the chronosystem. Chronosystem elements include the timing of a parent's death, divorce, or other major happenings in life. Chronosystem elements can be internal or external. An internal example might be the physiological changes that occur with the aging of a child. When children age they may or may not experience conceptual change in the same manner due to environmental changes (Damon & Lerner, 2006). These internal and external elements affect the potency of proximal processes within each nested system of human ecology (Berk, 2000). The timing of events can impinge or augment conceptual change. Faith Baldwin has been attributed with the saying, "Time is a dressmaker

specializing in alterations," and such can be said of the chronosystem (Lewis, 2008).

Heritability, the final element of bioecological theory, was defined by Cavalli-Sforza and Bodmer (1971) as "the proportion of the total phenotypic variance that is due to additive genetic variation" (p. 536). In broader terms, heritability is the amount of visible and non-visible changes in an organism's characteristics and cognition that can be produced by interaction between the organism's genetic makeup and the environment. In the words of Ceci, "Phenotypes are shaped by the interplay of genetic propensities in conjunction with proximal processes in the environment" (2008). (Note: Phenotypes are the visible expressions of a gene in living organisms and though each species may have the same gene structure in DNA, the manifestations and characteristics of such genes vary for a variety of known and unknown reasons.) Genetic propensities complicate one's social learning through conceptual change, because genetic makeup influences receptiveness to the processes of conceptual change throughout life (Bronfenbrenner, 2001; Luque, 2003).

In summary, Bronfenbrenner and Ceci's (1994) bioecological systems theory advances the idea that conceptual changes take place "throughout the life course…[and] through processes of progressively more complex reciprocal interaction ["proximal processes"] between an active, evolving biopsychological human organism and the persons, objects, and symbols in its immediate external environment...[thus] actualizing genetic potential for effective psychological development" (p. 572). Hence, changing the amount of proximal processes within an environment contextual level (microsystem, mesosytem, etc.) consistently over time may elicit deferring phenotypes resulting from

conceptual change (Bronfenbrenner & Morris, 1998).

Bandura added two more critical essentials to the bioecological/social cognitive perspective: personal agency and self-efficacy (Bandura, 1989, 1993, 2001). Figure 2.1 helps to gain a full visualization of the nested systems, interactions, and personal constructs of the Social Cognitive Bioecological Systems Theory. Self-efficacy represents individuals' beliefs about their capabilities to exercise control over their own level of functioning (Bandura, 1993). Self-efficacy beliefs influence motivation, behavior, thought, and feelings; hence, self-efficacy can augment or deter cognitive processes (Pintrich & Boyle, 1993) involving conceptual change (Bandura, 1992, 1993).
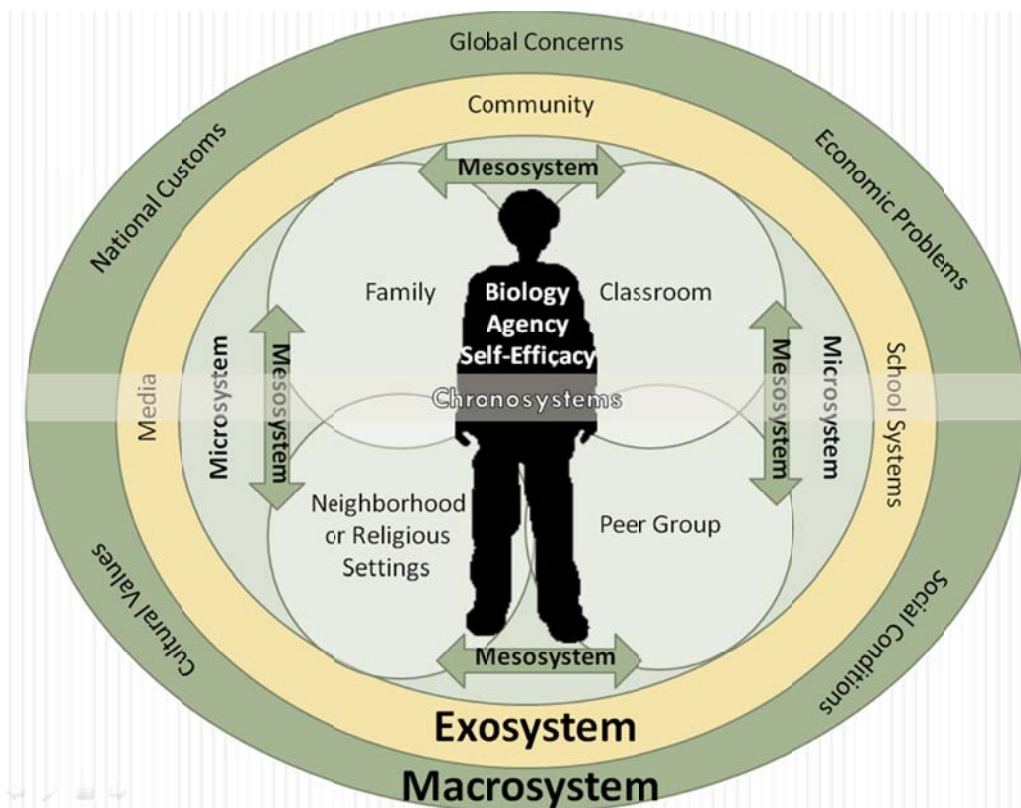
Figure 2.1. Processes of conceptual change.

For example, stronger belief in one's ability to learn may increase conceptual change, but belief in one's current knowledge may also stifle conceptual change (Luque, 2003).

Tied closely to self-efficacy is the human agency of each soul. Essentially all people are choosing what they will cognitively believe, change, and learn as "social cognitive theory subscribes to a model of emergent interactive agency" (Bandura, 2001, p. 4; see also Bandura, 1986, 1989). Social cognitive theory distinguishes three modes of human agency: personal agency, proxy agency (relies on others to act), and collective agency (group decisions that still require each individual's effort and choice; Bandura, 2001). No matter the mode of agency, such power to choose dramatically effects the conceptual change of all human beings, because many choose to retain false ideas, resist processes of conceptual change, or resist engaging in mechanisms that promote knowledge construction (Luque, 2003). Hynd, Alvermann, and Qian (1997) believed that there are more avenues for maintaining currently believed ideas than there are for changing them; therefore maintenance of current knowledge is often the chosen path of least resistance. So the question arises: Are teachers striving to help students choose to engage in the more difficult processes of conceptual change?

In generally accepted terms, conceptual change represents the simple restructuring and replacement of knowledge (Chinn & Brewer, 1993; Dole & Sinatra, 1998; Posner et al., 1982; Sinatra & Broughton, 2011; Vosniadou & Brewer, 1987). However, other literature suggests that conceptual change also references the complex environmental interactions that cause individuals to move from less sophisticated knowledge to more correctly sophisticated conceptions of the social and scientific world (Bandura, 1993;

Bronfenbrenner, 2001; Duit, 2002; Murphy & Mason, 2006; Vosniadou, 2007). From the theoretical framework described in the section above, I have chosen to closely tie myself to the second listed definition of conceptual change because it considers the individual, the environmental influence, and the process of a cognitive change to more accurate knowledge.

The history of research in conceptual change is documented back to the days of Piaget and has continued to be a research topic of great interest in modern times (Vosniadou, 2008). Piaget initially emphasized assimilation and accommodation as the process of adaption, or learning in child development (Ormrod, 2004). Assimilation involves using current skills and knowledge to understand new things, while accommodation describes a change in knowledge or skills to understand new things (Piaget, 1995). Piaget's accommodation process is generally accepted as the first specific model or theory of conceptual change and it acted like a springboard for initial empirical research aimed to explain the processes of conceptual change (Hynd et al., 1997; Strike & Posner, 1992).

The cognitive revolution of the 1950s broadened research in conceptual change as researchers focused on *describing knowledge development, identifying misconceptions,* and *designing instructional materials to support change* (Dole & Sinatra, 1998; Sinatra & Broughton, 2011; Sinatra & Mason, 2008). Currently there are many theoretical perspectives/models that ascertain conditions under which conceptual change can occur. Dole and Sinatra documented how some of these perspectives can be similar in nature by reviewing three philosophies to capitulate a succinct model for conceptual change. A

majority of others, including Sinantra and Pintrich (2003), distinguished inherent differences in conceptual change models, as well as differences in the way conceptual change takes place (Carey, 2009; Hynd et al., 1997; Inagaki & Hatano, 2008; Sinatra & Broughton, 2011;Vosniadou & Brewer, 1987). Some researchers see conceptual change as a restructuring of knowledge by adding fragments of understanding over time (DiSessa, 1993; Inagaki & Hatano, 2008). In contrast, others view the process of conceptual change as a complete replacement of a preconceived concept (Carey, 2009; Chi, 2008). Most researchers agreed that conceptual change is a gradual process that involves the addition or deletion of knowledge and beliefs (Chinn & Brewer, 1993; Dole & Sinatra, 1998; Mason, 2007; Vosniadou, 2003). However, researchers are very distinct in their views about whether conceptual change is a replacement or restructuring of knowledge. For the purposes of this study, I will take the definition of conceptual change to be a complete replacement of a misconception.

The defining perspectives discussed above capture the varying theories regarding conceptual change. An all-inclusive overview of the theoretical perspectives surrounding conceptual change is beyond the scope of the present discussion. However, a well-detailed review of the seminal theories of conceptual change is presented in the *International Handbook on Conceptual Change Research* (Vosniadou, 2008). My study borrows philosophical ideas from three conceptual change perspectives, which will be summarized in the rest of this section. This synthesis of these conceptual change models is a supported approach in many research examples within the current literature (Dole & Sinatra, 1998; Gregoire, 2003; Sinatra & Broughton, 2011; Sinatra & Pintrich, 2003;

Sinatra & Mason, 2008). I will begin with a description of Strike and Posner's (1992) seminal Conceptual Change Model (CCM) and then move to describe Dole and Sinatra's (1998) Cognitive Reconstruction of Knowledge Model (CRKM) and how it was developed from a model of persuasion known as the Elaboration Likelihood Model (ELM). I then proceed with a brief discussion on the Cognitive-Affective Model of Conceptual Change (CAMCC) before concluding with conceptual change as an individually constructed occurrence influenced by the social environment.

Conceptual Change Model

Two research traditions have generally contributed to the study of conceptual change: science education research and cognitive developmental research (Vosniadou, 1999). The science education perspective arose out of researchers' observations that students were bringing scientific misconceptions to class, while the cognitive developmentalists' perspective emerged from an attempt to describe how children matured in the learning process (Sinatra & Pintrich, 2003). Posner and colleagues' (1982) theory of conceptual change drew from a science education background and was devoted to the overturning of scientific misconceptions developed in student's interpretation of the world around them (Strike & Posner, 1992).

Strike and Posner (1992) ultimately believed that conceptual change was "the alteration of conceptions that are in some way central and organizing in thought and learning" (p. 148). This opened the door for multiple levels of conceptual change that could be described in Piaget's concept of assimilation or accommodation. Assimilation was described as a weak alteration of previously conceived concepts; whereas,

accommodation was the radical restructuring and complete replacement of a concept (Posner et al., 1982). Hence their conceptual change model (CCM), as it would come to be recognized, aimed to explain four necessary *conditions* for Piaget's accommodation to take place (Posner et al., 1982). Conceptual change is likely to happen when humans cognitively experience the conditions of (a) *dissatisfaction* with existing conceptions and (b) the discovery of new *intelligible* conceptions that (c) initially appear to be *plausible* and (d) *fruitful* for additional inquiry. When any of these four conditions are not met, then conceptual change is unlikely to occur.

It seems logical to assume that people do not alter concepts in their thinking until they can see such thinking as dysfunctional. However, dissatisfaction with current knowledge does not always immediately move people toward strong conceptual change. From the literature available at the time, Strike and Posner (1992) recognized that "when current concepts are not performing well, [people] are likely to attempt to solve such problems as arise with more modest changes in their conceptual schemata unless it has become apparent that only a major overhaul of their concepts will repair the dysfunction" (p. 149). Furthermore, individuals must view the new knowledge as intelligible and plausible, meaning that the new knowledge makes sense and could be true; otherwise only a weak conceptual change results when prior knowledge is assimilated with fragmented bits of a new concept (Strike & Posner, 1992). Therefore, opportunities for conceptual change in this model increase when the learner perceives his or her previous knowledge as dysfunctional in relation to their perceptions of the new knowledge being encountered.

Cognitive Reconstruction of Knowledge Model

Dole and Sinatra (1998) analyzed the CCM of Posner and colleagues (1982) and found it lacking consideration of students' motivation and engagement in the conceptual change process. Conceptual change often involves persuasion. The CRKM (Dole & Sinatra, 1998) proposed that the interaction between the learner and message characteristics is central to the change process. Other researchers also critiqued the CCM for its assumption that students had a coherent understanding of their knowledge (diSessa, 1993). Furthermore, researchers questioned the assumption that conceptual change was a revolutionary event and not a gradual evolutionary process (Siegler, 1996; Sinatra & Pintrich, 2003; Smith, diSessa, & Roschelle, 1993). These critiques led Dole and Sinatra to explore other conceptual change models in social psychology. Their exploration led them to develop a conceptual change model that incorporated theoretical aspects of *dual process models* from social psychology (Dole & Sinatra, 1998).

Dual process models are known in the social psychology literature as models of persuasion (Chaiken, Liberman, & Eagly, 1989; Petty & Cacioppo, 1986). Persuasion ultimately describes a change in attitude or belief. These models account for students' motivation within the learning concepts they encounter (Dole & Sinatra, 1998). They are dualistic in that they consider two variables influencing individuals' motivation for conceptual change: cognitive content evaluation and peripheral cues (Cacioppo & Petty, 1985; Petty & Cacioppo, 1986). *Cognitive content evaluation* refers to the students' evaluation of the content as being intriguing, desirable, or important. *Peripheral cues* reference judgments about the content based on such things as the teacher, the context, or

the perceptions of content difficulty or ease. For example, a class discussion on the National Debt might be important enough that some will choose to elaborate and think about the message or argument being presented. Others may not care about the content, but because the teacher is attractive, dynamic, and trustworthy they will also choose to engage in processing the argument. One group could be influenced by the content itself and the other by a peripheral cue. This type of example typifies dual process models of persuasion in social psychology (Cacioppo & Petty, 1985; Dole & Sinatra, 1998).

Dole and Sinatra (1998) were greatly influenced by social psychology persuasion models and borrowed principles from the seminal dual process model known as the Elaboration Likelihood Model (ELM; Petty & Cacioppo, 1986). The central concept for increasing the likelihood of persuasion is elaboration, the degree to which individuals "think about issue-relevant arguments contained in a message" (Petty & Cacioppo, 1986, p. 128). The ELM describes two routes to persuasion: central and peripheral. The central route indicates engaged thought processes of high elaboration with the issues and arguments involved in a message, while the peripheral route involves low elaboration based on superficial evaluations of peripheral cues (Dole & Sinatra, 1998; Limon, 2001; Petty & Cacioppo, 1986). When individuals engage in high elaboration, strong belief change is more likely to occur. Similarly, when individuals are employed in low elaboration, they are more likely to return to their previously held beliefs. Thus, it is the level of engagement a learner has with a message that influences the likelihood of change.

Petty and Cacioppo (1986) recognized that peripheral cues can serve as an

impetus toward central routes of elaboration, but generally such heuristic evaluations

result in low elaboration and weak belief change. Heuristic evaluations refer to the

socially accepted standards of appeal in appearance, delivery, context, and general culture

popularity (Nielson, 1992). Though such evaluations are peripheral to the message, some

researchers believe that individuals simultaneously follow central and peripheral cues in

their journey toward persuasion (Hynd, 2003). Dole and Sinatra (1998) believed that

individuals engage in information processing through the central or peripheral route as

described in the ELM. They also recognize that individual's characteristics, in relation to

the message characteristics and its connected peripheral cues, will influence the central or

peripheral route followed for conceptual change. Drawing heavily from observations of

ELM, Dole and Sinatra developed a model of conceptual change that included a dual

process of motivation.

　Dole and Sinatra (1998) considered an individual's *cognitive engagement* as the

"most important element of the [conceptual] change process" (p. 121). They believed

learners are influenced by their existing conception and motivation to process new

information. Interacting with these two learner characteristics are critical features of the

message itself, as Dole and Sinatra explained:

> The message carries with it a set of variables that are unique to that particular
> message, such as the format, organization, and the task implied by the message.
> These variables interact with the learners' existing conceptions and motivation to
> make the message more or less comprehensible, plausible, coherent, and
> rhetorically compelling to each individual. (p.120)

Dole and Sinatra (1998), however, posited that additional characteristics for the

learner and the message were needed to found a more concrete model for conceptual

change. The development of their CRKM built heavily on the principles of ELM and

CCM while accounting for, what they felt, were some missing characteristics in the

learner and the message (Dole & Sinatra, 1998; Limon, 2001).

      Existing conceptions/prior knowledge. Research suggests that prior knowledge

can inhibit the processing and interpretation of new information (Gaskins, 1996; Pintrich

& Boyle, 1993; Reynolds, Anderson, Taylor, Steffensen, & Shirley, 1981). Dole and

Sinatra (1998) explained, "Understanding student's existing conceptions is critical to

understanding the knowledge reconstruction process" (p. 118). Eagly and Chaiken

(1993), however, noted that many times the individuals' existing conceptions were not

assessed before most persuasion studies were conducted. Dole and Sinatra described

strength, coherence, and *commitment* as three qualities defining learners' prior/existing

conceptions. S*trength* is used to describe the "richness of a learner's existing idea; is it

well formed and detailed or sparse and fragmented" (Dole & Sinatra, 1998, p. 118), The

coherence refers to how well the individual comprehends the concept. *Commitment* is

used to describe the commitment to an existing concept, regardless of the idea's strength

and coherence.

      Motivation. Motivation to process new information is the second characteristic of

the learner in CRKM. Strike and Posner's (1992) reconceptualization of the CCM

indirectly accounted for motivation in the concept of a learner's dissatisfaction with

existing knowledge. Their original conceptual change model used *dissatisfaction* to

describe what motivated a learner to engage in processes of conceptual change (Posner et

al., 1982). Some researchers refer to this concept of dissatisfaction as cognitive conflict

or disequilibrium (Chinn & Brewer, 1993). Many feel that a cognitive conflict must exist before change can take place (Chi, 2008; Hynd et al., 1997; Limon, 2001). Dole and Sinatra (1998) saw dissatisfaction as "one of many reasons why individuals may be motivated to process new information" (p. 119). They recognized that some learners might be motivated to change their minds for other reasons such as their interests, needs, contexts, emotions, or self-efficacy (Dole & Sinatra, 1998). To account for these, the CRKM included three additional reasons that would motivate learners to engage in processing new information: need for cognition, personal relevance, and social context.

Need for cognition refers to "individuals, who by their very nature, are inherently motivated to process information" (Dole & Sinatra, 1998, p. 120). Researchers often characterize these individuals as being "intrinsically motivated" to engage ideas and concepts (Ormrod, 2004; Petty & Cacioppo, 1986). Learning the message itself, regardless of dissatisfaction, interest, or context, is motivation enough for some learners to elaborate or engage in critical thinking (Cacioppo & Petty, 1985). Petty and Cacioppo further hypothesized that each individual may have specific and unique reasons influencing their learning motivations beyond what researchers are able to account for as they are so personally relevant.

This hypothesis describes the second facet of motivation within the CRKM known as personal relevance. Motivation is predicted to increase when the learner perceives new information as personally relevant. Subsequently, the likelihood for deeper engagement with the message increases, as does the opportunity for conceptual change. Personal relevance may act as a two-edged sword, however, in that conceptual change

may be impeded should the learner deem the topic as highly personally relevant and resist

considering the new information. This may especially be the case when individuals are

presented information that conflicts with their prior beliefs, including religious beliefs.

The third facet of learner motivation is the social context in which the message is

considered. Dole and Sinatra (1998) described this as "the context in which the message

is considered contains a variety of *social context* variables. [The] interactions with

members of a community, school, or peer group may motivate individuals to process

information they would not otherwise consider" (p. 120). For example, an individual

student may have little interest or motivation to learn mathematical concepts on their

own, but in a class setting where group teaching is assigned, this same student may be

motivated to learn the mathematical concepts being taught so that they are perceived

positively by their peers.

Dissatisfaction, need for cognition, personal relevance, and social context all

influence the motivation of a learner. Motivation coupled with the facets of existing

conception explains the full view of the learner in the CRKM as both psychological

constructs and prior conceptual knowledge are accounted for and defined (Dole &

Sinatra, 1998).

A second central factor for conceptual change is found in the messages that

contain the new information for the learner to consider. Dole and Sinatra (1998)

explained that the message must be *comprehensible, coherent, plausible,* and *rhetorically*

compelling in order for the likelihood of conceptual change to occur. The CRKM

hypothesized that a message must be *comprehensible* and *plausible* (Dole & Sinatra,

1998; Strike & Posner, 1992). Plausibility judgments are the learner's perceptions of the relative fruitfulness of incoming information compared to one's existing mental representations (Lombardi, Sinatra, & Nussbaum, 2013). Learners must see the message as something that can reasonably be true, and they must have enough background knowledge to understand the new information (Chinn & Brewer, 1993). The new message must also be *coherent,* in that it makes sense within the broader spectra of a conceptual whole (Thagard, 1992). Finally, the message must also be *rhetorically compelling*, which means the "language usage, the sources of information that form the argument, and the justifications provided must be convincing and persuasive to the individual" (Dole & Sinatra, 1998, p. 120). It is the interaction between the learner's characteristics and the message characteristics that influence the level of engagement the learner has with the message. Deeper engagement increases the likelihood of conceptual change.

Cognitive engagement is the central element of the CRKM (Dole & Sinatra, 1998; Gregoire, 2003). Linnenbrink (2007) defined cognitive engagement as the quality of the individual's thinking in relation to cognitive strategies such as elaboration and rehearsal as well as metacognitive strategy use and self-regulated learning. Engagement described as cognitive processing also connects and compares existing conceptions with new information while reflecting and critically thinking as to why new information may be true (Dole & Sinatra, 1998). Dole and Sinatra argued that engagement exists on a continuum of high to low suggesting that when engagement is high, strong conceptual change is more likely to take place, and when engagement is low, conceptual change is

weak or non-existent. It is important to know that although high engagement increases

the likelihood of change, it may not yield conceptual change (Dole & Sinatra, 1998;

Gregoire, 2003; Luque, 2003). Current researchers' support this notion, as the processes

of conceptual change in individuals can be complex, unintentional, intentional, automatic,

or self-regulated (Sinatra & Broughton, 2011; Sinatra & Pintrich, 2003). Peripheral cues

related to the message can influence the level of engagement, though typically such cues

will result in lower levels of cognitive engagement (Dole & Sinatra, 1998). Thus,

conceptual change depends on the level of engagement as the learner interacts with the

message. A second model of conceptual change that views the interaction between the

learner and the message as central to the change process is the CAMCC (Gregoire, 2003).

Cognitive-Affective Model of Conceptual
Change

The CAMCC is a dual process model developed to "explain the process of

conceptual change in teachers' subject-matter beliefs" (Gregoire, 2003, p. 164). The

CAMCC predicts that motivation and ability affect cognitive processing and cognitive

processing mediates attitude change. The CAMCC also recognizes that individuals' prior

knowledge and experience generates feelings associated with a new message. These

feelings can be positive, negative, fearful, or neutral/benign. A learner may perceive a

new message as a threat to their current conceptual knowledge and thus engage in

cognitive processes to remedy their threatened knowledge.

Gregiore (2003) believed that teachers experiencing positive or neutral emotions,

when confronted with a new message are less likely to engage in systematic cognitive

processes, instead relying on heuristics or superficial processing of the message. Conversely, research suggests that negative emotions (e.g., anxiety) may lead to systematic cognitive processing of the information (Gregoire, 2003). Systematic processing increases the level of engagement a learner has with a message, and, in turn, increases the likelihood of conceptual (Dole & Sinatra, 1998; Petty & Cacioppo, 1986). When teachers do not engage in systematic processes then lasting conceptual change is less likely occur. However, Gregoire also recognizes that systematic processes do not guarantee conceptual change either.

The CAMCC does view motivation, message characteristics, and learner characteristics similarly to the CCM and CRKM, though Gregoire (2003) criticized these for lacking an "account for automatic evaluations that occur within teachers as they are introduced to reform messages" (p. 173). CAMCC aims to add to conceptual change literature in its more detailed consideration of ability and emotion (Gregoire, 2003). However, in its attempt, it specifically limits the model to math teachers confronted with messages for conceptual change, and is criticized as not being all inclusive. This model ultimately sees prior knowledge, feelings, motivation, and abilities influencing individuals' engagement in systematic processes that lead to conceptual change.

The literature has suggested that conceptual change is a complex process contingent upon many factors (Bronfenbrenner, 2001; Cacioppo & Petty, 1985; Dole & Sinatra, 1998; Gregoire, 2003; Sinatra & Broughton, 2011; Strike & Posner, 1992). The common factors affecting conceptual change were discussed in this literature review. The seminal models discussed in this literature review account for learner characteristics,

message characteristics, learner abilities, peripheral cues, feelings and emotions, motivation, assimilation versus accommodation, and gradual restructuring of knowledge versus the complete replacement of it (Carey, 2009; Dole & Sinatra, 1998; Gregoire, 2003; Petty & Cacioppo, 1986; Posner et al., 1982). Hence, I believe that processes of conceptual change are likely to occur in the classroom when students are individually motivated to cognitively engage, elaborate, and systematically process a message in consideration of their prior knowledge, feelings, and peripheral cues experienced in their social learning environment.

Refutation Text

Refutation Texts a Method of Teaching

One instructional intervention for presenting a message to students is refutation text. Many researchers have demonstrated that refutation texts help to facilitate conceptual change (Diakidoy et al., 2011; Guzzeti et al., 1993; Hynd, 2001; Limon, 2003; Mason & Boscolo, 2004). The current use of text in the classroom and the need for improvement is briefly reviewed by the researcher in this section. The researcher then describes refutation text and its power to promote conceptual change. The researcher also reviews the seminal studies involving refutation text and how these situate and support the use of refutation texts within the present study.

Current Uses of Text

The current use of text in some disciplines, including LDS religious education, is waning (Sinatra & Broughton, 2011; Webb, 2007). Many in LDS religious education

believe that the recent falling away from text use in teaching is the result of a current teaching emphasis focused on students' oral engagement in speaking, teaching, and explaining (Hall, 2003). Studies in K-12 science education have shown similar occurrences as text has taken a back seat to other emphasized instruction methodologies (Yore, Bisanz, & Hand, 2003).

These philosophical changes in emphasized methodology socially influence what teachers choose to do in the classroom (Hall, 2003). Like the proverbial pendulum, teachers may swing too far in the direction of current emphasis leaving behind them some effective methods of yesterday. The abandonment of past methodologies affects overall teaching effectiveness and creates a need to swing back and reincorporate methodologies unintentionally left behind. Broughton and Sinatra (2011) furthered this view as they documented the power of refutation text for conceptual change and the recent leaving of text use in science instruction. Along with other researchers, they urged educators to return to text use, specifically refutation text, which may prove to increase conceptual change in students (Broughton et al., 2010; Diakidoy et al., 2011; Sinatra & Broughton, 2011; Tippett, 2010).

Refutation Text

Refutation text is a text structure that states common misconceptions and then directly refutes those misconceptions with more "scientifically or academically" accepted viewpoints (Hynd, 2001). Typically a refutation text aims to change a pre-targeted conception or belief in favor of another (Hynd, 2001; Diakidoy et al., 2011). Literature surrounding refutation text structure agrees that refutation text is generally comprised of

two components: a single sentence statement of commonly held misconception and a single sentence statement refuting that misconception and emphasizing a scientifically accepted viewpoint (Broughton et al., 2010; Hynd, 2001; Hynd et al., 1997; Mikkila-Erdmann, 2001; Tippett, 2010). Some researchers also add a third component, termed a *refutation cue*, which alerts the reader to the possibility that their prior knowledge is a misconception (Maria & MacGinitie, 1987). An example of a refutation cue is seen in the simple phrase, "but this is not true;" this type of phrase cues the reader to contemplate the preceding statement as a misconception (Tippett, 2010). Refutation text is a longer text structure when compared to expository text as it includes potential misconceptions in addition to the information contained in a standard expository text (Diakidoy et al., 2011).

Refutation texts' ability to trigger the processes of conceptual change is potent enough that many researchers refer to refutation text as *conceptual change text* (Tippett, 2010). As mentioned earlier, refutation texts are intended to make explicit the contradiction between the learner's previously held misconceptions and the accepted scientific explanation. The likelihood of conceptual change increases when the reader notices the contradiction between their misconceptions and the scientific viewpoint (Broughton et al., 2010). Readers with relevant misconceptions may experience cognitive disequilibrium (Piaget, 1995) as they read a refutation text and notice the conflict between their prior knowledge and the scientific explanation. When readers experience this disequilibrium they are likely to attempt to resolve the conflict through the process of conceptual change (Kendeou & van den Broek, 2005; Limon, 2003; Mason, 2001;

Sinatra & Broughton, 2011)

The structure of refutation text effectively fosters Posner and colleagues' (1982) four conditions for conceptual change (Hynd, 2003). Refutation text typically promotes (a) dissatisfaction with existing conceptions, while supporting a scientific explanation that is (b) intelligible, (c) plausible, and (d) fruitful for additional inquiry. Furthermore, refutation text may increase the likelihood of conceptual change as readers are more likely to carefully and critically weigh the information presented in the text (Broughton & Sinatra, 2010; Broughton et al., 2010). This cognitive level of engagement with the new information increases the likelihood of change as outlined by the CRKM (Dole & Sinatra, 1998).

Refutation Text and Conceptual Change

Most research involving refutation text use for conceptual change is documented in the subject of K-12 science, though the principles behind its use may apply in all disciplines (Tippett, 2010). Research in science education has shown that effective intervention strategies for conceptual change involve an activation of student's background knowledge and the presentation of more correct knowledge through reading a refutation text (Diakidoy et al., 2003; Guzzeti et al., 1993; Hynd, 2001). Unlike expository text, which merely states facts in list like fashion, refutation texts specifically activate student's prior knowledge in connection with more correct knowledge (Diakidoy et al., 2011; Guzzeti et al., 1993; Hynd, 2003). The acknowledging and contrasting of misconceptions with more acceptable teachings may activate readers' prior knowledge and ensures simultaneous activation of the working memory (van den Broek & Kendeou,

2008). According to the coactivation hypothesis of van den Broek and Kendeou (2008), simultaneous activation of the working memory involves the activation of "incorrect concepts at the same time as the correct ones" (p. 339). This co-activation is a necessary prerequisite for conceptual change to occur (Diakidoy et al., 2011; Kendeou & van den Broek, 2007).

Guzetti and colleagues' (1993) meta-analysis was a foundational work in K-12 reading and science education that documented the power of refutation type text for conceptual change. It consisted of 23 research studies from reading education and 47 research studies from science education. The meta-analysis of these studies involved determining the difference between the experimental and control mean scores so that the relative efficacy of refutation text intervention could be placed in a standard score unit and examined across studies (Guzzetti et al, 1993). This standardizing of scores allows a systematic comparison of findings from numerous studies with disparate results. The primary question guiding Guzetti and colleagues research was, "Is there efficacy in using any type of science text to eradicate misconceptions" (p. 119).

An advisory council was formed to determine appropriate studies for analysis while identifying key variables of interest within each study. This council also developed a numerical coding scheme to systematically record the studies' general characteristics. Statistical software was utilized to determine the descriptive and frequency statistics necessary for the meta-analysis. The study itself conducted a meta-analysis of studies in reading research and then a meta-analysis in science education before meshing results together. Findings in reading research indicated a lack of research within secondary

education students. Findings also showed that refutationally structured expository text consistently elicited superior effects when compared to other types of expository text (Guzetti et al., 1993). Furthermore, reading education studies showed that delayed effects were found for refutational text, while the effects of other interventions were not sustained over time.

The results of the actual meta-analysis of studies in science education were disappointing, as most of the studies in the analysis viewed multiple instructional interventions. Though the advisory council chose the most pertinent studies for analysis, they also recognized that the available science education studies for conceptual change were highly criticized as disjointed, unclear, and over involved (Gilbert, 1983). Due to the nature of the science education data, it was not possible to examine the effect sizes for any single intervention; therefore the efficacy of instructional approaches can only be answered by future science education studies with true experimental designs. However, the meta-analysis in science education did indicate that conceptual change of misconceptions was affected from interventions that created cognitive conflict (Guzetti et al., 1993). This linked directly to the meta-analysis of reading research, which showed that studies involving activities facilitating cognitive conflict produced large effects of conceptual change (Guzettie et al., 1993).

On the basis of the accumulated evidence, Guzzetti and colleagues (1993) found that text can affect conceptual change under two conditions: when text is refutational in format or when text is used "in combination with other strategies that cause cognitive conflict" (p. 130). Results also showed no efficacy in using expository text as a single

intervention (Guzzetti et al., 1993). Furthermore, the combined results of the meta-analysis highlighted the importance of creating cognitive disequilibrium as a process of conceptual change. It also validated refutation style text as an influential intervention for creating disequilibrium through textual explanations of why misconceptions are incorrect (Guzetti et al., 1993). These findings support the conceptual change model of Posner and colleagues (1982) in its description of dissatisfaction (disequilibrium) as a necessary process in conceptual change. Ultimately, the meta-analysis statistically supported refutation style text as a stronger intervention for conceptual change than traditional expository text due to its ability to create cognitive conflict (Broughton et al., 2010; Diakidoy et al., 2011; Guzzeti et al., 1993)

Hynd and colleagues (1997) conducted a mixed-methods study to descriptively and qualitatively investigate changes in teachers' conceptions about motion. The interventions of refutation text and demonstration were used to teach participants principles about projectile motion. Participants were drawn from a pool of 94 fourth-year elementary education majors enrolled in methods courses at a state funded college. These participants were randomly assigned to receive projectile motion principles from either a demonstration prior to reading a text, or from only reading a text. Half of the participants were told they would be teaching the information to a fifth-grade student and the other half were not told that they would be teaching the information presented.

Researchers measured participant's conceptual understanding of projectile motion through pretests, posttests, and delayed posttests. Questionnaires also measured preservice teachers' attitudes towards science, other teachers, formal and informal

learning experiences, and topic-relevant knowledge. Qualitative interviews and video recordings were conducted with 32 randomly selected participants to enrich the findings of the study.

The study consisted of four phases designed to capture relative information for analysis. Phase 1 involved questionnaires and pretests in order to evaluate preservice teachers' prior knowledge. Phase 2 assigned preservice teachers to instruction presentations utilizing either demonstration and text or text only methodology. At the end of instruction, Phase 2 concluded with a posttest given to participants to measure learning and conceptual change (Hynd et al., 1997).

Phase 3 took 16 teachers from both presentation methods and videotaped them teaching the same principles to a fifth grade student. Eight teachers from each group had previously been informed of the teaching assignment and the other eight were not aware that they would teach what was just learned. This was done to measure the difference of conceptual change in those who were informed of the direct usefulness of the data versus those who were unaware that the data was useful for immediate implementation. Previous studies indicated that motivation for learning is higher when information is perceived as useful, therefore the researchers believed that the immediate teaching of the presented material would increase its apparent usefulness (Hynd, McNish, Qian, Keith, & Lay, 1994). Following the teaching experience, Phase 3 concluded with interviews of the 16 teaching participants. Phase 4 involved a delayed posttest given to students two months after the initial lesson.

Similar to the findings of Guzetti and colleagues (1993), Hynd and colleagues

(1997) also found a more enduring conceptual change for those who were engaged in the group of refutation text only instruction. This finding was in line with earlier studies by Hynd and colleagues (1994) who found that refutation text was a more powerful intervention for conceptual change than discussion or demonstration. Further analysis of the data also revealed that since the only factor experienced by all groups was the text, that text, rather than demonstration, might be more effective in solidifying concepts (Hynd et al., 1997). Motivation by the data's perceived usefulness was not a significant factor in promoting conceptual change and qualitative results from interviews and video analysis was limited to an in-depth look at only 2 of the 16 interviewed participants. Qualitative insights revealed that conceptual change proceeds in a piecemeal fashion of partial conceptual change affected by a complex interaction of many factors outside the parameters of the researchers study" (Hynd et al., 1997).

This study is particularly relevant to the present study as the researchers used demonstration as another intervention in connection with refutation text. This begs other questions regarding the effect of text use in connection to other interventions. However, a weakness of this study is found in its chosen sample as all participants were preservice teachers with inherent motivation to learn the topic due to its relevance to their future careers. Therefore the resulting magnitude of conceptual change in K-12 education students may differ due to this younger audience perception of topic usefulness. This opens the door to questions regarding new data for a conceptual change that is not presently perceived as useful by a student. Will refutation text still lead to conceptual change in the mind of these students?

In a pretest/posttest study, Palmer (2003) found that students exposed to refutation text had greater conceptual change in posttesting than students presented with expository text styles of the same information. His study aimed to identify the type of conceptual change induced by refutational text (Palmer, 2003). Palmer identified and followed Posner and colleagues' (1982) CCM designating "assimilation and accommodation as two types of conceptual change" (p. 664). As mentioned in the previous section, assimilation involved students using existing conceptions to deal with new phenomena, while accommodation involved a radical change or replacement of prior conceptions to grasp new phenomenon (Piaget, 1995; Posner et al., 1982). Argued that accommodation was a more difficult and deep conceptual change and sought to explore if the mere reading of refutation text would induce such a change.

The study was centered on biological concepts of ecological roles and involved 87 ninth-grade students. Pretesting of these participants began with an oral interview that asked two questions regarding motivation and interest. The questions required simple yes/no answers, but the novelty of the interview was thought to increase situational interest in the actual written pretest that followed (Stipek, 1998). The pretest aimed to identify students with misconceptions and was taken in the presence of the interviewer. Those students who showed no evidence of targeted misconceptions were returned to class and released from being a participant in the study. Students who showed evidence of having the targeted misconception moved on to the intervention phase.

In the intervention phase, participants were presented with a teacher's statement about the biological ecology test they just took. The teacher's statement was either

structured as an expository text or a refutation text. Participants were randomly given one type of text or the other and were allowed as much time as they desired to read the statement. Immediately following their reading they were asked to return the statement to the interviewer, who in turn issued a posttest to the participant. The posttest required students to circle all right answers so researchers could gauge the type of conceptual change resulting from the intervention (Palmer, 2003). Two weeks after the initial interview/pretest/posttest, participants were issued with a delayed posttest containing the same items as the immediate posttest. The delayed posttest sought to record the retention of knowledge rather than the development of new knowledge (Palmer, 2003).

Pretests indicated that 44% of the students (21 boys, 17 girls) had the targeted misconception. Posttests revealed that both texts were able to induce accommodation in large proportion to the group of students tested. However, 68% of students presented with the refutation text intervention displayed accommodation in immediate posttests compared to only 41% of students exposed to expository text. All students who elicited accommodation in the immediate posttest received the same scores in the delayed posttest. It was concluded that the interview structure of the testing increased students' motivation to engage in the mental effort necessary for long-term conceptual change (Palmer, 2003). It was further argued that the ecological misconception was not very robust, or strongly entrenched in the minds of the participants, therefore making the misconception more easily overcome through the presentation of new data (Tyson, 1997).

The findings and methodology of Palmer's (2003) study is relevant to the present study in its investigation of the type of conceptual change outlined by refutation text.

Though the findings indicate that both texts had significant affect upon participants, refutation text still yielded higher numbers of students evidencing conceptual change on test scores. This study also brings up questions about the content of a misconception's robustness in the minds of the students. Can refutation text elicit a more significant disparity between expository text when misconception robustness is high? Furthermore, will a onetime read of a simple statement of refutation text yield long-term conceptual change when misconceptions are more robust?

Refutation Texts: Activating and Refuting Misconceptions

A seminal study by Alvermann and Hynd (1998) aimed to investigate a low-cost way to enhance student learning of complex science concepts without totally revamping texts or methods of instruction. A second purpose of the study was to investigate whether refutation text will facilitate correct comprehension of Newtonian motion principles in participants with misconceptions. This study is relevant to the present study in its explanation and investigations of the effects of activating prior knowledge misconceptions and then refuting them with refutation text. The study drew from 99 college students who were nonscience majors enrolled in undergraduate educational psychology classes. The study centered on the topic of Newtonian theories of projectile motion. It was determined that 62 of the participants elicited misconceptions in projectile motion principles that allowed them further participation in the study. These participants were randomly assigned different groups of intervention.

One third of the students had their background knowledge activated by a drawing

activity, another one-third of the students were asked to complete the same activity and then read a statement that augmented the background knowledge accessed by the procedures of the drawing. The last one third acted as a control group and completed an activity that had nothing to do with the topic of interest. After completing one of the three tasks of intervention, all the students read either a refutation text or a non-refutation version of text that taught the correct principles of projectile motion (Alvermann & Hynd, 1989). All participants were then given three posttests to assess correct projectile motion comprehension.

A short-answer posttest was given first and consisted of 5 questions regarding information stated explicitly or implicitly in the text. A 21-item true-false test assessed participants' conceptual understanding of Newtonian motion principles. The false items supported common misconceptions while the true items supported a correct understanding of Newton's theory of motion. Conceptual change was also measured with a posttest application problem that presented a diagram to participants and asked them to indicate the projectile motion of a dropped object. Participants were then given time to write a brief explanation for their response.

Participants in the refutation group outperformed participants in both the control group and the activation only group (Alvermann & Hynd, 1998). Results suggest that the activation of background knowledge alone is insufficient for promoting conceptual change. Direct and explicit refutation of the misconception must be included in the intervention. Furthermore, there were no statistically significant differences found between text types in students who were competent readers. Competent readers benefited

from reading either text type and researchers postulated that better readers depend less on the text to cue them about conflicting information (Alvermann & Hynd, 1989). This study relates to the present study as Alvermann and Hynd demonstrate the need to both activate and refute learners' misconceptions in order to promote conceptual change.

Kendeou and van den Broek (2005) looked to investigate the effects of readers' misconceptions on text comprehension in an experimental study involving college age students. The researchers specifically aimed to discover the cognitive effects of misconceptions during online commitment to the text. Kendeou & van den Broek used the term *online* to describe cognitive measures happening during the actual reading of the text, whereas the term *offline* is used to reference the cognitive "recall measures" or "products" of the reading (p. 235). Ample evidence is given to document the offline effects of misconceptions, but little was known about the cognitive processes involving misconceptions during the reading of text (Kendeou & van den Broek, 2005). The researchers aimed to add to this research gap by investigating the online and offline effects of misconceptions on text comprehension.

The researchers conducted two experiments investigating the effects of misconceptions on cognitive processing within the subject of physical science. Participants were individually interviewed and issued a science questionnaire to access and evaluate prior knowledge and determine misconceptions. A Woodcock Passage Comprehension test was also given to determine participants' reading comprehension abilities. Participants were then asked to read two texts that appeared one sentence at a time on a computer screen. Texts were interrupted at predefined points and students were

asked to think aloud at these moments. Responses were recorded for evaluation by the researchers and another Woodcock Reading Vocabulary test was issued to see if comprehension was affected in participants with misconceptions. The experiments concluded with students being asked to write down everything they could remember from the text (Kendeou & van den Broek, 2005).

No evidence was found allowing the researcher to infer that readers altered their cognitive processing of the text when their prior knowledge conflicted with the information within the text. However, there was significant evidence that readers with misconceptions remembered less accurate information from the text and included more inaccurate information in mental recall measurements than those without misconceptions. Hence, misconceptions have an "intrusive effect on both the quantity and the quality of students' memory" (p. 241) Furthermore there was evidence that the expository texts did not trigger participants' cognitive awareness of their misconceptions. Researchers hypothesized that the missing connection between participants' misconceptions and the expository texts impeded them from engaging in the deeper cognitive processing necessary for conceptual change (Kendeou & van den Broek, 2005).

In a subsequent study, Kendeou and van den Broek (2007) repeated similar procedures of their first study using both refutation and expository text structures to determine if refutation texts more accurately triggered participants cognitive awareness of their misconceptions. Participants were tested individually to determine the presence of misconceptions and then they were given texts and asked to think aloud after every sentence. Responses were recorded for evaluation and coding. A ten item math test was

then given as a distracter activity and following that activity the participants were asked to recall everything they could remember from the text they had read. This testing procedure was done twice for every participant, once with a refutation text structure and once with an expository text structure. The aim of the study was to investigate the effects of text structure and misconceptions on comprehension processes (Kendeou & van den Broek, 2007).

Findings revealed that readers with misconceptions adjusted their processing of the text when confronted with a refutation text structure. These participants also spent more time reading and thinking about sentences that were refutational than those texts that were expository. Furthermore, participants acknowledged prior knowledge conflicts with the refutation text during think aloud and recall measurements. This acknowledgement was not present with readers during recall of non-refutation structured texts (Kendeou & van den Broek, 2007). This seminal study provides evidence that reading of refutation text "co-activates… prior knowledge and text information, which allows [learners] to detect the inconsistency between their knowledge and the text" (p. 1575). This connective cognitive processing meets essential theoretical assumptions of engagement for conceptual change, but the results do not indicate complete successful revision of the participants' incorrect ideas (Dole & Sinatra, 1998). Findings indicated that all participants with misconceptions remembered less correct information than those without misconceptions, regardless of text structure interventions (Kendeou & van den Broek, 2007). This may be due to an insufficiency of the correct alternative explanations in the text intervention or to the strength of individuals' commitment to preexisting

beliefs (Dole, 2000).

Kendeou and van den Broek (2008) further examined the effects of text structure on co-activation processes using computational simulations and empirical think aloud methods. The researchers found that in computational simulations only the refutation text contained all of the elements necessary for cognitive processing to co-activate prior knowledge misconceptions with correct knowledge. This suggests that refutation texts increase the likelihood of readers experiencing conceptual change by creating a "precondition essential" for detecting the contradiction between correct and incorrect ideas (Dole & Sinatra, 1998; Guzzeti et al., 1993; Kendeou & van den Broek, 2008; Posner et al., 1982). These studies by Kendeou and van den Broek (2005, 2007, 2008) relate to the present study in documenting refutation text as an effective intervention for activating learners' misconceptions while simultaneously presenting correct information.

Refutation Text Challenges and Limitations

Refutation text is not without challenges or limitations. In some studies, refutation texts did not possess greater power for long-term conceptual change than other informational texts (Broughton et al., 2010). Broughton and colleagues argued that text content accounted for refutation text conceptual change effectiveness when compared to other informational texts, assuming that where informational text and refutation text content are similar, the power for conceptual change is also similar. Gordon and Rennie's (1987) research also verified that text content similarities can affect results. Diakidoy and colleagues (2011) also believed that their expository texts skewed their results as two of the three expository texts were too similar to refutation text structure. Therefore

refutation text is limited in its conceptual change effectiveness over other text types due to similarities in the structures of text. This does not mean that refutation text is ineffective, but rather that other types of text may be equally as effective. It is also important to recognize that not all common assumptions are misconceptions. Therefore not all concepts need to have a misconception tied to them for learning effectiveness.

A challenge in refutation text can also be found in its development. Studies show that refutation text structure plays a major factor in its effectiveness (Diakidoy et al., 2003; Tippett, 2010). It can be difficult to determine common misconceptions, and then write understandable, credible, and useful refutation text (Mason & Gava, 2007). Another challenge and limitation in refutation text is linked to students' reading/spatial abilities, preferences, and commitments to misconceptions (Tippett, 2010). Tippett documented a study by Skopiliti and Vosniadou (2006) where students' abilities drastically affected the power of refutation text for conceptual change. Students will often respond uniquely to refutation texts as each individual varies in their levels of misconception, comprehension, and recall ability. Therefore refutation text may not be an effective intervention; nonetheless, a wide body of research demonstrates its effectiveness in increasing the likelihood of conceptual change (Guzzeti et al., 1993).

Current Refutation Text Research

Recent studies in refutation text have been used to examine more critically the refutation text effects in academic performance, learning, and cognitive processing within the discipline of science education. Broughton and colleagues (2010) researched how differential attention, reflected in reading time spent on reading refutation text, relates to

the refutation text effect. Their study sought to build on previous attention allocation research while extending the research of Kendeou and van den Broek's (2005, 2007, 2008) studies in online comprehension processes. Attention allocation research suggested that readers pay extra attention to some text structures and that this extra allocation of attention increases learning and recall (Reynolds, 1992). Kendeou and van den Broek (2008) found that online comprehension processes were increased when participants engaged in reading a refutation text. This correlates with attention allocation research as online comprehension similarly describes an increased attention allocation or cognitive processing that is happening in the moment of the reading (Kendeou & van den Broek, 2005). Therefore, Broughton and colleagues aimed to replicate the procedures of Kendoeu and van den Broek while measuring the time allocation students' placed on reading expository and refutation text structures.

Data was collected in two phases and participants were selected from undergraduate college students. Phase 1 involved 48 participants who were randomly assigned to an experimental or control group. Participants were seated at individual computer stations and asked to read paragraphs on the computer. After reading practice paragraphs to familiarize themselves with computer software, participants completed a Seasons Concept Inventory pretest. Following the pretest participants read either a refutation or expository text generated at random by the computer. The computer program showed one sentence at a time and students would advance each sentence by pressing the space bar. The computer software timed how long it took to read each sentence. After reading the text, participants were given a Seasons Concept Inventory

posttest (Broughton et al., 2010).

Phase 2 involved 40 participants and followed the exact same procedures as Phase 1, but added an additional element of inquiry. After participants completed the reading and posttest, they were individually interviewed by the researchers for the purpose of gaining additional information about participants' interest in the text. The interview sought to investigate whether one sentence stood out as important or if there was a particular part of the text that contradicted participants' beliefs (Broughton et al., 2010). Participants were given hard copies of the text they had read on the computer and were asked to point to a sentence or phrase in answer to the interview questions. Fourteen days later, both Phase 1 and Phase 2 participants were issued a Seasons Concept Inventory delayed posttest.

The results of their study confirmed previous research showing refutation text as an intervention that decreases misconceptions and increases scientific knowledge among participants. Findings also indicated that students spent significantly less time reading the refutation text than they did reading the expository text. This second finding was contrary to researchers' hypothesis, which posited that readers would spend more time reading the refutation text as it was thought to engage the learner in deeper cognitive processing than expository text. Refutation text has been shown to co-activate readers' misconceptions along with the scientific viewpoint presented in the text. This co-activation is believed to trigger cognitive conflict, and in turn, increase the reader's attention toward the refutation statements (Kendeou & van den Broek, 2008). In the Broughton and colleagues (2010) study, participants actually spent less time reading the refutation text. The researchers

hypothesized that reading a refutation text may be more easily processed by a reader than expository text, or that it may more easily draw readers' interest (Broughton et al., 2010). Their hypothesis is supported in the interview and testing data that indicated participants' interest in the refutation text segments and noted attention allocation sufficient enough to decrease misconceptions in immediate posttesting.

Diakidoy and colleagues (2011) examined the effects of refutation text on comprehension and learning outcomes in comparison with those of a standard expository text. Though most research surrounding refutation text has investigated its effects on conceptual change, learning outcomes, and cognitive processes; this particular study is unique in its specific focus on comprehension outcomes. The study involved refutation text statements around the scientific topic of the concept of energy. Sixty-one undergraduate participants enrolled in an education psychology class participated in the study. These were pretested on their knowledge about energy to determine the extent to which they adhered to the targeted misconceptions.

Participants were divided and tested in small groups that met in three sessions over a 2-month period. Session 1 involved an energy knowledge pretest that asked participants to provide clear written responses to short-answer questions. Session 2 began 1 month after pretesting and students with misconceptions were randomly assigned either a refutation or expository text and were asked to read the text once. Following their reading, students completed a belief questionnaire that served as a distracting filler activity before they were issued a cued recall assignment that asked them to write down everything they could remember from the text they had read. The text section headings

were given to the students to act as memory cues and students were allowed as much time as desired to complete the task. Session 3 involved the administration of an energy knowledge posttest that was given to all participants two weeks following Session 2. This posttest aimed to ascertain the comprehension effect of the texts previously read.

Findings revealed that refutation text outperformed standard expository text in learning outcomes and comprehension. Findings also showed that refutation texts facilitated the greatest learning gains in students with misconceptions. These findings all aligned with previous research showing similar results in refutation studies within the discipline of science. There was, however, a significant finding that opens the door to further investigation. Diakidoy and colleagues (2011) found that the superiority of refutation text was only observed in relation to one of the three misconceptions they addressed.

In explaining a similar phenomenon, Mason, Gave, and Boldrin (2008) previously observed that the nature of the misconception and the beliefs about knowledge influences the magnitude of comprehension and learning achieved from reading refutation texts. Diakidoy and colleagues (2011) argued that perhaps another reason for the lack of conceptual change was the result of the refutation text structure itself and not the personal beliefs of knowledge or nature of the misconception. This calls for further examination into refutation text structure and its power for conceptual change when misconceptions and beliefs about knowledge vary greatly in other subjects outside of physical science. If refutation text structure does accurately target misconceptions, will it still be superior to expository text in promoting conceptual change in other disciplines of learning where

misconceptions may be more deeply rooted and tied to epistemological beliefs about knowledge itself?

Topic Interest and Conceptual Change

Topic interest is another component linked to refutation text in the research of Mason and colleagues (2008). Topic interest refers to students' personal interest in a topic (Schiefele, 1996) with that interest generally existing before textual statements of a topic are encountered (Schraw, Bruning, & Svoboda, 1995). Furthermore topic interest references the amount of interest generated when a topic is presented (Ainley, Hidi, & Berndorff, 2002a). Researchers in the field of *interest* have shown that topic interest takes into account feeling-related and value-related valences (Krapp, 1999; Krapp, Hidi, & Renninger, 1992; Schiefele, 1996). Feeling-related topic interest could be expressed in the excitement of the topic while value-related interest is expressed in the perceived importance of the topic (Krapp, 1999). Research specifically concerned with interest and its effects on learning (Krapp, 1999; Krapp et al., 1992; Schraw et al., 1995; Wade, 1992) has focused on the broader aspects of individual interest and situational interest though some studies have specifically looked at topic interest (Ainley et al., 2002a; Schiefele, 1996).

Individual interest is generally unique to each person and is topic specific, long lasting, and existent prior to engagement with the topic (Schraw et al., 1995). Situational interest refers to interest generated by the specific features of the environment or task at hand (Ainley, Hillman, & Hidi, 2002b). Some researchers claim that situational interest promotes greater learner engagement than individual topic interest (Flowerday, Schraw,

& Stevens, 2004) while other researchers see topic interest as an aspect of situational interest (Ainley et al., 2002a). In examining topic interest, Schiefele and Krapp (1996) assessed students to rate how they felt about a given topic (feeling-related valence) and how valuable the topic was to them personally (value-related valence). They studied 80 German college students and found that topic interest was related to recall of the texts that they were given though there was not substantial enough evidence to explain topic interest's effect on text recall. These findings led other researchers to further explore the correlation between topic interest and learning.

Ainley and colleagues (2002a) studied 117 Australian eighth graders and 104 Canadian nineth graders to gain insights about the relationships between topic interest and learning. The topics of expository texts given to participants consisted of two scientific topics: x-rays and chameleons and two topics from popular culture: body image and Star Trek/X-Files. Using a 5-point Likert-type rating (1 = little; 5 = a lot) students were given pretest measures to rate their knowledge of the subject and to see how interesting they thought each topic would be (Ainley et al., 2002a). After reading the expository statements on the four chosen topics, students were administered a pencil-and-paper questionnaire that aimed to measure their depth-of-interest. This questionnaire was followed up by another 5-point Likert-type scale (1= very little; 5= a lot) that asked students to indicate how much they knew about each specific topic prior to reading the texts. Results showed that topic interest related to increased engagement with the text and researchers concluded that the increased engagement related to higher learning (Ainley et al., 2002a). The research does leave questions about how much the text structure

contributed to topic interest during reading engagement.

To account for topic interest in refutational text studies, Mason and colleagues (2008) developed a 10-item questionnaire that measured interest in a 5-point scale with 1 = not at all and 5 = much. This topic interest questionnaire was given to all participants during the first session of their study.

Overall data gathering for the study took place in three sessions. Session 1 involved a pretest that included an epistemological questionnaire (Conley, Pintrich, Vekiri, & Harrison, 2004), open-ended generative questions about light phenomenon, interest questionnaire, and a reading comprehension test. Session 2 began a week after the pretest session. One group of participants was given a traditional expository test while another group of participants were given a refutational text. Immediate posttests were then given to all participants to assess knowledge recall. The posttest asked participants to rate their liking of the text they read and the texts they usually read in their schoolbook. The posttest also asked text retention questions and open-ended generative questions. Session 3 involved a delayed posttest that occurred 2 months after Session 2. Participants were again asked the text retention questions and the open-ended generative questions to assess their lasting knowledge recall and conceptual change.

Findings revealed that students who read the refutation text were facilitated in their conceptual change much more than those who read the traditional text (Mason et al., 2008). Findings also revealed that topic interest did not correlate with prior knowledge. There was, however, an interaction between topic interest and text type. Students with high topic interest responded positively to refutation text and indicated the greatest

degree of conceptual change (Mason et al., 2008).

Mason and colleagues also found that refutation text compensated for students with low topic interest. Participants with low topic interest who had read a traditional expository text did not perform as well in posttesting as students with low topic interest who read a refutation text. Students also indicated that they preferred refutation text to the traditional expository text. These findings suggest that refutation text has power to influence the learning of students of all types of interest levels. This finding is relevant to the present study, which aims to investigate refutation text effect on religious doctrines that are heavily supported by individuals' topic interest. Other factors influencing refutation text and conceptual change were researched and determined to be beyond the scope of this study. Appendix I highlights some of these additional factors (see Appendix I).

Conclusion

The majority of studies in refutation text have been predominately enacted in the discipline of K-12 science education (Diakidoy et al., 2011; Tippett, 2010). Though these studies empirically support refutation text as an effective intervention for conceptual change in science learning, there still remain unanswered questions regarding refutation text's effects on conceptual change in other disciplines. There are also few research studies that explore refutation text as an effective intervention for conceptual change in subject matter containing deeply rooted misconceptions and interest levels. The present study seeks to add to the discussion by exploring refutation text effects on conceptual

change in LDS religious doctrines.

Religious subject matter is thought to deeply engage participants' with varying interest levels while also bringing out robust misconceptions tied to intangibles of faith and belief (Chinn et al., 2011). Refutation text's power for conceptual change has never been explored in this subject matter and the present study aims to add meaningful data to the current literature discussion. Findings are of interest to researchers, educators, and learning theorists.

CHAPTER 3

METHOD

Introduction

The present study aims to quantitatively measure refutation text's power for conceptual change while qualitatively discovering students' preference of refutation or expository text structures. This researcher also seeks to examine if religious interest levels predict conceptual change. All quantitative data will be measured at a .05 significance level and qualitative data will be coded according to measures supported in research literature.

Participants

Participants for this study were 9th-, 10th-, 11th-, and 12th- grade seminary students from a moderate sized LDS high school seminary located in the western U.S. (estimated *n* = 120, with 60 in treatment and 60 in control). This seminary was selected because of its practical location and its willingness to allow research studies. The ethnical diversity of the area is comparable to other Western United States' regions of similar size and is estimated to be 75% Caucasian, 15% Latino, 8% Asian Pacific Islander, 1% African American, and 1% Native American with an overall median household income that is approximately 7% lower than the national average (U.S. Census Bureau, 2010). Participants were selected from a sample of convenience utilizing all six classes of approximately 22-30 students each.

Design of Study

The present study was conducted in two sessions. In the first session of this mixed-methods study, all participants completed a Religious Concept Inventory and a Topic Interest Inventory as pretests. Following pretesting, participants were randomly assigned to read either an expository or refutation text on a doctrinal subjects of faith, baptism, and grace. A distracter activity of five math questions was given to each participant prior to retaking the Religious Concept Inventory posttest. The process of reading a refutation text or expository text, engaging in a five-question distracter activity, and taking a Religious Concept Inventory posttest was repeated three times by each participant so that all participants were exposed to testing on all three doctrinal concepts of faith, baptism, and grace.

Session 2 began exactly 4 weeks later and participants again completed the Religious Concept Inventory for all three doctrines of faith, baptism, and grace. Following this delayed posttest, all participants read both a refutation and expository text with a short Likert scale survey that evaluated how much they liked the text they had read. Participants were randomly selected to take part in one-on-one interviews that sought to discover participants' text structure preference and perception. These interviews concluded Session 2 and data analysis followed.

Measures

I received approval to enact this study and its measures through the Utah State University Social/Behavioral Institutional Review Board (IRB) prior to conducting the

research. Approval was granted on July 31, 2012, Protocol #irb-4577. Under the

evaluation of USU IRB, the research study was considered exempt from review under

federal guidelines 45 CFR Part 46.101(b) category #1. In addition, the Seminaries and

Institutes Research Committee approved this study on September 15, 2012. These

approved measures and procedures are explained in detail throughout the remainder of

this chapter.

Topic Interest Survey

Participants' interest in the topics of religious faith, baptism, and grace were

assessed through a topic interest survey (Appendix A). This survey was issued as a

pretest and preceded the Religious Concept Inventory. Utilizing Mason and colleagues'

(2008) 5-point scale of topic interest, a 10-item questionnaire was devised to rate

participants' interest on a scale from one to five with 1 = not at all, and 5 = much. Items

devised from this scale have changes made to Mason's original measuring tool only in

the topic area of measurement. Faith, grace, baptism, and religious doctrines replaced the

topics of science, light, and colors used in the Mason scale (Mason & Gava, 2007).

Higher responses in the scale will indicate higher levels of topic interest and questions

will account for feeling-related and value-related valences of topic interest as is common

in previous research reviewed in Chapter 2 of this study (Krapp, 1999; Krapp et al., 1992;

Mason & Gava, 2008; Schiefele, 1996). For data analysis, Items 5 and 9 were reverse

coded so that higher scores reflected greater levels of interest towards LDS doctrinal

topics.

Religious Concept Inventory

The Religious Concept Inventory was used to assess conceptual knowledge about the doctrines of faith, baptism, and grace (see Appendix B). The assessment consists of six open-ended questions and three multiple choice questions. The format is similar to that used by other researchers investigating conceptual change through pre- and posttest measures (Broughton et al., 2006; Hynd, 2001; Mason, 2008; Palmer, 2003). The questions were taken from assessment measures previously administered to the worldwide student body of Seminary and Institutes in 2009. The Church Educational System Research Committee designed the assessment and approved and encouraged these questions to be used. This committee also serves as the LDS Seminary and Institutes Institutional Review Board (IRB). Questions for this study were taken from the LDS research committees' test in accordance to LDS IRB suggestions. The research committee for Seminaries and Institutes believe these questions are proven to accurately assess student's knowledge of LDS doctrinal concepts. Examples from open ended questions used include, "What does it mean to have faith?" and "What promises are made at baptism?" A multiple-choice question is exemplified in the question "What does baptism by immersion symbolize?" Each multiple-choice question has multiple correct answers amidst other common misconceptions listed (see Appendix B).

Refutation Texts

The effects of conceptual change will be examined through refutation text interventions (Appendix C). The refutation texts explain the LDS religious doctrines of faith, baptism, and grace. The first text on faith consists of 171 words and one paragraph

with an average of 19.1 words per sentence. The Flesch-Kincaid readability analysis of

the text showed that it was at the 7.3 grade reading level. The text on grace consists of

203 words and one paragraph with an average of 18.4 words per sentence and also shows

a Flesch-Kincaid 7.5 grade reading level. The third text on baptism is 267 words and one

paragraph with an average of 17.8 words per sentence and a 9.0 Flesch-Kincaid grade

reading level. It should be noted that the high school age readers would be 9th-12th

graders, though this particular seminary does not have an equal balance of each grade

represented. Two expert judges of content purity reviewed the passages: one full-time

seminary teacher and one seminary principal. The content purity was further triangulated

as the majority of the diction in each text was taken from either the LDS correlated

curriculum for Seminaries and Institutes or the general Sunday school manuals of the

LDS Church. Expert reviewers' recommendations were taken into consideration and

revisions were made accordingly.

The church publications, canonized scripture texts, and Seminary and Institutes

curriculum used in writing the texts include: *True to the Faith* (The Church of Jesus

Christ of Latter-day Saints, 2004), The *Holy Bible*, *Book of Mormon*, and *Basic Doctrines*

and Principles (Seminaries and Institutes, 2009). In addition to refuting students'

misconceptions about faith, baptism, and grace, the texts also summarized the basic

doctrines as a whole (see Table 1).

Expository Text

The control group for the study was measured through three expository texts on

the subjects of faith, baptism, and grace (see Appendix D). The expository texts are direct

Table 3.1

Expository and Refutation Text Statistics

Text type and topic	Word count	Words per sentence	Flesch-Kincaid reading level
Expository text: FAITH	158	22.5	8.0
Refutation text: FAITH	171	19.1	7.3
Expository text: BAPTISM	281	16.5	8.8
Refutation text: BAPTISM	267	17.8	9.0
Expository text: GRACE	203	25.3	10.2
Refutation text: GRACE	203	18.4	7.5

statements taken from the current Sunday School and Seminary and Institutes'

curriculum, and all participants enrolled in seminary currently have access to these

statements in their seminary resources (*True to the Faith*, *Bible*, *Book of Mormon*, *Basic*

Doctrines and Principles). The first text on faith consists of 158 words and one paragraph

with an average of 22.5 words per sentence. The Flesch-Kincaid readability analysis of

the text showed that it was at the 8.0 grade reading level. The second text on grace

consists of 203 words and one paragraph with an average of 25.3 words per sentence and

also shows a Flesch-Kincaid 10.2 grade reading level. The third text on baptism is 281

words and one paragraph with an average of 16.5 words per sentence and a Flesch-

Kincaid 8.8 grade reading level.

Text Preference and Interviews

In both reading conditions, students were asked to rate how much they liked the

text on a 5-point Likert type survey and in personal interviews. The text preference

questions of the survey followed the structure of Mason and colleagues (2008) in

presenting two Likert scale questions that appeared at the bottom of both the expository

and refutation text statements. These two questions were aimed at ascertaining whether

there would be a greater preference for the refutational text over the traditional expository

religious text (see Appendix E). Following participants' reading and brief evaluating of

the texts, selected students were asked four open-ended interview questions aimed to

draw out their opinions about the texts they have read (see Appendix F). These questions

seek to enrich the study with raw data that gives insights to the perceptions that

participants are having with the text. Examples of the types of questions asked are "How

did the texts influence your learning?" or "What did you think about the texts that you

have read?" The interview proceeded with some follow-up questions as determined by

the interviewer in the moment of each interview. These relevant follow up questions will

be reported in the analysis chapter of this study.

Procedure

Pilot Testing of Instruments

All instruments have been piloted and evaluated for potential revision prior to the

administration of the study. The pilot study clearly indicates that misconceptions in the

topics of faith, grace, and baptism do exist. In addition, the pilot study confirmed the

appropriate time allotments needed for participants to complete the procedures of the

study. Participants for the pilot study were 10th-, 11th-, and 12th-grade LDS seminary

students ($n = 72$) from an LDS seminary. The pilot study replicated Session 1/Phase 1 of

the dissertation study while adding a short second phase specific to time measurement

needs. Data from the pilot study was also used to inform the researcher about potential revisions necessary for clarity in directions and questions. The findings and structure of the pilot study are discussed in the section below and Table 2 gives a general outline of the pilot procedures.

Phase 1. The researcher read aloud the directions for both pretests (Religious Concept Inventory and Topic Interest Survey*).* Participants were instructed to raise their hands if they needed help for any questions that were confusing or unclear. Following the directions, participants completed both pretests while the researcher fielded questions and timed how long it took for all participants to finish.

Phase 2. Following the completion of Phase 1, all students were directed to a projected statement that discussed the principle of faith. The expository statement was 158 words long and had a Flesch-Kincaid Reading Level of 8.0. The purpose of the statement was to analyze how long participants needed to complete the reading. This time allotment would gauge the projected time needed to read statements presented in the dissertation study.

Table 3.2

Pilot Study

Phases	Data	Instrument/ literature source
Pilot study phase 1	Read directions aloud	Researcher
	Pretests	Kendeou 2011
	• Religious Concept Inventory	Researcher
	• Topic Interest Survey	Mason 2008
Phase 2	Document one:	
	Read an Expository text on Faith to Measure how long it takes to read.	Researcher/S&I 2009

Findings. It was discovered that only two participants had questions about unclear diction on the pretests. Both questions originated from the same question on the Topic Interest Survey. The Topic Interest Survey is a proven research instrument borrowed from the 2008 research of Mason and colleagues. Because of such, it was determined that these participants desire for clarity did not present a significant need for general question alteration. All other participants appeared to understand directions and questions without difficulty and since the instruments in question had previously been validated (Mason et al., 2008), no changes were made.

It was further discovered that participants needed less than three minutes to complete the reading of the expository text statement. Furthermore, all participants completed the pretest, survey, and reading in less than 30 minutes. This finding verifies the researcher's assumptions that 70 minutes would be enough time to complete all pretests and reading tasks in Session 1. This assumption proved to be accurate in the actual study as all participants comfortably completed tasks within the allotted time.

The pilot study also verified the existence of common misconceptions in each of the three topics: faith, grace, and baptism. For example, it was noted that 55.5% of participants elicited the same misconception surrounding the LDS doctrine of baptism. 91.6% of participants stated a common misconception of the LDS doctrine of grace and 83.3% indicated a common misconception about the LDS doctrine of faith. These common misconceptions verified the assumptions of the researcher and confirmed that the refutation and expository texts of the study were accurately chosen and written to correct these specific false ideas. It is also interesting to note that each participant almost

identically worded the misconceptions, as if the common misconception surrounding these LDS doctrines were statements participants learned together. This finding in the pilot study was especially exemplified in the topic of baptism. Approximately 55.5% reported a misconception using nearly identical word-for-word short answer descriptions. Only conjunction words such as "is or the" and punctuation differed in participants statement of misconception. This finding was similarly seen in the dissertation study and raises questions for future investigations.

Data Collection at the Research Site

Data collection took place over a 1-month period at the designated research site. Participants were drawn from six classes and two 90-minute sessions were conducted per classroom. In the first session, participants were randomly issued a packet containing two parts: pretests (Religious Concept Inventory and Topic Interest Inventory) and interventions/posttests (refutation texts or expository texts, distracter activity, and posttests). Their packet was labeled with a 5-digit identification number card that ensured confidentiality and organizational congruency. This number card was given to the student, and the same number was found on each of the items in their packet, and on the exterior of the two-part packet.

The researcher read directions aloud while participants were invited to follow along in their individual copies of assigned tasks. Participants were given time to ask any questions before being allowed to begin each phase of the study, but no relevant questions to study procedures were asked. After completion of Session 1, participants turned in their packet and wrote their name on the back of the five-digit number card. The

number card was then paper clipped to the packet and checked by the researcher. Participants were asked to write their name on their personal identification card to ensure that cards items were correlated to the correct participant until the testing was done. Named identification cards also aided in collection organization and distribution. The number card further ensured that participants received the correct packets for testing in Session 2 four weeks later.

Session 2 started with the dispersal of delayed posttests and previous packet materials. Following the dispersion of packets, identification cards were placed in a bowl and one or two names were drawn out to aid in the random selection of participants for interview. Session 2 ended with participant interviews, and the data from interviews was recorded as an electronic sound bite. These sound bites were correlated to participants' identification number and written notes taken by the researcher during the interview process. All identification cards were then destroyed by the participants or thrown away by the researchers. Information gathered during Session 2 was placed back inside participants' packets and from then on only the five-digit identification number was used to track participants surveys, tests, and materials.

Session 1

Two weeks prior to the first session, a letter of information was sent home with students informing them and their parents/guardians of the study. The letter of information gave parents/guardians opportunity to have their student "opt" out of the research study. Currently, the LDS seminaries already have parental consent forms on file. In these general forms, parents/guardians have given full permission for their child to

engage in all seminary-related activities, studies, and events. These forms are a mandatory part of the current registration process. Seminary and Institutes have cleared this study and approved it in light of the study being in line with current curriculum and instructional practices. The implication of the study in the classroom does not alter what things may normally happen in the classroom as part of everyday instruction and evaluation. Therefore, it was determined that a letter of information with an "opt-out" clause would suffice. No other parental consent form was necessary for this study. Both the Seminaries and Institutes Research Committee and the USU Social/Behavioral Institutional Review Board jointly determined and confirmed this (July 31, 2012, Protocol #irb-4577). If students' parents/guardians decided to have their child opt out of the study, they would do so by signing and returning the letter of information. Students who have this "opt-out signature" will remain in their classrooms and not be taken to the research classroom where the study will be conducted. The research study had only one student whose guardians signed an "opt" out clause. This participant's letter of information also included a note from the legal guardian stating that the choice to participant was up to their student and they would allow their student to "opt-out" of the study if desired. This student made the choice to "opt in" and become a participant of the study. Hence, there was no attrition due to signed letters of information.

Phase 1. At the beginning of Session 1, all eligible students were randomly assigned seating as they entered the research classroom. These participating students were issued a packet labeled with a five-digit participant identification number. The first three digits of the identification number were used to track the number of participants

involved. The fourth digit indicated the type of text they received: a refutation text (experimental group = 1) or an expository text (control group = 2). The fifth digit is used for organizational purposes and did not have significant meaning for the research, though it did aide in number correlation ambiguity in the minds of participants.

The randomly assigned packets consisted of two legal envelopes bound together by a large paper clip. One envelope is entitled *Phase 1* and the other *Phase 2*. After packets were randomly assigned, participants were asked to pull out the pretests from the Phase 1 envelope (see Appendices A and B). The researcher then read aloud the directions and students were asked to not begin until all directions were read. Students then completed the Topic Interest Survey (Appendix A) and the Religious Concept Inventory (Appendix B). Upon completion of each pretest, they placed the documents back into the Phase 1 folder and awaited further instruction. It was anticipated that Phase 1 should take approximately 30 minutes and all participants were finished within 35 minutes or less.

Phase 2. The next phase of Session 1 involved the refutation and expository text interventions. Students returning all documents into the Phase 1 folder were then asked to seal the folder and sit quietly until all were ready for Phase 2. The Phase 2 envelopes contained three separate documents of three pages each. Each document had a textual statement of a religious doctrine (faith, baptism, or grace) on the first page (see Appendix C and D), a distracter activity on the second page (see Appendix G) and the Religious Concept Inventory posttest (see Appendix B) on the third page. Participants were asked to pull out the three paper-clipped documents from the packet and stack them on the desk

so that only one page is seen at a time. All directions for engagement were read aloud by the researcher before they began.

Participants were instructed to read the first page carefully and then put it back into the Phase 2 envelopes when they were finished. They were then allowed to begin answering the questions on the next page. This instruction was the same on all pages as participants are not to advance to the following page until they have put the completed page back into the Phase 2 envelopes. In the end of Phase 2 participants had engaged themselves with three documents of three pages each for a total of nine pages. This means that they read a textual statement on faith before completing a five-question math test that serves as a distracter activity. Following the distracter activity, they took the Religious Concept Inventory posttest on faith. Upon completion of this posttest, they saw another textual statement on the topic of baptism. After reading this topic they answered another five-question math test, and then completed a Religious Concept Inventory posttest on baptism. Finally they read a textual statement on grace, followed by another five-question distracter activity, and a Religious Concept Inventory posttest on grace.

After completion, participants were asked to seal both Phase 1 and Phase 2 envelopes. Participants were then instructed to paperclip their identification card at the top of the combined two-folder packet. The researcher checked each completed packet before being taken from the participant. As the researcher took completed packets, participants were asked to wait patiently until excused. When all students completed the testing, participants were further informed that identification cards would be kept to ensure that participants are given the correct packets in Session 2. They were also

instructed of the timing of Session 2 before being thanked for their efforts and excused.

During the study processes the researcher strictly monitored the students to be sure that only one page was viewed at a time. The researcher also walked up and down each row to be attentive to any possible threats to study validity. Students were also instructed to know that once a page is placed in an envelope, it may not be taken out again and the researcher monitored such accordingly. It was anticipated that Phase 2 of the study would take 45-60 minutes and that all of Session 1 would be completed in a 93-minute class time allotment. Pilot study data gave confidence to this hope and it was found that only one participant struggled to complete Session 1 in the 90-minute time allotment. More of this student will be spoken of later as this participant proved to be an exciting enrichment to the study.

Session 2

Session 2 began 4 weeks later in the same classroom sites as Session 1. Participants were issued tests packets that correlated to their personal identification number. These tests, represented Phase 3, and consisted of the Religious Concept Inventory posttest, and two textual statements. One textual statement was an expository text and the other was a refutational text. These statements were both on the same doctrine, whether faith, baptism, or grace. Each class had an equal smattering of different topics so that all topics were represented even though they were randomly distributed in each class. For example some students received the topic of faith, while others randomly received the topic of grace.

Participants were instructed to begin with the Religious Concept Inventory

posttest (Though this post-posttest was written exactly like the pretest and posttest from Session 1, there was one additional form that asked participants to designate their age, grade, and gender. There also was a blank space where they could confirm their personal identification number, see Appendix H). Directions were read aloud as they were in pretesting. After having completed the Religious Concept Inventory posttest, participants were then given the textual preference statements with four preference questions asked (see Appendix E). The researcher again explained instructions aloud and participants were instructed to read the statement and rate how much they liked the statement before moving on to the next statement. When they completed their reading and evaluations, students were asked to be sure to write the identification number on these two items (Religious Concept Inventory Posttest and Statement preference page) and place them back into assigned phase 2 packets that correlated with their ID number. The packets were then returned to the researcher.

The researcher then randomly selected one to three individuals from each class to participate in an interview. Drawing out a personal identification card made this selection from a bowl containing all cards from participants in the respective class. 16 participants between the six classes were selected and interviewed. Interviews were limited to ten minutes or less and were initially guided by four prewritten questions (see Appendix F). These interviews were digitally recorded and the researcher also wrote and typed notes throughout. It was expected that Session 2 would be fully accomplished in a 93-minute class and that expectation was nearly held save the one participant from Session 1 who again needed more time and who was also selected for interview. Nearly all students

completed the religious concept inventory posttest and textual statement ratings in under 30 minutes. This benefitted the researcher, leaving nearly 40-60 minutes for interview procedures in almost every class.

Table 3 provides an overview and timeline of the procedures of this study while highlighting the data collection processes involved in each phase.

Table 3.3

Study Organization and Outline

Phases	Data experimental group (refutation text)	Control group (expository text)	Instrument/ literature source
Session 1 (Day 1)	Random assignment of packets (designates refutation group or control group)		
Phase 1	Read aloud	Read aloud	Researcher:
	Pretests	Pretests	Kendeou 2011
	Religious Concept Inventory	Religious Concept Inventory	Researcher
	Topic Interest Survey	Topic Interest Survey	Mason 2008
			Schraw 2007
	Religious Doctrines Beliefs Survey	Religious Doctrines Beliefs Survey	Mason2008/Researcher
Phase 2	Document one:	Document one:	
	• Refutation Text on Faith	• Expository Text on Faith	Researcher/S&I 2012
	• 5 question distracter activity	• 5 question distracter activity	Researcher
	• Religious Concept Inventory	• Religious Concept Inventory	Researcher
	Document two:	Document two:	
	• Refutation Text on Baptism	• Expository Text on Baptism	Researcher/S&I 2012
	• 5 question distracter activity	• 5 question distracter activity	Researcher
	• Religious Concept Inventory	• Religious Concept Inventory	Researcher
	Document three:	Document three:	
	• Refutation Text on Grace	• Expository Text on Grace	Researcher/S&I 2012
	• 5 question distracter activity	• 5 question distracter activity	Researcher
	• Religious Concept Inventory	• Religious Concept Inventory	Researcher
Session 2 (Day 2) 6 weeks later	Distribute *Phase 3* packets according to Identification number. Draw number from a bowl to randomly select interviewees.		Broughton 2008? Palmer 2003?
Phase 3	Read aloud	Read aloud	Researcher
	Religious Concept	Religious Concept Inventory	Researcher
	Read aloud	Read aloud	Researcher
	Rate textual preference	Rate textual preference	Mason 2008
	Refutation text Statement	Refutation text Statement	Researcher
	Expository text Statement	Expository text Statement	Researcher
	Interview Randomly Selected Participants		Mason 2008

Data Analysis

Quantitative Analysis

A correlation analysis was conducted among the instruments at the pretest, posttest, and delayed posttest levels. Correlation analysis helped to determine whether a relationship existed between topic interest and the conceptual knowledge of faith, baptism, and grace. I also used a correlation analysis to investigate whether students' topic interests correlated with the overall religious concept inventory. This correlation will aid in data analysis for research question three as well as provide data that will enrich the concluding discussion of the findings of the study. Preliminary analysis was also conducted to verify that there was no significant difference between groups.

Question 1. Does the use of refutation text in LDS Religious Education significantly change students' conceptual knowledge of core scriptural doctrines in comparison to expository text? (a) Does the use of refutation text in LDS religious education change student's conceptual knowledge of faith in comparison to expository text? (b) Does the use of refutation text in LDS religious education change students' conceptual knowledge of baptism in comparison to expository text? (c) Does the use of refutation text in LDS religious education change students' conceptual knowledge of grace in comparison to expository text?

To explore answers of question 1, the researcher looked at frequency and descriptive statistics to determine the percentage of participants whose scores were indicating a change in conceptual knowledge at the pre, post, and delayed posttest times. In order to check significance and validity, a mixed-design, repeated measures ANOVA

was conducted using text type (refutation, expository) as the between-groups factor and time (pre-, post-, and delayed posttest) as the within-groups factor. Students' conceptual knowledge became the outcome variable and alpha was set at a .05 significance level. To view each set of the three doctrinal subjects separately, the researcher conducted three separate analyses, one for each of the three concepts (faith, baptism, grace). Using this analysis approach, insights were given as to the significant conceptual change that is occurring within text type intervention.

Question 2. Do differences in levels of religious interest (high interest, low interest) predict conceptual change?

A correlation test was conducted to determine the initial relationship of interest to conceptual change. However, a simple regression analysis using interest (high interest, low interest) as the predictor variable and conceptual knowledge as the outcome variable also was executed to provide more meaningful and interpretive results. Three separate regressions were conducted, one for each concept (faith, baptism, grace). Alpha was set at a .05 significance level and results were tabulated according to accepted statistical measures.

Question 3. Do students prefer refutation text structures to traditional expository text structures? (a) Do LDS students prefer refutation text structures on faith to expository text structures? (b) Do LDS students prefer refutation text structures on baptism to expository text structures? (c) Do LDS students prefer refutation text structures on grace to expository text structures?

Descriptive statistics was used to measure students' text preferences

quantitatively with additional data coming from the qualitative interviews that took place. Mean, mode, and median highlighted the statistical preferences of participants while giving insight to the overall preferences of the participants as a whole.

Qualitative Analysis

Interviews. Question 3 was also analyzed through an interview process that questioned participants' perceptions with regards to text preference. Interview analysis used content analysis to code participants' comments into small units of meaning relating to text preference. Results were logically analyzed and reported to enrich the study.

Open-ended question. An open-ended question also asked participants to tell which text structure they preferred and why. Though the question will be quantitatively analyzed, the reasons why will also be evaluated qualitatively.

Conclusion

The present study sought to be efficient and professional in its investigation of the refutation text effect. Results of this study are of interest to teachers, researchers, and curriculum writers within religious and secular subjects. The specific aim of the study hones in on LDS religious education, and therefore results of this study are of particular interest to the private LDS church educational system of Seminaries and Institutes. The determination that refutation text provides heightened interest and is a significant intervention for promoting conceptual change leads this researcher to encourage LDS curriculum developers and instructors to work toward using this intervention to increase students' understanding and application of the scriptures. It is hoped that the proceeding

results and analysis of the study will eventually impact LDS learners' classroom

experience in preparing to "study the scriptures…understand them…and live

accordingly" (Monson, 2009).

CHAPTER 4

RESULTS AND ANALYSIS

Introduction

In this chapter, I present a description of the data analyses and results for the study. Following the predetermined study methodology, I begin by presenting the description of the participants as well as a discussion of the preliminary analyses. A detailed discussion is provided on the quantitative analyses related to topic interest, text structures, and conceptual change. A minor statistical description also highlights the text structure preference of students, whether refutation or expository text. I further provide quantitative correlation descriptions of topic interest in regards to conceptual change. The qualitative analyses are also set forth, including the content analysis used to provide specific analysis of the students' responses. This qualitative analysis is also written to enrich and support the statistical data relating specifically to text structure preference.

Participants

The participants for this study were 9th-, 10th-, 11th-, and 12th-grade seminary students from a moderate sized LDS high school seminary located in the western U.S. This seminary's population was 144 students and 134 of these students participated in the research study. Because of attrition and other factors, only 101 participants completed the all three phases of the study. One of these participants was legally blind from birth and audible accommodations were made to allow study completion and participation.

However, this particular participant was dropped from the official statistical reporting of the study group as audible reading and explaining of research items led to threats of response validity as it created non-uniform instructions and help. This particular participant, however, was allowed full participation, though the findings are not reported in this study. Thus the total number of participants examined in the study group tallied an even 100.

Participants involved were overwhelmingly Caucasian (96%) across all grade levels, and spoke English as their primary language. Student's ages ranged from 14-18 years of age, with a mean age of 15.30 years. Participants' demographic characteristics are presented in Table 4.1. Participants were randomly seated and assigned to either the experimental group (refutation text, n =54) or the control group (expository text n = 46). The decision to test all grades together is logical with the nature of Seminary and Institutes. Students at this seminary all receive the same instruction from the same instructor regardless of grade or age. Each of the six classes tested maintain a healthy mix of students from every grade. Therefore the participants were tested together and not separated any differently than current classroom norms.

A series of multivariate analyses of variance were conducted to test the equivalence of 9th-, 10th-, 11th-, and 12th- grade students. Data from each test at pre-, post-, and delayed posttest phases were compared to see if there was statistical justification for combining the two classes. The alpha level was set *a priori* at .001. Table 4.2 displays the significance values of Levene's tests of homogeneity of variance for these analyses. With the exception of Concept/Faith 2 at posttest (p = .000), Levene's test revealed no

Table 4.1

Participant Demographics for the Experimental and Control Groups

Variable	9th grade (n = 22)	10th grade (n = 11)	11th grade (n = 10)	12th grade (n = 15)
Refutation text (experimental)				
Age				
14 years	17	1	0	0
15 years	5	8	1	0
16 years	0	1	9	1
17 years	0	1	1	9
18 years	0	0	0	0
Gender				
Male	4	7	1	5
Female	18	4	10	5
Ethnicity				
Caucasian	22	11	11	8
Asian/pacific	0	0	0	0
Latino/Hispanic	0	0	0	0
Other	0	0	0	0
Expository text (control)				
Age				
14 years	13	1	0	0
15 years	6	6	0	0
16 years	0	5	7	0
17 years	0	0	3	4
18 years	0	0	0	1
Gender				
Male	8	3	5	1
Female	11	9	5	4
Ethnicity				
Caucasian	17	12	10	5
Asian/pacific	0	0	0	0
Latino/Hispanic	2	0	0	0
Other	0	0	0	0

Table 4.2

Homogeneity of Variance Analyses Significance Levels

Survey/Item	Test time	Levene's Test
RCI pretest		$p = .061$
RCI posttest		$p = .127$
RCI delayed post		$p = .051$
Concept/faith 1	Pre	$p = .307$
	Post	$p = .076$
	Delayed	$p = .004$
Concept/Faith 2	Pre	$p = .835$
	Post	$p = .000$[a]
	Delayed	$p = .226$
Concept/Faith 3	Pre	$p = .182$
	Post	$p = .765$
	Delayed	$p = .694$
Concept/Grace 1	Pre	$p = .118$
	Post	$p = .374$
	Delayed	$p = .195$
Concept/Grace 2	Pre	$p = .561$
	Post	$p = .589$
	Delayed	$p = .038$
Concept/Grace 3	Pre	$p = .768$
	Post	$p = .795$
	Delayed	$p = .561$
Concept/Baptism 1	Pre	$p = .100$
	Post	$p = .992$
	Delayed	$p = .042$
Concept/Baptism 2	Pre	$p = .091$
	Post	$p = .455$
	Delayed	$p = .025$
Concept/Baptism 3	Pre	$p = .179$
	Post	$p = .829$
	Delayed	$p = .379$

[a] This posttest concept will be viewed separately by grade level in specific analyses while all others concepts pass the homogeneity of variance test.

significant difference between groups and homogeneity of variance was maintained (*p* >.001). Table 4.2 also highlights that the RCI pre-, post-, and delayed posttest sum scores also showed no significant difference between grades and further verified the homogeneity of variance. The means and standard deviations for the RCI Concept Items at pretest among the four grades are shown as an example in Table 4.3. In general, no significant differences were found among the four grades, and based on these aforementioned statistical and logical justifications; the grades were combined for further analyses.

Preliminary Analysis

Measures

Topic Interest Survey. The Topic Interest Survey (see Appendix A) was created utilizing Mason's (2008) 5-point scale of topic interest, a 10-item questionnaire. It was

Table 4.3

Means and Standard Deviations for RCI Concept Items at Pretest

Concept item	9th grade (n = 41) M	SD	10th grade (n = 23) M	SD	11th grade (n = 21) M	SD	12th grade (n = 15) M	SD
Item 1	2.90	.49	2.78	.51	2.95	.58	3.13	.78
Item 2	2.10	.43	2.21	.67	2.19	.51	2.13	.63
Item 3	2.90	.53	2.70	.97	2.80	.81	3.33	.97
Item 4	2.41	.49	2.14	.66	2.14	.65	2.46	.83
Item 5	1.58	.94	1.43	.89	1.95	1.20	2.13	1.10
Item 6	2.24	1.10	2.08	1.00	2.28	1.10	2.60	1.10
Item 7	2.04	.31	2.08	.28	2.23	.43	2.20	.41
Item 8	2.48	1.00	2.30	1.10	2.42	.97	2.66	.89
Item 9	2.70	.46	2.60	.49	2.57	.59	2.93	.59

devised to rate participants' interest on a scale from one to five with 1 = *not at all*, and 5 = *much*. Items devised from this scale have changes made to Mason and colleagues' (2008) original measuring tool only in the topic area of measurement. Faith, grace, baptism and religious doctrines replaced the topics of science, light, and colors used in the Mason scale (Mason & Gava, 2007). Higher responses in the scale indicated higher levels of topic interest and questions accounted for both feeling-related and value-related valences of topic interest as is common in previous research reviewed in chapter two of this study (Krapp, 1999; Krapp et al., 1992; Mason & Gava, 2008; Schiefele, 1996). For data analysis, Items 5 and 9 were reverse coded so that higher scores still reflected greater levels of interest towards LDS doctrinal topics.

The sum of scores for each participant was calculated to give a single number that could show topic interest for religious concepts as a whole. The range of the sum of topic interest scores for each participant spread between 12 to 49 with a mode of 40 and a median of 41. As previously tested by Mason and colleagues (2008), the alpha reliability coefficient of the questionnaire was .80. Cronbach's alpha was also measured for internal consistency and was found to be .823. This indicated an acceptable consistency. It is further noted that there were no outliers identified in the topic interest survey as all were well under the three standard deviations of the mean. Following the pattern set by Mason and colleagues, the present study used the sum total score of each participant to account for topic interest whether high or low. The total score was dichotomized on the basis of the median and this score was used to create two mutually exclusive groups. One group was made up of participants with higher topic interest ($n = 47$; 27 in the experimental or

refutation condition and 20 in the control or expository condition), and the other group was made up of participants with lower topic interest ($n = 53$; 27 in the experimental or refutation condition and 26 in the control or expository condition). This preliminary analysis determined the necessary numerals used in further analyses seeking to answer research question two regarding topic interests' predictability of conceptual change.

Religious Concept Inventory. The Religious Concept Inventory (RCI) was used to assess conceptual knowledge about the doctrines of faith, baptism, and grace (see Appendix B). The assessment consists of six open-ended questions and three multiple choice questions. The format is similar to that used by other researchers investigating conceptual change through pre- and posttest measures (Broughton et al., 2006; Hynd, 2001, Mason et al., 2008; Palmer, 2003). The questions were taken from assessment measures previously administered to the worldwide student body of Seminary and Institutes in 2009. The RCI was given as a pre-, post-, and delayed posttest in the present study. The nine items tested on the RCI related to a scale of conception whether no conception, misconception, partial conception, or correct conception. Answers were coded using the same rubric for all measurements of the RCI whether in pre-, post-, or delayed posttest analyses.

Reliability of the RCI instrument was tested using Cronbach's alpha. The means and standard deviations for each item within each administration of the RCI are presented in Table 4.4. These coefficients were acceptable with pretest .669, posttest .797, and delayed posttest .779. These Cronbach's alpha coefficients indicate a moderate level of internal consistency for this instrument over time within this sample. In analyzing the

Table 4.4

Means and Standard Deviations for Religious Concepts Inventory

Test time and concept	N	M	SD
Pretest	100	21.52	3.65
Item 1	100	2.92	.56
Item 2	100	2.15	.54
Item 3	100	2.90	.80
Item 4	100	2.30	.58
Item 5	100	1.71	1.03
Item 6	100	2.27	1.08
Item 7	100	2.12	.36
Item 8	100	2.46	1.03
Item 9	100	2.69	.53
Posttest	100	21.50	4.58
Item 1	100	3.07	.61
Item 2	100	2.48	.89
Item 3	100	2.79	.62
Item 4	100	2.89	1.06
Item 5	100	3.00	1.02
Item 6	100	3.02	.80
Item 7	100	3.19	.80
Item 8	100	2.86	.84
Item 9	100	2.53	.63
Delayed posttest	100	23.41	4.65
Item 1	100	3.01	.56
Item 2	100	2.34	.78
Item 3	100	2.93	.91
Item 4	100	2.37	.71
Item 5	100	2.31	1.24
Item 6	100	2.58	1.02
Item 7	100	2.25	.59
Item 8	100	2.80	1.01
Item 9	100	2.82	.64

RCI measures for normality of distributions, outliers were looked for on the mean score variables at pre-, post-, and delayed posttest times. An outlier was any score three standard deviations above or below the mean. No outliers were identified from this analysis. Skewness values of the RCI were pretest -.04, posttest -.68, and delayed posttest -.403. These values are relatively low and reflect a weak normal distribution. Kurtosis values on the RCI were -.193, .946, and .378 at pretest, posttest, and delayed posttest respectively. The kurtosis values for all three RCI tests were less than one, indicating that the distributions were approximating normality. Based on this data, the remaining analyses of the RCI were conducted assuming a normal distribution.

The rubric constructed for each item was used to determine the type of conception participants elicited in their responses. Participants whose responses were not related to the concept received a "1" while answers containing misconceptions about the item received a "2." Participants with partial conceptions and no misconceptions received a "3" and participants with complete and correct conceptions received a "4." Hence the rubric was simply defined as follows: 1 = no conception, 2 = misconception, 3 = partial conception, and 4 = correct conception. The coding of each answer was strictly measured against predetermined answers contained in the rubric. For example, the answer "I don't know" always scored a "1" for no conception. Questions intentionally left blank or an answer that was unrelated to the general concept also received a "1."

A specific example of the coding in the rubric is seen in Item 2 where the question states, "What does it mean to have faith?" The rubric designated that a solitary answer only involving the concept of "belief in something you can't see" is categorized as a

misconception. Hence this participant's response stating, "To have faith is to believe in something that may be farfetched, but you still believe," scored a 2. However, the rubric designates that an answer involving the concept of "trust in God's will" shows partial conception. For example, a participant's response, "Trusting that what the Lord is allowing in your life," received a 3. The rubric designated that a correct conception of *having faith* involves the concepts of "living or acting in accordance to ones beliefs with trust in the Lord or in what is right." This participants' response, for example, scored a 4 as they stated in part: "[Faith is]…to act on your beliefs…to manifest through your actions and daily life…that you put your work and heart [trust] into what you believe is right…." All other short answer items in the RCI pre-, post-, and delayed posttests followed the same structure of rubric for each concept item analyzed and examples of students responses will be given later in this chapter.

The three multiple-choice questions also followed the logical rubric involving the same 1- through 4-point scoring system. The multiple-choice questions had at least five choices to select from. Each question had the choice, "I don't know" and each question had three or more correct answers. There was also one common misconception listed as a possible choice. Participants choosing all the correct answers, without circling the misconception received a "4." Any participant who selected the misconception received a "2" and any participant selecting "I don't know" received a "1." If a student did not select a misconception, but they did not select all the right answers, then they scored a "3." All numbers were recorded to SPSS and preliminary analyses were conducted to create sum scores of RCI at pre, post, and delayed post times.

These generated sum scores of participants RCI at pre-, post-, and delayed posttest times gives a general numerical showing of the participants' conception as a whole. The sum total of scores for each pre-, post-, and delayed posttests were analyzed on the basis of descriptive statistics and were used to develop initial assumptions about participants' conceptions. This data also preliminarily generated statistics used in further analyses to answer question one of this research study.

Preliminary statistical analyses showed that the sum of scores for RCI pretest had a mean score of 21.5 while RCI posttest had a mean of 25.83. The RCI delayed posttest sum of scores mean was 23.4. Hence, it statistically appears that an increase in overall conception occurred after intervention of either type of text structure whether refutational or expository. This finding is consistent with other studies as is verified in Guzzeti and colleagues' (1993) meta-analysis of similar research analyses. It is also interesting to note that the sum of scores from the delayed posttest was greater than the pretest, but less that the posttest. This finding seems to initially indicate that conception gained from the intervention was lost during the passage of time. This is a common finding in the conceptual change literature (Broughton et al., 2010). Such findings seem logical in the preliminary analyses and a deeper discussion of this phenomenon will ensue later in the research conclusions. In preparation for these later analyses the researcher created sum variables for faith, baptism, and grace at the pre, post, and delayed post levels.

Refutation and expository text preference. The third research question of the present study sought to discover which text preference LDS seminary students prefer when reading LDS doctrine. During delayed posttesting, students were given both

refutation and expository statements on the same topic. In both reading conditions,

students were asked to rate and explain how much they liked each text. Two survey

questions were created and four interview questions were additionally devised to discover

students' text preference. The text preference questions of the survey followed the

structure of Mason and colleagues (2008) in presenting a 5-point Likert-scale question

that appeared at the bottom of each text statement. Higher Likert-scale scores equaled

higher enjoyment of reading the text as the diction of these questions specifically aimed

at ascertaining students' text preference (see Appendix E). Another 5-point Likert-scale

question was also developed to act as a contrast measure for text preference. This

question sought to know participants general enjoyment of reading religious texts (see

Appendix H).

Descriptive statistics were initially calculated to determine the mean scores for all

three Likert-scale questions. It was discovered that refutation texts had a Likert-scale

mean of 3.97 while expository texts showed a mean of 3.80. Student enjoyment of

reading religious texts had a mean of 3.68. Skewness values of -.821(refutation text

preference), -.779 (expository text preference), and -.694 (enjoy reading religious texts)

showed that all three text preference scales were negatively skewed and in weak to

normal distribution. Kurtosis values of expository text preference and text enjoyment

questions were .136, and -.293, respectively. Since both kurtosis values were less than 1

and stably above 0 a normal distribution is assumed. In the refutation text preference

question the kurtosis value was -.004. This value is consistent with a mesokurtic (that is,

normally high) distribution that would indicate many scores weighted to one end of the

Likert scale. Such is expected, as the mean of refutation text preference is higher than the other two means. A significance test of the means will be analyzed later in this chapter.

Interviews. Following participants' reading and brief evaluating of the texts, randomly selected students were asked four open-ended interview questions aimed to draw out participants' opinions about the texts they have read (see Appendix F). These questions sought to enrich the study with raw data that gives insights to the perceptions that participants are having with the text. Examples of the types of questions asked are "What aspects of the text caught your interest?" or, "Which text statement did you prefer?" Interviews were recorded on an mp3 audio device and were later transcribed by an assistant to the primary researcher.

Participants' responses were coded into three general categories based on the constructs of text preference, interest, and conception reasoning. Text preference was simply grouped according to the rubric of "like" or "dislike." Interest was similarly categorized as participants' responses were placed into categories that showed that they felt the text was "interesting" or of "no interest." Conception reasoning referred to the participants' perception that reading the text caused them to reflect, ponder, question, or think. Responses surrounding participants' conception reasoning was coded as "made them think" or "no reasoning." A detailed table of the categories and subcategories of these items is presented in Table 4.5.

Preliminary Correlation Analysis

A correlation analysis was conducted among the instruments at the pretest, posttest, and delayed posttest levels to determine whether a relationship existed between

Table 4.5

Interviews

Construct	Text preference	Rationale	JJ	Savy	Lydia	Ian	Cam	Kai
Refutation	Like	Little more depth Stood out to me Caught my Attention	x				x	
	Dislike	Didn't like it; Primary Level				x		x
Expository	Like	Like more More Scriptures				x		x
Interest	Interesting	Baptism gives Holy Ghost	x			x		
	Interesting	Remission of Sins after	x	x			x	
	Interesting	Does not wash away sin	x	x	x	x	x	
	Interesting	Baptism is important						
	Interesting	Allows to Repent	x		x			
	Interesting	Didn't agree, interested				x		
	No interest	Basic primary level						x
	No interest	Knew it all before	x	x				x
Concept reasoning	Made me think	I didn't know	x	x				
	Made me think	Something New; Surprised	x	x	x			
	Made me think	Made me think	x			x	x	
	Made me think	More depth	x					
	Made me think	Stood out				x	x	x
	Made me think	Didn't agree; thought differently				x	x	
	No reasoning	Not really						x

topic interest and the RCI. A correlation analysis was also conducted to see if topic interest related to conceptual knowledge of the individual items of faith, baptism, and grace. A medium, but significant correlation was revealed between *topic interest* and *RCI pretest* as the Pearson coefficient $r = .446$, $N = 100$, $p = .000$, two tailed. The scatter plot also shows a correlation between the two variables with data points scored away from the regression line (see Figure 4.1). A stronger correlation was revealed between *topic interest* and *RCI posttest* as the Pearson coefficient $r = .503$, $N = 100$, $p = .000$, two tailed. The weakest correlation was revealed between *topic interest* and *RCI delayed*

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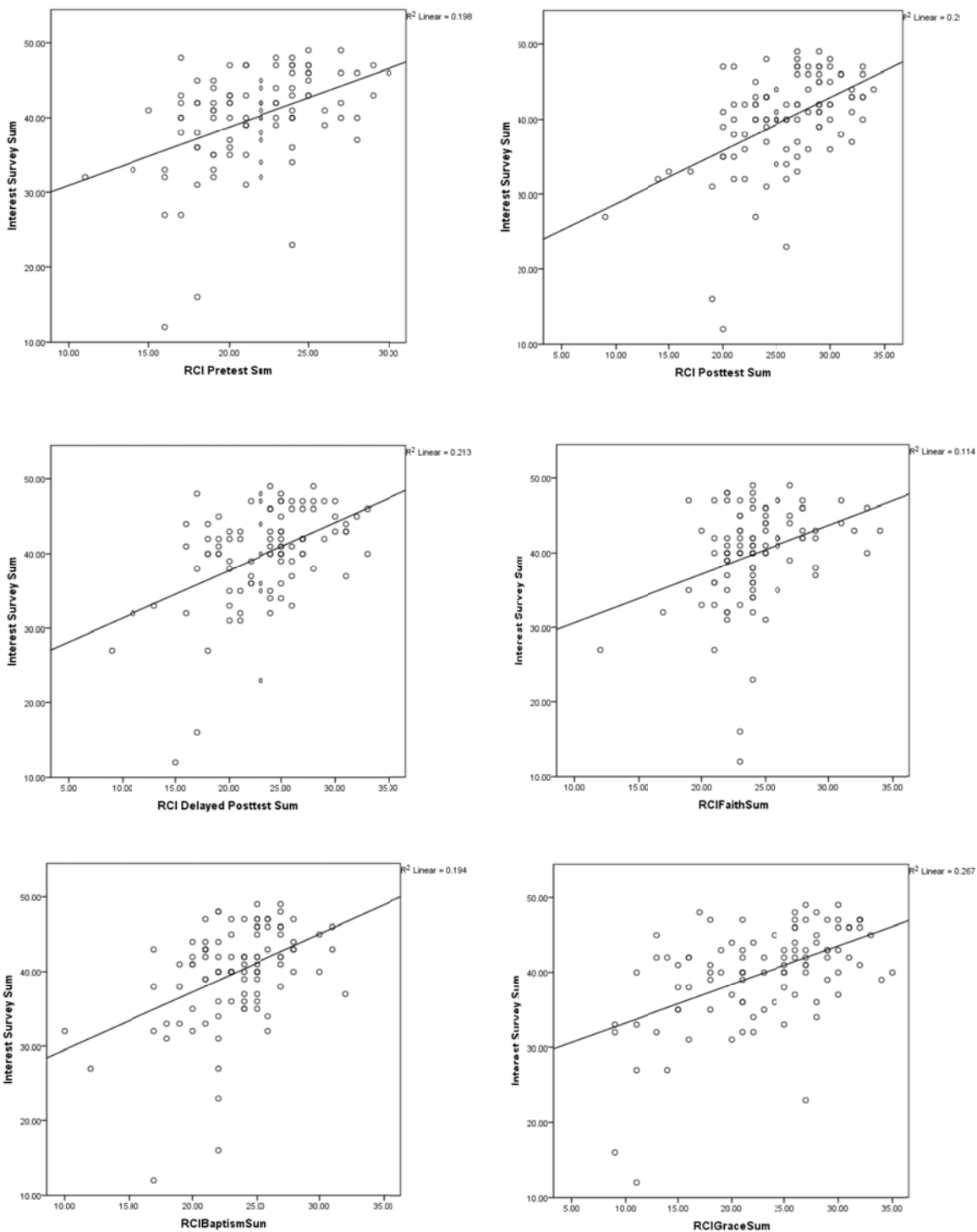
Figure 4.1. Correlation charts.

posttest as the Pearson coefficient $r = .462$, $N = 100$, $p = .000$, two tailed. However, all of these relationships were significant at a .01 *a priori* alpha level of significance; a greater significance level than the previously determined .05 *a priori* significance level set by the researcher.

The correlation of topic interest and individual RCI topics of faith, baptism, and grace were examined by creating sum variables for RCI pre, post, and delayed posttest items of each topic. These sum variables showed the overall scores of RCI topics individually. A Pearson correlation was computed and findings revealed significant weak to moderate correlations for each topic. A weak, but significant correlation was revealed between *topic interest* and *RCI Faith* as the Pearson coefficient $r = .338$, $N = 100$, $p = .000$, two tailed. A moderate correlation was revealed between *topic interest* and *RCI Baptism* as the Pearson coefficient $r = .441$, $N = 100$, $p = .000$, two tailed. Finally, a moderately strong relationship was seen between *topic interest* and *RCI Grace* as the Pearson coefficient $r = .441$, $N = 100$, $p = .000$, two tailed.

Plots along the regression lines also verify moderate correlations for each of these variables (see Figure 4.1). These findings in preliminary analyses indicate that there were positive relationships between the variables as topic interest may be playing a factor in RCI achievement scores. Similarly a correlation analysis was preliminarily performed to see if a relationship existed between the interventions and RCI post and delayed posttest. A moderate and significant correlation was revealed between *refutation/expository interventions* and *RCI posttest* as the Pearson coefficient $r = -.450$, $N = 100$, $p = .000$, two tailed. A weak, but significant (.05 *a priori* alpha level) correlation was revealed between

refutation/expository interventions and *RCI delayed posttest* as the Pearson coefficient $r = -.225$, $N = 100$, $p = .025$, two tailed. Findings indicate the existence of a relationship between the variables thus justifying further investigation of the refutation text affect.

Summary of Preliminary Analysis

Preliminary analysis set the stage for complete statistical and qualitative analyses to occur in the remaining pages of this chapter. Data were coded, necessary outliers/ discrepancy participants were dropped, new sum variables were created, descriptive stats were determined, consistency was tested, and significance levels were set. It should be further explained that outliers where checked for in the survey measurements during preliminary analysis. Though no outliers have been identified in the final sample size (*n* = 100), there were a few participants previously dropped from the study before statistical analysis, as it was apparent that they would be outliers in many concepts. This was due to a lack of effort in correctly reading and answering the items tested. Most of these participants' answers were not completed and even one participant had inappropriate diction and mockery in the completed responses. This was not a surprise to the researcher as notes were made flagging three to four participants when test items were completed in unrealistically fast times. Therefore it may be that possible outliers where dropped before having opportunity to be statistically discovered. In concluding preliminary analyses it should be further noted that the decision to set alpha at .05 *a priori* for each of the analyses was firmly made and such will be used for testing significance in the remaining sections of this study.

Text Structure and Conceptual Change

The first research question asked: Does the use of refutation text in LDS Religious Education significantly change student's conceptual knowledge of core scriptural doctrines in comparison to expository text? The subquestions specifically asked: Does the use of refutation text in LDS Religious Education change student's conceptual knowledge of Faith in comparison to expository text? Does the use of refutation text in LDS Religious Education change student's conceptual knowledge of Baptism in comparison to expository text? Does the use of refutation text in LDS Religious Education change student's conceptual knowledge of Grace in comparison to expository text? To examine this question and its sub-questions individually, the researcher first examined the descriptive statistics by calculating the means and standard deviations as noted in the preliminary analysis.

Descriptive and Frequency Calculations

Preliminary statistical analyses showed that the sum of scores for RCI pretest had a mean score of 21.5 while RCI posttest had a mean of 25.83. The RCI delayed posttest sum of scores mean was 23.4. The higher mean averages suggest that the text interventions, whether refutational or expository, indicate a positive increase of conceptual knowledge as whole. However, a further analysis that specifically separates the experimental group from the control group is needed to more correctly view the refutation text effect in answering question one. Therefore, the researcher calculated the means and mean differences of the experimental group (refutation text) in comparison to

the control group (expository text). This was done for the RCI pre-, post-, and delayed

posttests as a whole and then such statistics were gathered on the individual topics of

faith, baptism, and grace (see Table 4.6).

It was discovered that in every case the experimental group's (refutation text)

means were higher than the control group's (expository text) means. The mean of the

experimental group's RCI posttest ($M = 27.72$) was 5.97 points higher than the pretest

mean ($M = 21.75$) while the mean average of the control group's RCI posttest ($M = 23.6$)

was only 2.37 points higher than the pretest mean ($M = 21.23$). The delayed posttest

Table 4.6

Means and Differences by Topic and Time for Religious Concepts Inventory

	Refutation		Expository	
Variable	Text (*M*)	Conception change	Text (*M*)	Conception Change
Topic				
RCI faith sum	24.90		23.42	
RCI baptism sum	24.77		21.89	
RCI grace sum	24.09		21.80	
Time				
RCI pretest	21.75		21.23	
RCI posttest	27.72	5.97	23.60	2.37
RCI delayed	24.37	2.62	22.28	1.05
RCI faith pretest	7.77		7.73	
RCI faith posttest	8.74	.97	7.86	.13
RCI faith delayed	8.46	.69	7.82	.09
RCI baptism pretest	7.44		7.17	
RCI baptism posttest	9.46	2.02	7.54	.37
RCI baptism delayed	7.87	.43	7.17	0
RCI grace pretest	6.53		6.32	
RCI grace posttest	9.51	2.98	8.19	1.87
RCI grace delayed	8.03	1.50	7.28	.96

showed similar results as the experimental group's mean (M =24.37) positively increased

2.62 points above the pretest mean and the control group's mean (M =22.28) rose only

1.05 above the pretest mean. These increases of the mean scores on RCI post and delayed

posttests indicate that greater conceptual knowledge was demonstrated in testing by those

with refutation text intervention than by those with expository text intervention. These

scores may also indicate that conceptual change is happening to a greater degree in the

experimental group than in the control group and further analyses on each item will be

employed to aide in verifying this assumption.

The mean post and delayed posttest scores for individual topics of faith, baptism,

and grace were also higher in the experimental group than in the control group (see Table

4.6). RCI faith pretest means for the experimental and control group were 7.77 and 7.73,

respectively. RCI faith posttest means were .97 points higher for the experimental group

and .13 points higher for the control group. RCI faith delayed posttests saw experimental

group mean of 8.46 and a control group mean of 7.82. These scores reflected a mean

score increase of .69 and .09 from the pretest means. A frequency test was also run and

found that 8% of participants had the misconception on RCI faith Concept 1 while 84%

and 31% of participants had misconceptions on RCI faith Concept 2 and three

respectively. RCI faith posttest saw a decline of participants' misconceptions on RCI

faith concepts items two and three with 61%, and 26% respectively. RCI faith item one

did have a slight increase as 9% of participants indicated a misconception in posttesting.

RCI baptism pretest means for the experimental and control group were 9.46 and

7.54, respectively. RCI baptism posttest means were 2.02 points higher for the

experimental group (M = 11.48) and .37 points higher for the control group (M = 7.91).

This was quite a large discrepancy indicating that the refutation text on baptism more

dramatically influenced conceptual understanding in comparison to the expository text.

RCI baptism delayed posttests saw experimental group mean of 7.87 and a control group

mean of 7.17. These scores reflected a mean score increase of .43 for the experimental

group and a zero-point increase from the control group when compared to pretest means.

It is apparent that the conceptual changes from the intervention waned over time as scores

in delayed posttesting were minimally higher than pretest scores and significantly lower

than posttest scores t(100) = 45.995, p < .05. This could reflect a robust misconception

that was overcome initially by the refutation text statements read. Over time, participants

reverted to their previously held misconceptions (Tyson, 1997). Similar findings have

been identified in previous studies (Broughton et al., 2010; Palmer, 2003) and additional

statistical analyses will be conducted to determine if this trend is occurring within the

present study.

A frequency test was conducted and that revealed 13% of participants held the

misconception on RCI baptism Concept 1 while 67% and 86% of participants had

misconceptions on RCI baptism Concept 2 and three respectively. RCI baptism posttest

saw a sharp decline of participants who reported misconceptions, with only 9%, 34%, and

48% having misconceptions on RCI baptism Concept 1, 2, and 3, respectively. However,

it was observed that an increase of students with misconceptions was found in the

delayed posttest as 61% had misconceptions on RCI baptism Concept 2 and 71% had

misconceptions on RCI baptism Concept 3. These frequency statistics represent all 100

participants and do not separate the intervention and control groups. However, these statistics do verify that a robust misconception is had in the topic of baptism.

RCI grace pretest means for the experimental and control group were 6.53 and 6.32, respectively. These pretest means were lower than the previous topics of faith and baptism indicating a greater number of participants with limited knowledge or misconception. RCI grace posttest means were 2.98 points higher for the experimental group and 1.87 points higher for the control group. The large increase of mean scores for both refutation and expository text add to the assumption that knowledge was scarce in pretest and any intervention added to the knowledge at large, thus significantly increasing the mean scores of RCI posttest conception. RCI grace delayed posttests saw experimental group mean of 8.03 and a control group mean of 7.28. These scores reflected a mean score increase of 1.50 for the experimental group and a .96 increase from the control group when compared to pretest means.

A frequency test was run and found that 66% of participants indicated "no conception" on RCI grace Concept 1 while 39% and 30% of participants also indicated "no conception" on RCI grace Concept 2 and three respectively. RCI grace posttest saw a sharp decline of participants indicating "no conception" with only 18%, 16%, and 8% having "no conception" on RCI grace Concept 1, 2, and 3, respectively. It was further noted that only 3-5% of participants showed evidence of the misconception while 25-54% had partial conceptions of the topic of grace. This helps confirm the assumption that knowledge was gained more than changed with interventions in the topic of grace as 4-8% of participants still held the misconception at posttest while 41-60% gained partial

knowledge.

These overall frequency tests suggest that a change in conceptions is occurring (whether the change in conception derived from the acquisition of new knowledge or the restructuring of misconceptions). In order to compare and contrast the specific conceptual changes occurring in the experimental and control group, the researcher sought to specifically gather frequency data by creating new variables specific to the individual group (experimental and control). As research question one seeks to specifically understand conceptual change and not conceptual acquisition, the researchers were more interested in the frequency of change from *misconception* to *partial* or *correct* conception than change from *no conception* to *partial* or *correct conception*.

Faith. Frequency tests run on faith Concept 1 at pretest found that 11.1% percent of the experimental group had misconceptions and 4.3 % of the control group had misconceptions. This is a relatively small minority of the overall population of this study and perhaps the concept was fairly well understood by all. 85% of the experimental group had partial or correct conception and 89% of the control group had partial or correct conception. After interventions the experimental group was unchanged at posttesting with 11.1% still having the misconception. However, the control group actually saw an increase in participants with misconceptions about faith Concept 1 in posttesting as 6.3% of participants' elicited misconceptions. That was an increase of 2%. This suggests that faith Concept 1 was a robust misconception and that interventions did not positively affect conceptual change.

Faith Concept 1 delayed posttests also showed a continuance of the

misconception as the experimental group had 7.4% of participants reported a misconception and the control group remained with 4.3% of participants having a misconception. The drop in misconceptions in the refutation text (experimental) group could have been the result of chance and may not be significant. There is also a chance that slight remembering of the intervention caused participants at a later time to score more correctly. The researchers at this point find it too difficult to determine as further analyses is needed to show whether any significant change was occurring.

Frequency tests conducted on faith Concept 2 at pretest revealed that 85.2% of the experimental group had a misconception while 82.6 % of the control group had a misconception. After interventions, the experimental group was changed 35.2% at posttesting as 50% still had the misconception. However, the control group posttest scores revealed a less drastic decrease with a change of only 8.7% as 73.9% of the control group still elicited the same misconceptions from pretesting. Delayed posttest scores showed a slight increase in those manifesting misconceptions about faith Concept 2 as the experimental group rose 13% to 63% and the control group rose 4.4% to 78.3%.

These frequency findings suggest that the experimental group who read refutation texts at intervention had a higher likelihood to have a change in conception. It also suggests that the passage of time leads to a returning to the previously held misconceptions. Approximately 36.9% of those who overcame the misconceptions at posttest returned to their misconception at delayed posttest in the experimental group. 50.5% of those who overcame misconceptions at posttest returned to their misconception at delayed posttest in the control group. This further suggests that refutation texts about

faith had greater and longer lasting power for conceptual change in faith Concept 2 of

this study. Tests of significance will be reported later in this chapter to note if such

findings and interpretations prove valid at *a priori* .05 significance level.

Frequency tests run on faith Concept 3 at pretest found that 33.3 % percent of the

experimental group held misconceptions and 28.3 % of the control group held

misconceptions. After interventions, the experimental group scores had a minor change

of 7.4% as 25.9% of the sample still had the misconception. Control group participants

saw a change of 2.2% as 26.1% of the sample still had the misconception. These statistics

still assert a higher percentage of conceptual change among those receiving the

experimental intervention (refutation text) than those in the control group (expository text

intervention), but tests of significance must verify the strength and validity of this

finding.

Delayed posttest results for the experimental group mirrored faith Concept 1 and

two as a slight increase in those having misconceptions occurred. Results showed a 1.9%

increase in those having misconceptions in delayed posttests for faith Concept 3. The

delayed posttest results for the control group changed 4.4%, but in the opposite direction

as only 21.7% had the misconception compared to the posttest of 26.1. This anomaly was

inconsistent with the other results observed across topics in delayed posttesting and could

be the result of chance as tests of significance may indicate.

Baptism. Frequency tests run on baptism Concept 1 at pretest revealed that 10.9%

of the experimental group had a misconception while 14.8 % of the control group had a

misconception. After interventions, the experimental group was changed 5.3% at

posttesting as 9.6% still had the misconception. The control group posttest scores, however, revealed a smaller decrease of only 1.1% as 13% of the control group still elicited the same misconceptions from pretesting. Delayed posttest scores showed a returning to the misconceptions or an increase in participants with no conceptions about baptism Concept 1 as the experimental group rose to 26% and the control group rose to 19.5%. It is possible that the increase of participants with no conception of baptism Concept 1 could be explained by the lack of effort or interest that participants exuded in completing delayed posttest questions. This probable explanation was given as researchers noted that delayed test results for baptism Concept 1 showed less doctrinally correct understanding and more misconceptions at delayed posttest than at pretest. Either knowledge had decreased overall or participants did not put forth as much effort in posttest question response as they may have done in pretest question response.

Frequency tests run on baptism Concept 2 at pretest indicated that 72.2 % of the experimental group had a misconception while 60.9 % of the control group had a misconception. After interventions, the experimental group was changed 55.5% at posttest as only 16.7% of the participants reported a misconception in their response. The control group posttest scores indicated a minor change of only 6.6%, as 54.3% of the control group still elicited the same misconceptions present at pretest. The trend with participants reverting to their original misconceptions continued at delayed posttest. The experimental group showed an increase in misconceptions from posttest to delayed posttest with 53.7% of participants reporting misconceptions. Similarly, the control group rose from posttest to delayed posttest with 69.6% of participants reporting

misconceptions.

Frequency tests run on baptism Concept 3 at pretest showed that 83.3% of the experimental group had a misconception while 89.1% of the control group had a misconception. After interventions, the experimental group dropped to only 16.7% of participants with misconceptions while the control group posttest scores still had 87% of participants with misconceptions. This finding shows a wide discrepancy of the experimental group and the control group as the experimental interventions decreased the number of misconceptions by 82.2%. The control group had only one participant change misconceptions on baptism Concept 3. This participant accounted for a 2% change in conception. Such a discrepancy appears to have significant differences between the refutation text's (experimental) ability for fostering conceptual change and the expository text's (control) ability for fostering conceptual change.

Delayed posttest scores followed similar patterns as a return to misconceptions occurred among the experimental group as 63% elicited misconceptions. The control group changed slightly with an increase of participants with no conception and a slightly lower percentage (80.4%) of participants with misconceptions. In looking at individual participants, the researchers discovered that some with misconceptions at posttest had no conception at delayed posttest. Thus it appears that the number of participants with misconceptions was bettered in delayed testing when the reality is that some with misconceptions lost any type of coherent conception before completing delayed posttests. It also raises questions about the effort of the participants in answering delayed post test questions. Lack of effort could be one explanation for these findings as students choose

to write less complete answers at this final stage of testing.

Grace. Unlike the previous three faith and baptism concepts, the frequency tests run on grace Concept 1 found that a majority of participants had no conception of this topic. Responses from the experimental group suggested that 66.7% of the participants had no conception and 65.2% of the control group had no conception. Though the scope of the research is to examine those with misconceptions and the conceptual change of such, the findings of the grace concept may encourage researchers to further investigate aiming to explore refutation and expository text's power for conceptual acquisition. Those with misconceptions about grace Concept 1 totaled only three participants, with one participant in the control group and two participants in the experimental group. After interventions, there was not a decrease in the percentage of participants with misconceptions. There was, however, a significant amount of concept acquisition that occurred.

Participants with no conception dropped to 13% in the experimental group and those with no conception in the control group dropped to 23%. The researcher finds it interesting that more participants in the experimental group increased to a partial or complete conception after reading the refutation text than those in the control group who read expository texts. Especially since both texts, whether refutational or expository, elicit the exact same contextual information with only a small structure difference between the two (see Appendices C and D).

Delayed posttest scores showed still showed little change in those with misconceptions, but those with no conception increased from posttest scores suggesting a

forgetting of the knowledge acquired from the text intervention. Thirty-seven percent of those in the experimental group had no conception, a rise of 27% from posttest to delayed posttest. The control group saw a more significant increase in participants with no conception as 52.2% indicated such responses in delayed posttesting of grace Concept 1. This rise of 29% is slightly higher than those reading refutation texts and perhaps gives light on future studies involving refutation text's power in conceptual acquisition of new knowledge.

Frequency tests run on grace Concept 2 at pretest revealed similar results to grace Concept 1. Only 3.7% of participants had misconceptions in the experimental group, but 37% elicited no conception. Participants in the control group reporting misconception at pretest were 4.3% with 41.3% of participants had no conception. After interventions, the experimental group was changed 2.4% at posttesting as only 1.9% still had the misconception. Only 11.1% of experimental group posttest scores verified no conception. The control group posttest scores, however, revealed an increase of 2.2% as 6.5% elicited the misconceptions. Furthermore, the decrease in participants with no conception was minor as 21.7% indicated they still had no conceptual knowledge of grace Concept 2. As in grace Concept 1, the experimental group had a greater decrease in those with no conception (25.9%), compared to the decrease (19.6%) observed in the control group. The experimental group also had greater overwriting of misconceptions than did the control group and it appeared that the control group's expository text actually increased misconceptions by 2.2%.

Delayed posttesting of grace Concept 2 revealed a return to misconceptions in the

intervention group as 3.7% again elicited the misconception. Those with no conception increased 11.1% to 22.2% in delayed posttesting in the experimental group. This was still lower than the percentage of participants with no conception in the control group. 30.4% (a rise of 8.7% from posttest) of participants in the control group had no conception of grace Concept 2 at delayed posttest. These delayed posttest results further show a discrepancy in refutation text's ability to help participants gain and retain conceptual knowledge of concepts at a higher frequency than those reading expository texts. Such findings invite further investigation.

Frequency tests on grace Concept 3 found that a majority of participants had partial or correct conception of the concept. The experimental and control group had 70.4% and 58.7%, respectively. Frequency charts on grace Concept 3 at pretest also indicated that 3.7% of the experimental group held misconceptions while 6.5 % of the control group held misconceptions. After interventions, the experimental group was unchanged at posttest and the control group increased to 10.9% of participants with misconceptions. It is apparent that some in the control group might have picked up a misconception from what they read in the intervention. Perhaps the reading triggered a past misconception that was taught or maybe they misread the reading. Delayed posttest scores revealed no change in the percentages of participants with misconceptions at pre and posttests for the experimental group. The control group saw a slight decrease of 2.2% in those with misconceptions. Perhaps participants were moving back to the same state of conception elicited at pretest as the percentage of participants scoring "no conception" rose 6.5% to 21.7%.

Overall the frequency analyses suggested that the experimental group reading refutation texts had higher percentages of conceptual change across nearly all concepts than those in the control group. In eight out of nine concepts, the experimental group saw a greater decline in participants with misconceptions; the only exception coming in "grace Concept 3" where misconception percentages remained the same in the experimental group, but increased in the control group. These frequency tests also indicate that conceptual acquisition percentages were higher when participants read refutation text in comparison to the expository text of the control group. A returning to misconceptions was also observed among concepts in the delayed posttest. However, it is important to note that the final percentage of participants with misconceptions in the control group was always higher than that of the experimental group. These frequency findings lead the researcher to an initial assumption that refutation text appears to change students' conceptual knowledge of core scriptural doctrines more than expository text. Frequency data indicates such higher percentages in all three doctrines of faith, baptism, and grace. This assumption needs validation by determining if significant variance exists between refutation and expository groups; therefore the researcher continued research plans to conduct analyses of variance.

One-Way and Repeated Measures ANOVA

The researcher conducted an ANOVA using text type (refutation, expository) as the fixed factor and time (pretest, posttest, or delayed posttest) as the dependent factors. Participants' conceptual knowledge was the outcome variable and alpha was set *a priori* at *.05*. The ANOVA compared scores of the RCI refutation and expository groups as the

fixed factor in order to see if the variance of higher outcome scores for the refutation text intervention were significant. The concept item means and change in means from pre, post, and delayed posts tests are presented in Table 4.7. The means and standard deviations of the sum scores and topics from the one-way ANOVA are seen in Table 4.8. The sum scores of all tests were analyzed before repeated measure ANOVA computations were conducted on the RCI as a whole and then on the specific concepts items of faith, baptism, and grace.

Results of a one-way ANOVA on the RCI showed no significant variance between the refutational and expository groups at pretest, $F(1,98) = .500$, $p = .481$. This was to be expected, as the intervention had not been introduced. The purpose of the pretest aimed to illicit what participants currently knew about concepts and little variance existed between group pretest scores.

However, the analysis did reveal significant variance between groups after text interventions were given. Both posttest and delayed posttest ANOVA results indicated significant variance between the groups as the mean conceptual scores of the refutation text group were higher (these higher percentage scores were previously verified in descriptive and frequency tests). At posttest, a significant variance in scores was found in favor of the refutation text group, $F(1,98) = 24.81$, $p = .000$, suggesting participants' knowledge shifted from misconceptions to partial or correct knowledge. The same significant difference between groups was seen in the delayed posttest in favor of the refutation text group, $F(1,98) = 5.21$, $p = .025$.

Levene statistics and preliminary analyses indicate that homogeneity of

Table 4.7

Means and Differences by Topic and Time for Religious Concepts Inventory

RCI topic/time	Refutation		Expository	
	Text (*M*)	Conception change	Text (*M*)	Conception Change
Faith				
Concept 1 pre	2.96		2.86	
Concept 1 post	3.12	+.16	3.00	+.14
Concept 1 delay	3.09	-.03	2.91	-.09
Concept 2 pre	2.12		2.17	
Concept 2 post	2.74	+.62	2.17	0
Concept 2 delay	2.57	-.17	2.06	-.11
Concept 3 pre	2.68		2.69	
Concept 3 post	2.87	+.19	2.69	0
Concept 3 delay	2.79	-.08	2.84	+.15
Baptism				
Concept 1 pre	2.98		2.80	
Concept 1 post	3.27	+.29	3.08	+.28
Concept 1 delay	3.00	-.27	2.84	-.24
Concept 2 pre	2.29		2.30	
Concept 2 post	3.27	+.98	2.36	+.06
Concept 2 delay	2.46	-.81	2.26	-.10
Concept 3 pre	2.16		2.06	
Concept 3 post	2.90	+.74	2.08	+.02
Concept 3 delay	2.40	-.50	2.06	-.02
Grace				
Concept 1 pre	1.68		1.73	
Concept 1 post	3.05	+1.37	2.69	+.96
Concept 1 delay	2.48	-.57	2.10	-.59
Concept 2 pre	2.31		2.21	
Concept 2 post	3.27	+.96	2.67	+.46
Concept 2 delay	2.68	-.59	2.45	-.22
Concept 3 pre	2.53		2.36	
Concept 3 post	3.18	+.65	2.82	+.46
Concept 3 delay	2.87	-.31	2.71	-.11

Table 4.8

Means and Standard Deviations for Refutation and Expository Text Groups

Topic/time	Refutation ($N = 54$)		Expository ($N = 46$)	
	Text (M)	SD	Text (M)	SD
RCI pretest	21.75	3.52	21.23	3.83
RCI posttest	27.72	4.08	23.60	4.14
RCI delayed	24.37	4.77	22.28	4.28
RCI faith pretest	7.77	1.19	7.73	.854
RCI faith posttest	8.74	1.56	7.86	1.42
RCI faith delay	8.46	1.43	7.82	1.21
RCI baptism pretest	7.44	1.02	7.17	1.19
RCI baptism posttest	9.46	1.67	7.54	1.08
RCI baptism delayed	7.87	1.80	7.17	1.35
RCI grace pretest	6.53	2.42	6.32	2.78
RCI grace posttest	9.51	2.00	8.19	2.53
RCI grace delayed	8.03	2.75	7.28	2.72

variances can be assumed across all concepts and effect size measurements specific to

RCI posttest and delayed posttest indicate $\eta^2 = .202$ and $\eta^2 = .050$, respectively. In this

case, 20% of all variance in posttest and 5% of all variance in delayed posttest is

accounted for by the factor groups (refutation and expository). These statistics indicate

significant differences and lead the researcher to believe that an alternate hypothesis may

have some value as the mean posttest and delayed posttest scores were higher for those in

the refutation group than those in the expository text group. Using similar ANOVA

strategies, the researcher conducted analyses on the individual sum scores of the RCI by

doctrinal concept. The concepts of faith, baptism, and grace all revealed no significant

individual differences at pretest, but like the overall RCI, there were some significant

variance in post and delayed posttest analyses.

Next, I conducted an ANOVA using text type (refutation, expository) as the fixed factor and time (posttest, or delayed posttest) as the dependent factor using the sum scores of participants' answers on the concepts of faith. The means and standard deviations of this analysis are presented in Table 4.9. The results of the ANOVA for posttest showed significant variance in favor of the experimental group, $F(1,98) = 8.33$, $p =. 005$, $\eta^2 = .078$. This trend continued at delayed posttest, reflecting increased conceptual understanding in favor of the refutation text group, $F(1,98) = 5.60$, $p =. 020$, $\eta^2 = .054$. Effect size measurements at posttest and delayed posttest indicate $\eta^2 = .078$ and $\eta^2 = .054$, respectively, and it can be determined that 7.8% of all variance in posttest and 5.4% of all variance in delayed posttest, is accounted for by the factor groups (refutation and expository).

Results of ANOVA using the sum scores of participants' answers on the concept

Table 4.9

RCI Tests Pre-, Post-, Delayed Posttest, Means, and
Standard Deviations by Group

Time/group	*M*	*SD*	*N*
RCI pretest			
Refutation text	21.75	3.52	54
Expository text	21.23	3.83	46
RCI posttest			
Refutation text	27.72	4.08	54
Expository text	23.60	4.14	46
RCI delayed posttest			
Refutation text	24.37	4.77	54
Expository text	22.28	4.28	46

of baptism found a significant difference between groups at posttest, $F(1,98) = 44.21$, p =. 000. Effect size measurements at posttest indicate $\eta^2 = .31$ attesting that 31% of all variance is conditional upon the factor group of refutation or expository text interventions. Delayed posttests also indicated significant variance between groups as $F(1,98) = 4.63$, p =. 034. The effect size measured $\eta^2 = .045$ and 4.5% of variance was accounted for by the factor groups. Results of grace specific ANOVA at posttest showed a significant variance as refutation text groups again had higher test score means, $F(1,98) = 8.47$, p =. 004. Eight percent of all variance is accounted for by the factor groups as the effect size measured $\eta^2 = .080$. Grace specific delayed posttest ANOVA indicate no significant variance between factor groups, $F(1,98) = 1.87$, p =. 174. This confirms the anomaly of higher mean scores previously seen in grace concepts at delayed posttests and indicates that such scores could be the result of chance and not interventions of the study.

The results of these ANOVA's suggest that the refutation text intervention fosters significant difference in conceptual knowledge over and above the expository text interventions. The researcher determined that frequency data showing higher mean scores of conception for the refutation text group are significant. It also strengthens the assumption that refutation text is producing significantly more conceptual change in the topics of faith, grace, and baptism, than is expository text as mean scores of the refutation group were higher. It even further supports the researcher's initial/alternative hypothesis that students will engage more deeply with the refutation text intervention than expository text intervention, thus increasing the likelihood of conceptual change (Dole & Sinatra, 1998). To explore these assumptions more deeply by topic, the researcher

conducted repeated measure ANOVA tests on the RCI at pre-, post-, and delayed posttest times.

A repeated measures ANOVA was first conducted to compare students' religious concepts inventory using text type (refutation and expository) as the between subjects factor and time (pretest and posttest) as the within-subjects factor. Table 4.9 displays the means and standard deviations. The analysis revealed a main effect of condition, indicating a significant advantage for the refutation over the expository text intervention, $F(1, 98) = 10.850$, p = .001. This finding further supports the significance of means and frequency data showing greater conceptual change among those reading refutation texts. The analysis also showed a significant effect for time, $F(1, 98) = 148.437$, $p = .000$, indicating that students' concepts about religion changed from pretest to posttest. This main effect of time is reflected in the increase of the means from pretest to posttest as shown in Table 4.7. Significant interactions were also revealed in the analysis, $F(1, 98) = 27.606, p = .000$.

A second repeated measures ANOVA was conducted to compare students' religious concepts inventory using text type groups as the between subjects factor and time (pretest and delayed posttest) as the within subjects factor. A similar trend was shown with this set of findings and the means and standard deviations are presented in Table 4.9. The ANOVA showed a significant main effect of time as students' conceptual understanding about religion increased from pretest to delayed posttest, $F(1, 98) = 27.606, p = .000$. There were, however, no significant differences between text type groups from pretest to delayed posttest. The analysis also showed a fairly significant

interaction between time and text groups, F (1, 98) = 5.704, p = .019.

Repeated measures ANOVA strategies were then used to analyze each concept

individually at pre, post, and delayed posttest levels. The first repeated measures

ANOVA compared scores on faith Concept Item 1 with text type as the between group

factor and time of test (pretest, posttest) as the within subjects factor. The means and

standard deviations are presented in Table 4.10. The results found no significant

interactions between reading groups and time. The findings also failed to show a

significant main effect of text type. This suggests that students' ability to correctly write

Table 4.10

Concept Items 1 and 2 Means and Standard Deviations by Group

Time, group	*M*	*SD*	*N*
Faith concept item 1			
Pretest			
Refutation text	2.96	.548	54
Expository text	2.86	.581	46
Posttest			
Refutation text	3.12	.674	54
Expository text	3.00	.516	46
Delayed posttest			
Refutation text	3.09	.591	54
Expository text	2.91	.508	46
Faith concept item 2			
Pretest			
Refutation text	2.12	.551	54
Expository text	2.17	.529	46
Posttest			
Refutation text	2.74	.955	54
Expository text	2.17	.529	46
Delayed posttest			
Refutation text	2.57	.881	54
Expository text	2.34	.781	46

answers for faith Concept 1 at posttest were not more advantageously affected by either a refutation or expository text intervention; rather both interventions produced similar results in conceptual change. This was determined as the analysis revealed a significant main effect for time suggesting that students' conceptual understanding on faith Concept Item 1 significantly changed from pre- to posttest, $F(1, 98) = 8.693$, $p = .004$.

A second repeated measures ANOVA compared students' scores on faith Concept Item 1 using text type as the between group factor and time of test (pretest, delayed posttest) as the within subjects factor. Table 4.10 displays the means and standard deviations. Analyses found no significant main effect of condition or a significant main effect of time. The analysis also failed to show a significant interaction. Implications of these findings suggest that interventions on this concept had little to no effect on conceptual change over time.

The repeated measures ANOVA strategy was used to analyze faith Concept Item 2. Text type was used as the between group factor and time of test (pretest, posttest) as the within subjects factor. The means and standard deviations are displayed in Table 4.10. The analysis did reveal a main effect of condition, indicating a significant advantage between text type groups, $F(1, 98) = 3.391$, $p = .022$. The analysis also showed a significant main effect of time on faith Concept Item 2, $F (1, 98) = 4.638$, $p = .001$. This main effect of time is reflected in the increase of the means from pretest to posttest as shown in Table 4.7. Students in both groups experienced a forward shift in their correct understanding of faith's inclusion of works. The results also showed a significant interaction between text type and time. Refutation text showed advantage over the

expository text from pre to posttest, $F(1, 98) = 4.638$, $p = .001$.

The second repeated measures ANOVA conducted on faith Concept Item 2 used text type as the between group factor and time (pretest, delayed posttest) as the within subjects factor. Table 4.10 shows the means and standard deviations. Significant differences were found between text groups, $F(1, 98) = 4.792$, $p = .031$. Figure 4.2 helps to make this main effect more visible. A main effect of time was shown, indicating a significant shift in students' acceptance of correct concepts of faith, $F(1, 98) = 4.919$, $p = .029$. This suggests that the forward shift towards acceptance experienced from pretest to posttest was sustained over time through delayed posttest. There were also significant interactions found between time and text type groups as refutation texts outperformed the
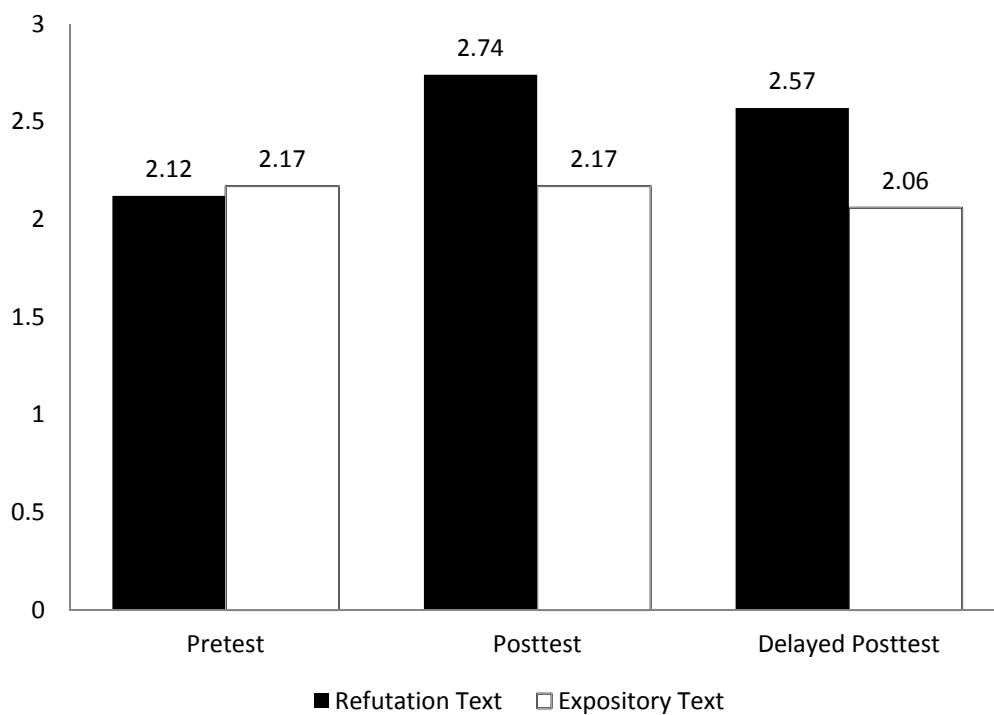

Figure 4.2. Group means of faith Concept Item 2.

expository text group over time, $F(1, 98) = 3.800$, $p = .000$.

To analyze students' responses to faith Concept Item 3, a repeated measures

ANOVA was conducted using text type as the between group factor and time (pretest,

posttest) as the within subjects factor. The means and standard deviations are shown in

Table 4.11. The analysis failed to show a main effect of text type, indicating that both

groups performed similarly. There was also no significant main effect of time revealed

neither were there significant interactions found. Another repeated measures ANOVA

Table 4.11

Faith Concept Item 3 and Baptism Concept Item 2 Means and
Standard Deviations by Group

Time, group	*M*	*SD*	*N*
Faith concept item 3			
Pretest			
Refutation text	2.68	.507	54
Expository text	2.69	.552	46
Posttest			
Refutation text	2.87	.615	54
Expository text	2.69	.627	46
Delayed posttest			
Refutation text	2.79	.655	54
Expository text	2.84	.631	46
Baptism concept item 1			
Pretest			
Refutation text	2.98	.713	54
Expository text	2.80	.884	46
Posttest			
Refutation text	3.27	.877	54
Expository text	3.08	.693	46
Delayed posttest			
Refutation text	3.0	.951	54
Expository text	2.84	.868	46

comparing students' responses to faith Concept Item 3 using text type group as the

between subjects factor and time (pretest, delayed posttest) as the within subjects factor

showed a similar trend. Table 4.11 displays the means and standard deviations. Again,

there was no main effect of text type from pretest to delayed posttest nor was there a

main effect of time. Furthermore the analysis did not reveal any significant interactions.

Therefore it is assumed that interventions for Faith Concept 3 did not produce any

significant conceptual change.

A repeated measures ANOVA was also conducted to compare students' responses

to baptism Concept Item 1 using text type as the between subjects factor and time

(pretest, posttest) as the within subjects factor. Table 4.11 presents the means and

standard deviations. As with the previous concept item analyses, this analysis on baptism

Concept Item 1 found no significant differences between groups. However, a main effect

of time was revealed, $F(1, 98) = 8.624, p = .004$. This indicates that students' responses

incorporated more correct concepts to this item from pretest to posttest. No significant

interactions were found.

A second repeated measures ANOVA was conducted to compare students'

answers on baptism Concept Item 1 using text type as the between subjects factor and

time (pretest, delayed posttest) as the within subjects factor. The means and standard

deviations are displayed in Table 4.11. Again, the analysis failed to show a significant

main effect of condition. The analysis also showed that there was no main effect of time.

As shown in the means, students' conceptions about baptism Concept Item 1 were

relatively the same at pretest and delayed posttest. This finding is common in conceptual

change research in that individuals often experience a returning to their previously held

misconceptions from posttest to delayed posttest.

The repeated measures ANOVA strategy was used to compare students'

responses to Baptism Concept Item 2 using text type groups as the between subjects

factor and time (pretest, posttest) as the within subjects factor. The means and standard

deviations are presented in Table 4.11. The analysis showed a significant advantage

between text type groups, indicating that those in the refutation text intervention reading

group had a degree of conceptual change, $F(1, 98) = 18.381$, $p = .000$. Figure 4.3 makes

this main effect more visible. Table 4.7 shows the increase of the mean from pre- to

posttest as a moderate gain and the ANOVA procedure confirms the significance of these

statistics. A main effect of time was found from pretest to posttest, $F(1, 98) = 46.153$, $p =$
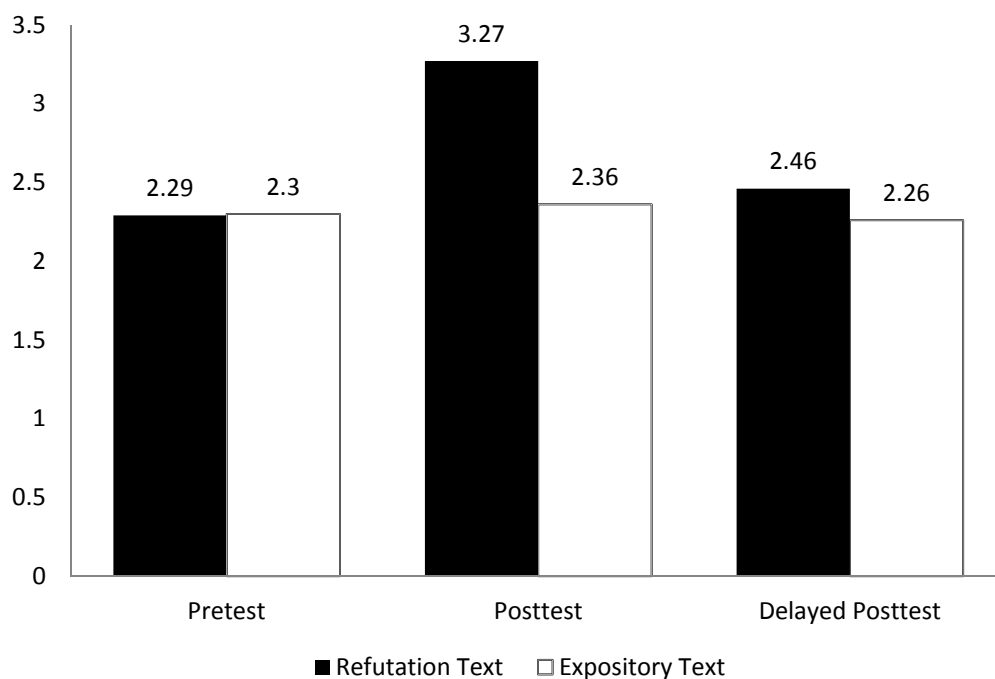

Figure 4.3. Group means of baptism Concept Item 2.

.000. This main effect indicates that students experienced conceptual change from pretest to posttest in their understanding of baptism Concept Item 2. Finally a significant interaction was also found between time and text type, $F(1, 98) = 35.367, p = .000$.

A repeated measures ANOVA for Baptism Concept Item 2 was again conducted using text type as the between subjects factor and time (pretest, delayed posttest) as the within subjects factor. Table 4.11 shows the means and standard deviations. The analysis revealed no significant effect of text type from pretest to delayed posttest. In addition, the analysis showed no significant effect of time from pretest to delayed posttest (see Figure 3). Students' conceptual change about Baptism Concept Item 2 was not sustained over time despite high change in the refutation text groups' conception at posttest. No significant interaction was revealed.

Repeated measures ANOVA strategies were used to analyze baptism Concept Item 3 with text type as the between group factor and time of test (pretest, posttest) as the within subjects factor. The means and standard deviations are presented in Table 4.11. The results found significant interactions between text type groups and time, $F(1, 98) = 40.144, p = .000$. The findings also showed a significant main effect of text type, $F(1, 98) = 54.968, p = .000$. This suggests that students' ability to correctly choose right answers for baptism Concept Item 3 at posttest were more advantageously affected by the refutation text intervention. These results confirm the significance of the change in means recorded in Table 4.7. Furthermore, a significant main effect for time revealed students' answers significantly changed from pre to posttests, $F(1, 98) = 45.146, p = .000$.

A second repeated measures ANOVA compared students' scores on baptism

Concept Item 3 using text type as the between group factor and time of test (pretest, delayed posttest) as the within subjects factor. Table 4.11 displays the means and standard deviations. An analysis found no significant main effect of condition nor was there a significant interaction between time and text type. The analysis did indicate a main effect for time, $F(1, 98) = 9.738$, $p = .002$. Implications of these findings suggest that there was a change in answers over time, but that the text interventions had similar effects on conceptual change over time. Figure 4.44 helps to visualize this data.

The repeated measures ANOVA strategy was used to analyze Grace Concept Item 1. Text type was used as the between group factor and time of test (pretest, posttest) as the within subjects factor. The means and standard deviations are displayed in Table 4.12.
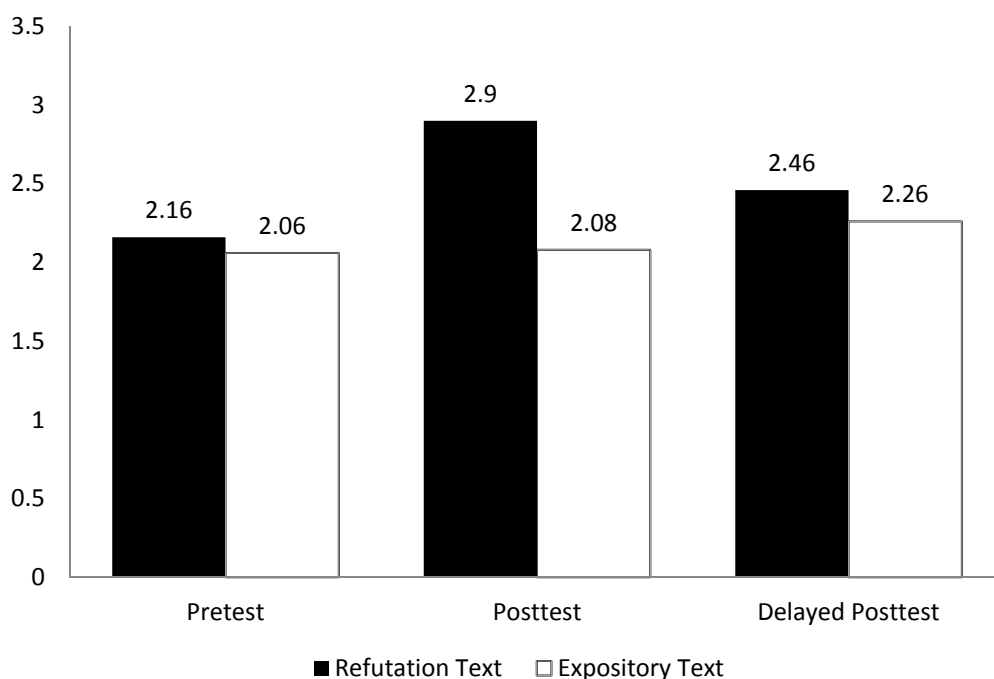
Figure 4.4. Group means of baptism Concept Item 3.

Table 4.12

Grace Concept Item 1 and 2 Means and Standard Deviations by Group

Time, group	*M*	*SD*	*N*
Grace concept item 1			
Pretest			
Refutation text	1.68	1.02	54
Expository text	1.73	1.06	46
Posttest			
Refutation text	3.05	.998	54
Expository text	2.69	1.11	46
Delayed posttest			
Refutation text	2.48	1.23	54
Expository text	2.10	1.23	46
Baptism concept item 3			
Pretest			
Refutation text	2.31	1.07	54
Expository text	2.21	1.09	46
Posttest			
Refutation text	3.27	.959	54
Expository text	2.67	1.01	46
Delayed posttest			
Refutation text	2.68	1.00	54
Expository text	2.45	1.04	46

The analysis did not reveal a significant main effect of condition, indicating no advantage

between text type groups. The analysis did show a significant main effect of time, $F(1,$

$98) = 89.965$ $p = .000$. This main effect of time is reflected in the increase of the means

from pretest to posttest as shown in Table 4.7. Students in both groups experienced a

large forward shift in their correct understanding of grace Concept 1. It was apparent

from mean scores and previously analyzed frequency statistics that participants were

lacking conceptions about grace. These results confirm the significance of those findings,

indicating that both interventions increased conceptual knowledge about grace. Further

analysis showed no significant interaction between text type and time.

The second repeated measures ANOVA conducted on grace Concept Item 1 used

text type as the between group factor and time (pretest, delayed posttest) as the within

subjects factor. Table 4.12 shows the means and standard deviations. There were no

significant differences found between text types in delayed posttest. However, there was

a main effect of time, indicating a significant shift in students' acquisition of correct

concepts of grace, $F(1, 98) = 25.956$, $p = .000$. Figure 4.5 helps to make the significance

of this main effect more visible. There were no significant interactions found between

time and text type groups.

To analyze students' responses to grace Concept Item 2, a repeated measures

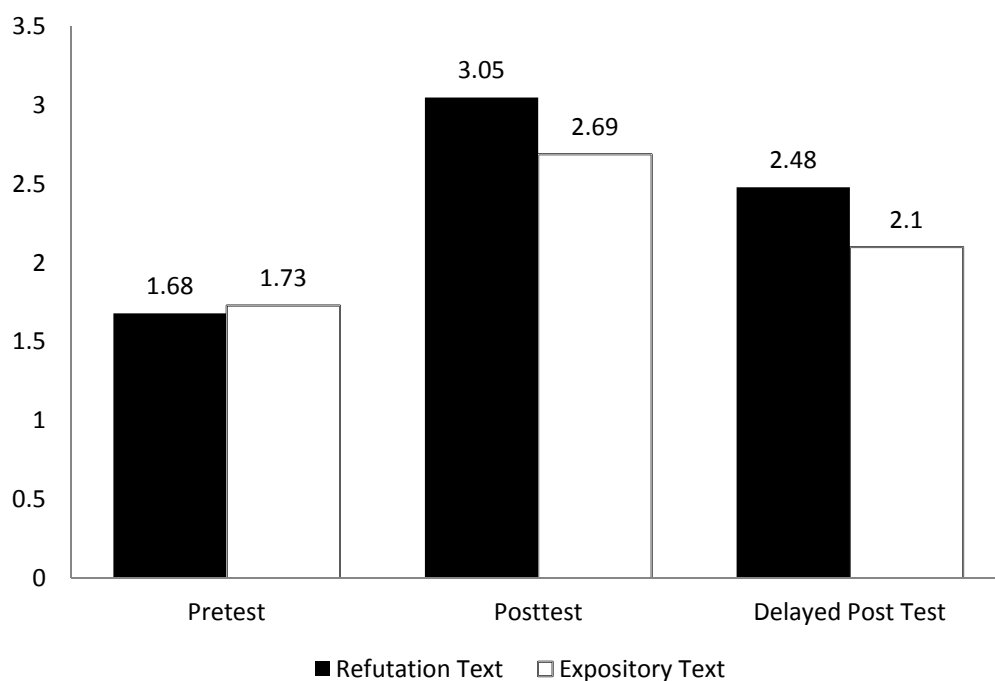ANOVA was conducted using text type as the between group factor and time (pretest,

Figure 4.5. Group means of grace Concept Item 1.

posttest) as the within subjects factor. The means and standard deviations are shown in Table 4.12. The analysis failed to show a main effect of text type, indicating that both groups performed similarly. However, a main effects of time revealed a significant shift in students' understanding of grace Concept Item 2 from pretest to posttest, $F(1, 98) = 42.527$, $p = .000$. There was also a significant interaction between time and text type as refutation texts again showed advantage over expository texts in posttesting, $F(1, 98) = 5.413$, $p = .022$.

Another repeated measures ANOVA comparing students' responses to grace Concept Item 2 was conducted using text type group as the between subjects factor and time (pretest, delayed posttest) as the within subjects factor showed a similar trend. Table 4.12 displays the means and standard deviations. The analysis revealed a main effect of time, $F(1, 98) = 8.783$, $p = .004$, suggesting an increase of conceptual understanding across groups from pretest to posttest (see Table 4.7). Again, no main effect of text type was shown from pretest to delayed posttest nor was there a significant interaction between time and text type.

A repeated measures ANOVA was conducted to compare students' responses to grace Concept Item 3 using text type as the between subjects factor and time (pretest, posttest) as the within subjects factor. Table 4.13 presents the means and standard deviations. A main effect of time was revealed, $F(1, 98) = 28.097$, $p = .000$, indicating that students' responses incorporated more correct concepts to this item from pretest to posttest. As with the previous grace concept item analyses, this analysis on grace Concept Item 3 found no significant differences between groups and no significant interactions.

Table 4.13

Grace Concept Item 3 Means and Standard Deviations by Group

Time, group	*M*	*SD*	*N*
Grace concept item 3			
Pretest			
Refutation text	2.53	.985	54
Expository text	2.36	1.10	46
Posttest			
Refutation text	3.18	.585	54
Expository text	2.82	.973	46
Delayed posttest			
Refutation text	2.53	.985	54
Expository text	2.36	1.10	46

A second repeated measures ANOVA was conducted to compare students'
answers on Baptism Concept Item 1 using text type as the between subjects factor and
time (pretest, delayed posttest) as the within subjects factor. The means and standard
deviations are displayed in Table 4.13. A main effect of time was revealed, $F(1, 98) =$
10.416, $p = .000$, reflecting a significant increase in conceptual understanding from
pretest to delayed posttest.. The analysis did not reveal a significant main effect of
condition nor a significant interaction.

Interest and Conceptual Change

The second research question asked: Do differences in levels of religious interest
(high, low) predict conceptual change? The findings in preliminary analyses revealed
positive correlations suggesting that topic interest may be a factor in RCI achievement
scores. Higher RCI scores indicate greater degrees of conceptual understanding. Higher

RCI scores were scores that had risen above the RCI pretest mean of 22. Preliminary

analyses showed that higher posttest scores (scores that had risen from pretest scores) had

strong correlations to high *topic interest* ($r = .503$, $N = 100$, $p = .000$, two tailed). High

delayed posttest scores had a weak to medium correlation to high topic interest ($r = .462$,

$N = 100$, $p = .000$, two tailed). To gain greater understanding of the significance of the

correlations, the researcher conducted simple regression analyses using interest (high,

low) as the predictor variable and conceptual knowledge (at posttest and delayed posttest)

as the outcome variable. Three separate regressions, one for each concept (faith, baptism,

grace) were conducted to account for specific topic correlations. Alpha was set at *a priori*

.05 significance level.

The examined relationship between topic interest and RCI posttest scores revealed

a medium to strong correlation ($r = .503$). Topic Interest accounted for a medium to strong

significant portion of the variance in RCI posttest total score, $F(1, 99) = 33.157$, p = .000,

$R^2 = .253$, $B = .357$. This suggests that topic interest is a significant predictor of the RCI

total scores at posttest. The positive slope of the regression line indicates that as topic

interest increases then RCI total scores at posttest also increase. Figure 4.6 helps visualize

this relationship.

The relationship between topic interest and RCI delayed posttest scores revealed a

medium to weak correlation ($r = .462$). Topic Interest accounted for a medium to weak

significant portion of the variance in RCI posttest total score, $F(1, 99) = 26.602$, $p = .000$,

$R^2 = .213$, $B = .333$. This suggests that topic interest is also a significant predictor of the

RCI total scores at delayed posttest. The positive slope of the regression line indicates

Figure 4.6. Regression line for topic interest and RCI posttest.

that as topic interest increases then RCI total scores at posttest also increase. Figure 4.7 helps visualize this relationship.

These two regressions give significance to the correlation that high topic interest is a predictor of conceptual change. As students experience the intervention they score higher on RCI posttests indicating their conception change to more correctly accepted definitions of LDS doctrinal concepts. The positive relationship between high topic interest scores and high RCI posttest scores verifies that differences in levels of religious interest can predict conceptual change.
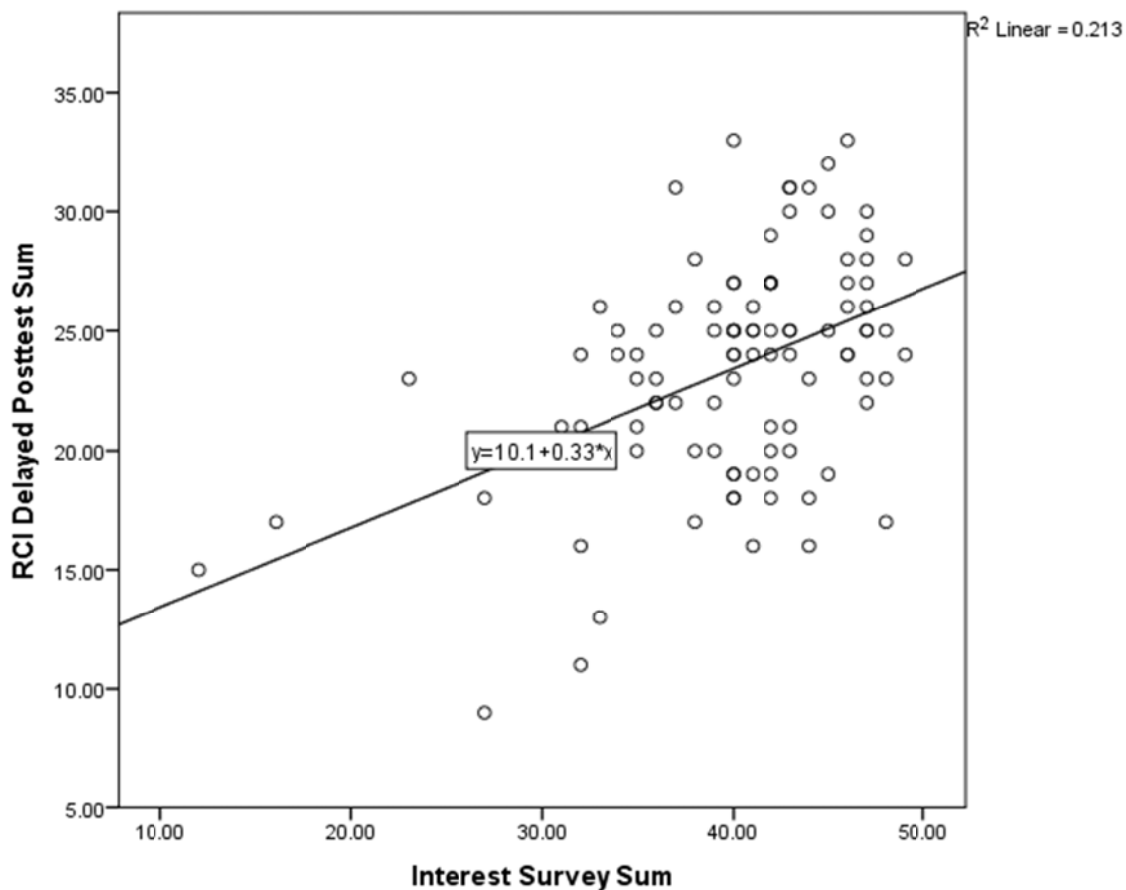
Figure 4.7. Regression line for topic interest and RCI delayed posttest.

The relationship between topic interest and conceptual change of specific topics of faith, baptism, and grace were also explored. Regression analyses revealed a weak relationship between topic interest and faith posttest scores ($r = .375$). Topic Interest accounted for a weak, but significant portion of the variance in faith posttest scores, $F(1, 99) = 16.064$, $p = .000$, $R^2 = .141$, $\beta = .153$. This suggests that topic interest is also a significant predictor of the faith scores in the RCI posttest. The positive slope of the regression indicates that as 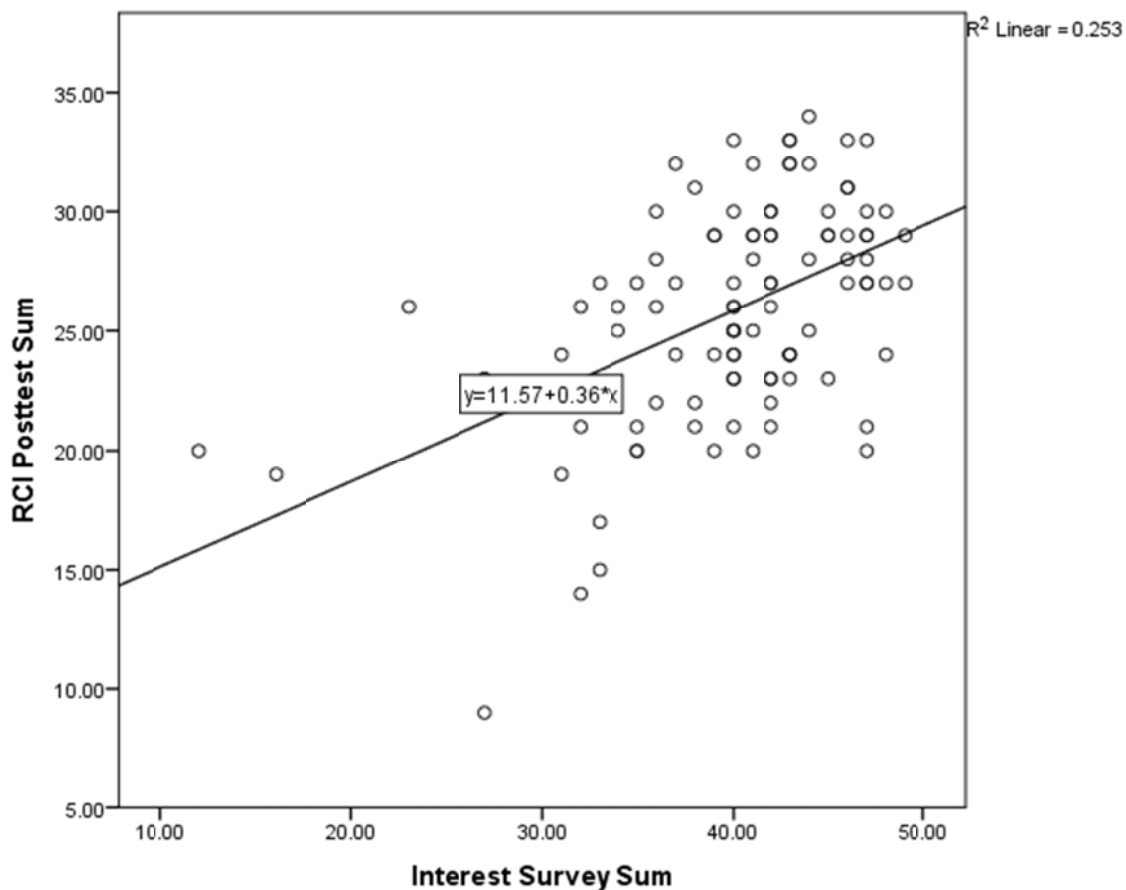topic interest increases then correct faith understanding after intervention may also be expected to increase (see Figure 4.8).
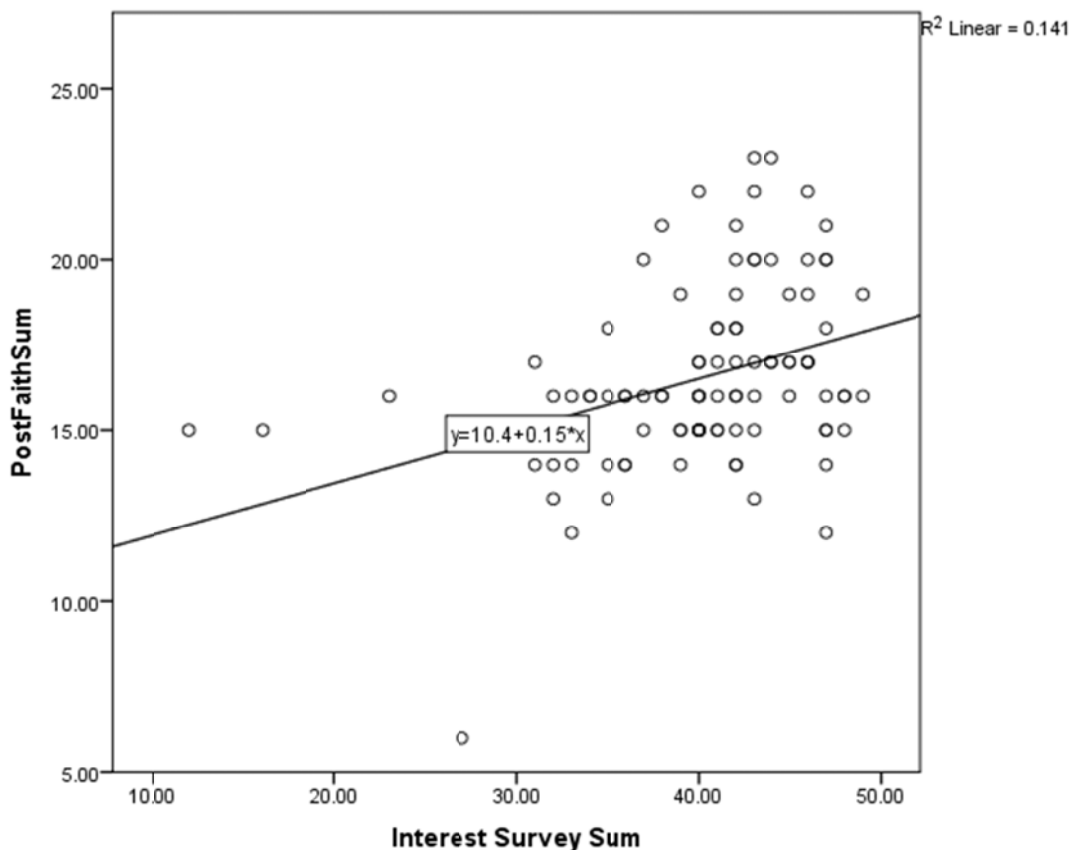
Figure 4.8. Regression line for topic interest and faith posttests.

Regression analyses further revealed a weak to moderate relationship between topic interest and baptism posttest scores ($r = .405$). Topic Interest significantly accounted for a moderate portion of the variance in baptism posttest scores, $F(1, 98) = 19.194$, $p = .000$, $R^2 = .164$, $\beta = .188$. This suggests that topic interest is also a significant predictor of the baptism scores in the RCI posttests. Furthermore it suggests that students with high topic interest may also have higher change in conception following interventions than those with low topic interest. The positive slope of the regression line indicates that as topic interest increases then the likelihood of correct conceptions at posttest also increases (see Figure 4.9).

R² Linear = 0.164

y=8.63+0.19*x

PostBaptismSum

Interest Survey Sum
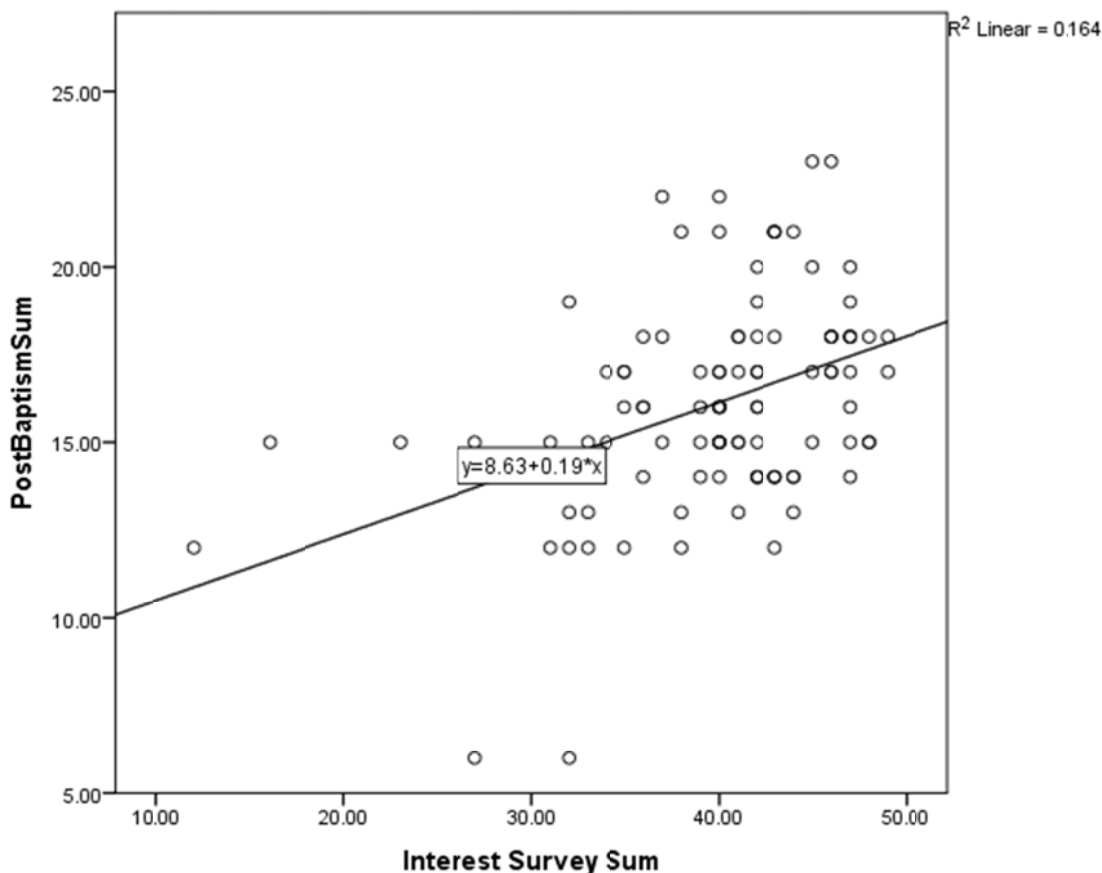
Figure 4.9. Regression line for topic interest and baptism posttests.

A stronger relationship between topic interest and grace posttest scores was discovered in regression analyses ($r = .505$). Topic Interest significantly accounted for a medium strong portion of the variance in grace posttest scores, $F(1, 98) = 33.511$, $p = .000$, $R^2 = .255$, $\beta = .349$]. This suggests that topic interest is also a significant predictor of the grace scores in the RCI posttests. The positive slope of the regression line indicates that students with high topic interest may also have higher change in conception following interventions than those with low topic interest. Figure 4.10 gives a visual depiction of this regression slope.
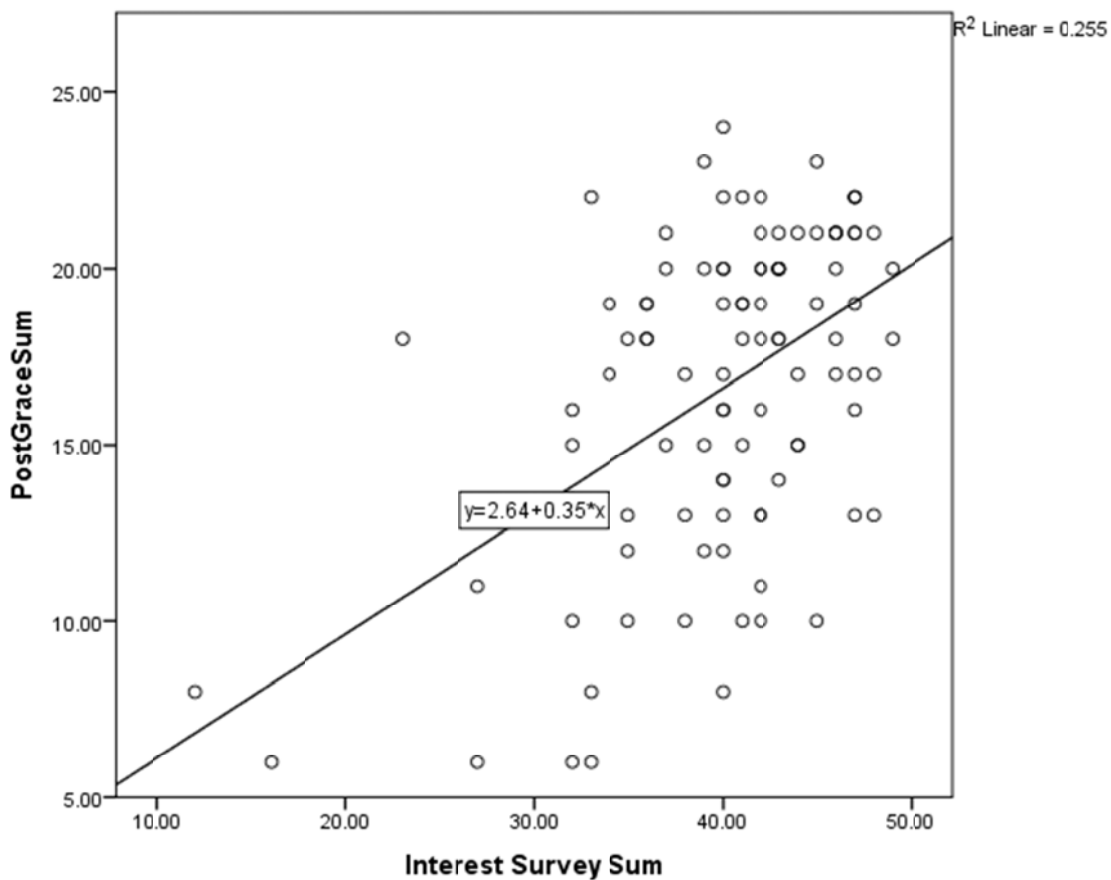
Figure 4.10. Regression line for topic interest and grace posttests.

Text Preference

The third research question asked: Do students prefer refutation text structures to traditional expository text structures? The subquestions specifically ask: Do LDS students prefer refutation text structures on Faith to expository text structures? Do LDS students prefer refutation text structures on Baptism to expository text structures? Do LDS students prefer refutation text structures on Grace to expository text structures? Quantitative statistical analyses for these questions were analyzed using descriptive statistics.

Recall that all 100 participants were given both a refutation and expository text statement to read. Recall further that these participants were then asked to rate their reading enjoyment of each text and their reading enjoyment of religious texts in general. Study results found that 66% of all participants enjoyed reading religious texts while 71% of all participants enjoyed reading a religious refutation text. There were also 71% of participants who indicated reading enjoyment for the expository texts. Of those who enjoyed reading religious texts, 24% of participants indicated "much" enjoyment reading expository religious texts with 38% indicating "much" enjoyment reading refutation texts. Results further revealed that 47% of participants "somewhat" enjoyed reading expository texts and 33% "somewhat" enjoyed refutation texts. This shows an equal grouping of 71% of participants' enjoying expository and refutation texts with a higher percentage of those 71% "much" enjoying refutation texts. See Table 4.14 for a percentage overview.

A slightly higher reading enjoyment for refutation text ($s = 397$) as compared to expository text ($s = 380$) was indicated when the sum of scores for reading enjoyment was considered. Mean scores also show refutation text favoritism ($M = 3.97$) over

Table 4.14

Reading Enjoyment Percentages

Text type	Not at all	Not too much	Not sure	Somewhat	Much
General religious	4	14	16	42	24
Expository	2	11	16	47	24
Refutation	2	8	19	33	38

expository text ($M = 3.80$) as t tests indicate significance difference of the means $t(100) =$ 38.203, $p < .05$. Interestingly, all scores for general religious reading enjoyment were lower than reading enjoyment scores for the specific expository and refutation texts read by participants in this study. The mean score for general religious reading enjoyment was $M = 3.68$. The mode indicates that the most chosen response for reading enjoyment of refutation texts was "much" whereas the most chosen reading enjoyment response for general religious reading and expository texts was "somewhat." Such findings indicate that students prefer refutation text statements over expository statements. They also reveal a lack of reading enjoyment for currently used expository statements in seminary curriculum. These findings will be interpreted further in the next chapter.

A negative mesokurtic distribution (-.004) was elicited for refutation text reading enjoyment, thus indicating a high enjoyment of reading refutation texts. A positive mesokurtic distribution (.136) for expository reading enjoyment further accompanies high reading enjoyment by participants. It can be concluded that reading enjoyment was not as strong as that of the refutation text as the kurtosis statistic is further away from zero.

Participants were asked to indicate whether they preferred refutation texts or expository texts after they had read both types of text statements. Examination of frequency statistics indicate that 59% preferred the refutation text compared to 28% who preferred the expository text, while 13% of participants indicated no preference. These findings support an assumption that participants prefer and enjoy reading refutation texts more than expository texts (Mason & Gava, 2007). The data support the researcher's conclusion that the topics of faith, baptism, and grace were more enjoyable to read than

religious texts in current curriculum (Student Manual, Gospel Principles Manual, Seminary Student Study Guide, Scriptures, etc.).

Examination of the topic frequencies support a conclusion that respondents were uniformly in favor of refutation texts with the topic of baptism demonstrating the highest number of individuals preferring the refutation text ($N = 23$). Table 4.15 provides a measure of these frequencies. 64% of those reading texts on baptism preferred the refutation text. 59% of those reading texts on grace preferred the refutation text while 54% of those reading texts on faith preferred the refutation text. 20% of the faith-reading group had no preference on text type while 10% of the Grace group and 8% of the Baptism group indicated no preference on text type.

Qualitative Analysis

A content analysis was conducted using the individual participant interview transcripts. Participants' responses were coded into three general categories based on the constructs of text preference, interest, and conception reasoning. Text preference was simply grouped according to the rubric of "like" or "dislike." Interest was similarly

Table 4.15

Text Type Preferences by Topic

Text topics	No preference	Prefer refutation texts	Prefer expository texts	Totals
Faith	7	19	9	35
Baptism	3	23	10	36
Grace	3	17	9	29
Total	13	59	28	100

categorized as participants' responses were placed into categories that showed that they felt the text was "interesting" or of "no interest." Conception reasoning referred to the participants' perception that reading the text caused them to reflect, ponder, question, or think. Responses surrounding participants' conception reasoning was coded as "made them think" or "no reasoning." A detailed table of the categories and subcategories of these items is presented in Table 4.5.

Text Preference

Participants' comments were brief and concise. They were quick to answer the questions posed by the researcher and slow to expound on their thoughts. Two out of six participants preferred the refutation text and two out six students preferred the expository text. There were also two participants who did not have a text preference. JJ and Cam both elicited statements of preference toward the refutation text. JJ stated, "I [liked] the second one (refutation text), I think it went a little more in depth." Cam also mentioned that he preferred the refutation text stating that it "was more probably more right than number one (expository text)." The four other participants had no preference.

Only Kai and Ian indicated dislike for the refutation text. Both participants were also the only ones interviewed that expressed more liking/preference toward the expository text. Kai felt that the refutation text was juvenile, expressing, "It seemed like it was more basic in the words it was using…it was almost like primary level." Ian, however, did not like the refutation text; specifically citing the sentence of refutation as the reason for his dislike. He stated, "I just didn't really like that idea… I just don't think that part of it is true." It appeared that Ian had deep commitments to the misconception

that was refuted in the Baptism refutation text. In interview, he refused to believe that the refutation text was a correct representation of LDS baptism doctrines. "I don't think our religion's really like that," he stated. When Ian was asked follow up questions about the misconception he was very short in his replies as he confirmed his previous statements, "Yeah, [I like] baptism one (the expository text)." Following the official interview, the researcher was able to correctly resolve his misconception about the literal/symbolic cleansing of baptism. This conversation was not part of the actual study or interview at hand, but worth mentioning for the closure of the reader.

Interest

All interview participants had comments reflecting their interest or no interest toward the refutation text. JJ, Lydia, Ian, and Cam, all found the refutation text statement, "baptism does not wash away sin, but the remission of sins comes from the Holy Ghost" interesting because it triggered something that contradicted their current understanding. JJ previously supposed that your sins are washed away at baptism, but during the interview she pointed to the refutation text stating:

> There was a part I didn't really know—that you are not really cleansed of your sins when baptized. You are cleansed when you receive the Holy Ghost…[the text] was going over things that I already knew, but some things that I wasn't sure about…[made me think] a little bit….

Lydia indicated her interest in the refutation text statement saying, "I found it interesting because I thought that baptism washed away our sins, but it said that the remission of sins comes after baptism." Ivan also indicated his interest in the refutation text statement, even though he did not like it. He felt that the refutation statement stood

out to him, catching his interest, because he didn't believe it. He said, "The part where it

mentioned that it does not wash away your sins… that's what stood out to me." Cam

thought the refutation text was more interesting.

> Many people believe that baptism washes away their sins, and that's the
> difference between one [expository text] and two [refutation text]. One says that
> baptism does wash away sins, but number two says the belief is incorrect;
> washing away sin, known as remission of sins, comes after baptism when people
> receive the Holy Ghost.

Cam's clarity of answer showed his critical thinking of the refutation text statement. He

felt like it clearly was refuting a misconception that he and "many people" have.

Only Kai and Savvy expressed no interest in the refutation or expository text.

When Kai was asked if there any of the statements that she read interested her, she

simply replied, "Not really." Savvy similarly responded, "Basically I already knew or at

least had heard [all of this before] and was reminded of it again." It was further revealed

that only Kai had statements that could be linked to expository text interest. She stated, "I

do like the fourth line of the first statement [expository]." The researcher felt that this

statement showed some interest in the expository text statement. Though Ian preferred

the expository text, he did not make any statements that showed it interested him. He

repeatedly stated that he felt like the refutation text was incorrect and his interest was

definitely piqued more in the things he did not agree with than in the expository text he

preferred. The lack of comment about the expository text could be assumed as no interest

by other interviewees, at least when compared to the comments of interest projected

toward the refutation text.

Concept Reasoning/Critical Thinking

Questions that dealt with concept reasoning were also asked by the researcher to determine which text statement the participants felt made them think. The interviewer essentially asked, "Which statement or phrases in the statements made you think?" Five of the six participants felt like the refutation text made them think. Only Kai felt like nothing really roused her mind. As mentioned earlier, she did feel like a phrase in the expository text stood out to her. After reading aloud that phrase, "He too was baptized even though he was without sin," she thoughtfully commented, "He got baptized for us even though he didn't need to be." The researcher decided to code this statement as an evidence of cognitive reasoning, even though Kai did not feel like any of the statements made her think.

JJ, Savvy, Lydia, Ian, and Cam all felt like something from the texts made them think. When asked specifically which text made them think, they all chose the refutation text statement. In alluding further, they all spoke to the same refutation text sentence within the refutation text paragraph. JJ jokingly said that the refutation text statement made her think "a little bit," though she actually was communicating that the statement caused her to think deeply. "I didn't really know that," she stated. "I think I have learned something." When Savvy was asked if something in the texts caused her to think, she quickly responded:

> In the second one [refutation text], it said washing away sins, known as remission of sins, comes after baptism…. I didn't know this before. I thought it was just as soon as you're baptized; your sins are gone…. I remember being surprised there.

Lydia similarly found herself thinking of the same refutation text phrase. She explained:

> I thought baptism washed away our sins, but it said that the remission of sins comes after baptism; when people have received the Holy Ghost. I always thought that when you get baptized, your sins are washed away.

Both Lydian and Savvy's comments indicate that they had a misconception that caused them to think when they read a statement refuting their previous thoughts. This cognitive co-activation effect is the purpose of refutation texts (Kendeou & van den Broek, 2008) as verified in the expressions of Savvy and Lydia.

Ian definitely felt cognitive conflict with the refutation text. For that reason, he preferred the expository text to the conflicting information of the refutation text. He explained, "The [refutation text] stood out to me. I didn't really like that idea that [baptism] wouldn't wash away your sins. I don't think that part of it is true." The misconception that "baptism washes away our sins" was such a robust misconception for Ian that it caused him to think and argue with the refutation text. Ironically, the expository text taught the exact same doctrine of baptism, teaching that cleansing of sins comes by the Savior and through the Holy Ghost. None of the participants, however, felt like the expository text grabbed their attention with this doctrinal teaching.

As mentioned earlier, Cam's comments really showed deeper thinking with the refutation text statement. When asked if he felt that the refutation text statement made him think more deeply, he quite seriously replied:

> Definitely. At first, before I read either of them, I saw the first sentence of both and they looked like the same thing and I figured they would be the same, but then [when I read] number two (refutation text), that part (Pointing to the sentence, 'But this belief is incorrect.') stood out to me, and I was like, Whoa, that's harsh---they want to make it plain that that's not the only thing you have to do [to be clean from sin]… you have to get the blessing [of the Holy Ghost].

Cam's mind was definitely more attuned to the refutation text. He clearly was exhibiting

more interest and thought with that text than with the expository text. Though he did not indicate that he preferred the refutation text, his statements seem to support an n opinion that refutation text is a more effective type of text.

The interviews conducted by the researcher were short, but fruitful. The researcher found enriching insights in participants' comments that will aide in concluding statements. In general the interviews revealed mixed text preference. However, it was apparent that refutation text elicited more interest and deeper thinking by interviewed participants. Furthermore, support for co-activation theories by Kendeou and van den Broek (2008) were also discovered in the responses of those interviewed.

Text Preference Reasons

Every participant was given an opportunity to respond to why they preferred either the refutation or expository text. The question asked them which text they preferred reading (text one or text two) and why. Most participants only circled an answer and relatively few gave substantial reasons why they preferred that text structure. Most responses were some form of the statement, "I just liked it better." It is important to note that some papers had text one as the refutation text, while others had text two as the refutation text. This was to offset the threat to validity that one text would be looked at as redundant or not valued or that a certain order of appearance on the page would misconstrue findings.

Qualitative findings were content-coded into seven themes including a non-valid response theme (see Table 4.16). Fifty-nine percent of participants did not give a valid response describing why they preferred one text to the other. These reasons included

Table 4.16

Reading Preferences

Text preference reasons	Refutation texts	Expository texts	Totals
No valid response			59
Short length	1	3	4
Content specific	4	2	6
Attention/interest relevance	6	1	7
Greater perceived learning	6	1	7
Easier to read	10	4	14
Spiritual	2	0	2

blank answers as well as responses like: "I just did," "don't know," "same text," "don't care," and "I liked both." All other responses were content-coded into categories describing preference reasons of: short length, content specific, attention-interest-relevance, greater perceived learning, easier to read, and spiritual. These categories covered the remaining 41 valid responses of participants.

Short length. Three students preferred expository texts because of their perceived shorter length on the page, while one participant preferred a refutation text for its perceived shorter length. The researcher thought it odd that the perceived shorter length was not true to the actual shorter length of the statements. One participant explicitly wrote, "I like the [expository text] because it is shorter and teaches the same thing."

Content specific. Six participants preferred textual statements based on a specific statement within the paragraph. Four participants preferred the refutation text citing different sentences that caught their attention in the text. One participant quoted the refutational text sentence, stating it as the reason for his preference. Another participant

cited the refutation text and said, "It told me what I wanted to know." The third student referenced a phrase in the refutation text statement that he felt was "more emphasized" than in the expository text, even though this statement was not the refutational statement and was found in both texts. The fourth participant stated, "The [refutation text] is more about having strength...and I need strength in my faith and actions." Both the refutation and expository text taught the same thing, but this participant perceived that one had a greater focus on strength; even though the word 'strength' was not even mentioned in either of the texts.

The two participants who cited textual reasons for preferring the expository text referenced different statements. One participant mentioned that he preferred the expository text "because [the refutational text] says that baptism doesn't wash your sins away." In cross checking this participant's ID number, it was found to be the same student interviewed under the name Ian, whose interview data mirrored this reasoning. The other participant felt like the expository text had a statement that gave example of how to get closer to God. This participant did not expound any further on which statement made them think this.

Attention, interest, relevance. Eight students made statements about the attention, interest, or relevance aspect of the text they preferred. Both participants who preferred the expository text used the phrase, "more interesting." One of them stated, "It just seemed to have more interesting words." The other six participants gave similar reasons for their preference of the refutation text even using the same phrase, "more interesting." Two of the six thought the refutation text was easier to pay attention to. The

other four felt like it was easier to attend to because the refutation text was perceived as more relevant. One participant stated, "I feel like the [refutation text] is more directed to the reader." Another stated, ""the [refutation text] zones you in, more than just citing the facts." There was one of the six in favor of the refutation text who stated, "It seems more personal and less like reading from a textbook."

Greater perceived learning. Seven total participants indicated a preference based on their perception that greater learning was gained by the text. Six of these participants preferred the refutation text and four of the six cited "more detail" as their reason for favoring the refutation text. The other two preferred the refutation text because it presented new learning. One stated, "[the refutation text] is more precise and I learned new things." The other said, "I learned something new in the [refutation text]." The researcher finds it interesting that such would be said since the same doctrines are taught in both types of text statements. The one participant who sided with the expository text thought that this text was, "more detailed and in depth and had more information than the [refutation text].

Easier to read. This was the largest category aside from those who did not elicit valid responses. Fourteen participants preferred the text structure that they thought was easiest to read. All participants' comments in this category were simple and specific and could be summarized by this participants' comment, "It was easier to understand." Seven out of the ten in favor of refutation text stated that they felt like the refutation text was "easier to understand." The other four mentioned similar themes. One wrote, "I just get it more." Another stated, "[Refutation text] seemed a little simpler." The four who

preferred expository texts all provided reasons involving the easiness of reading for understanding. One stated, "The wording makes it easier to follow." Another wrote, "It seemed more matter of fact and was easy for me to understand." A third made clear, "[Expository text] was easier to understand and quicker to get through." The last supporter of expository texts felt like, "it was worded in a way that I could appreciate more."

Spiritual. The last category was different than all other reasons listed and was of particular interest to the researcher as the study was looking at religious doctrines of the LDS church. Two students preferred the refutation texts because they were more spiritual. One wrote, "I feel [the refutation text is] more accurate and it has more details. I felt the Spirit more and I felt the words were not just words, but something more." The other student stated, "I felt the Spirit a lot more than the [expository text] for some reason." These answers are intriguing as to the identification of spiritual feelings associated with the text. No other participant made any such mention. Though these participants only represent 2% of those in the study, the finding does lead the researcher to wonder about these statements' implications.

CHAPTER 5

DISCUSSION

Introduction

The following is a summary of the findings of this study in the context of this research. The discussion centers the significance of the results in connection with refutation text's ability for fostering conceptual change in LDS youth who hold common doctrinal misconceptions. The discussion involves the significance of study results in connection with how students' interests may be predictors of conceptual change. The discussion addresses the goals set forth by the researcher in Chapter One. Recall that conceptual change is the process of restructuring one's prior alternative or naïve conceptions to align with correct viewpoints (Vosniadou, 2008). Recall further that topic interest is a component that has been shown to positively interact with refutation text and conceptual change (Mason & Gava, 2007). Therefore refutation text and topic interest, in connection with study findings, will also be used to discuss pertinent educational implications. This chapter concludes with a synopsis of the limitations of the present study along with suggestions for future research.

Confirming the Past and Adding to the Present

The majority of studies in refutation text have been predominately enacted in the discipline of K-12 science education (Diakidoy et al., 2011; Tippett, 2010). Though these studies empirically support refutation text as an effective intervention for conceptual

change in science learning, questions have remained about refutation text's power for promoting conceptual change in other subjects. The results of this study support past literature affirming refutation text's ability in promoting conceptual change (Guzzeti et al., 1993). However, the results of this study also add to the refutation text discussion, as conceptual change was observed to be a result of refutation texts written about a nonscientific topic. The findings of this study provide evidence that refutation text's power for promoting conceptual change may be equally present across other disciplines outside of K-12 science.

The present study also affirms past research findings that observe a learner's return to previously held misconceptions over time (Broughton et al., 2010; Palmer, 2003). In all topics, the present study witnessed a waning of correct knowledge at delayed posttest. The present study did, however, observe that a one-time read of a refutation text still had power for conceptual change over a 6-week period. The 6-week timespan from posttest to delayed posttest was longer than most research previously conducted using pre, post, and delayed posttest methodology (Palmer, 2003; Tippett, 2010). This finding suggests that students may experience conceptual change after one reading of a refutation text (Hynd et al., 1997). It may be that students could have experienced deeper conceptual change with repeated readings of the texts (Kardash & Scholes, 1996), which in turn may decrease opportunities for readers' to revert to their prior misconceptions over time. Future studies may examine the effects of repeated readings, small group discussions, and other reading comprehension strategies for increasing cognitive engagement and the likelihood of conceptual change related to LDS doctrine.

The findings of the present study also add insights to the robust nature of misconceptions. Religious subject matter is thought to promote deep engagement among students who hold varying interest levels while also bringing out robust misconceptions tied to intangibles of faith and belief (Chinn et al., 2011). As mentioned earlier, it was discovered that misconceptions of baptism were the most prevalently returned-to misconceptions. Other misconceptions in topics of faith and grace were not as greatly returned to at delayed posttesting. These results add evidence to the varying degrees of misconception robustness, suggesting that some common doctrines may have strong misconceptions that are firmly held too, while other doctrines may have weak misconceptions that are easily let go.

Past research on refutation text revealed that readers with misconceptions adjusted their mental processing of the text when confronted with a refutation text structure (Kendeou & van den Broek, 2007). Qualitative responses of the present study supported this finding as participants perceived more learning and cognitive processing when reading refutation texts (see Table 4.5 and Table 4.16). There were also qualitative findings that indicated mental disequilibrium and conflict with information in the refutation text as participants grappled with the textual statement in relation to their current beliefs. These findings further support current research that documents a co-activation effect of refutation text structures on mental processing (Kendeou & van den Broek, 2008). The findings also strengthen past research that suggests dual processes of thought are influencing individuals' motivation for conceptual change (Dole & Sinatra, 1998; Petty & Cacioppo, 1986).

Results of the present study suggested that conceptual change is more likely when topic interest is high and refutation texts are read in place of the current expository texts. Qualitative findings of the study confirmed that the refutation text caught the interest of the participant more than the expository text. Quantitative findings also showed higher interest and enjoyment of the refutation text. This suggests that topic interest is enhanced when students are confronted with a refutation text, thus promoting greater levels of engagement for conceptual change. Such a finding supports the Cognitive Reconstruction of Knowledge Model in that the interaction between the message and the learner is central to the change process and that a deeper engagement with a text increases the likelihood of change (Dole & Sinatra, 1998). This finding also supports the researchers' theoretical assumptions of social cognitive (Bandura, 1993) and bio-ecological systems theories (Bronfenbrenner & Ceci, 1994) for conception as engagement is believed to increase with interest and environment interaction, thus promoting learning acquisition and conceptual change. In this study, the environment interaction is the reading of the texts.

This study further supports previous research affirming topic interest in relation to refutational texts used to facilitate conceptual change (Mason & Gava, 2007). Results from this study show that topic interest significantly correlates with refutation text in post and delayed-post testing. Furthermore, this study's results confirm previous research that shows increased interest correlating to higher achievement in test results (Ainley et al., 2002a). This speaks to the importance of generating interest among students related to core LDS doctrine as the findings suggest that high topic interest is associated with

increased levels of conceptual change.

The present study adds to the refutation text discussion by looking into qualitative reasons for students' text preference. Though the qualitative findings of this study were few, they did give meaningful insight as to why students significantly preferred refutation text structures over currently used expository texts. The researcher believes that this finding opens pathways to more research that seeks to find out why students may or may not perceive refutation text structures as more interesting and desirable than expository text statements.

Mason and colleagues (2008) found that refutation text compensated for students with low topic interest. Similar effects were found in the present study as participants with low topic interest who read a traditional expository text did not perform as well at posttest as students with low topic interest who read a refutation text. This finding of Mason is supported by this study and the researcher believes that individuals may prefer refutation text because of its interest-creating properties. The results of this study observed that more participants experienced an attention, interest, thought, or mental conflict increase with refutation texts than with the expository texts. The researcher believes that these experienced feelings caused by refutation texts are a form of interest being aroused in the minds of participants. This interpretation of these results invites more research to verify the possible interest-creating properties of refutation text.

Summary of the Findings

The examination of participants' responses on the Religious Concept Inventory at

pre-, post-, and delayed posttest levels, suggest that refutation text interventions are indeed changing student's conceptions to a greater degree than expository text interventions. As a whole, participants exposed to the refutation text performed 61% higher better than those given expository texts. However, it was also noted that most participants elicited some degree of conceptual change following text interventions, regardless of text structure. These findings were consistent across all doctrinal topics of faith, baptism, and grace. This supports the researcher's hypothesis that a majority of students would experience some degree of conceptual change when confronted with a text intervention. Findings further support the researcher's hypothesis that refutation text structures may produce greater levels of conceptual change in comparison to the expository text.

The examination of participants' religious topic interest, whether high or low, suggests that there is a significant ($p < .000$) relationship between topic interest and conceptual change that may allow topic interest to be a predictor of conceptual change. Participants who had high topic interest also had higher levels of conceptual change at post and delayed posttests. Examination of the regression analyses revealed that as interest increases, the likelihood of conceptual change also increases. Original hypotheses of the researcher were supported by this finding, as the researcher's theoretical assumptions of bio-ecological systems theory (Bronfenbrenner, 2001) indicate that higher interest will correlate with greater engagement and greater engagement will facilitate cognitive processing for conceptual change (Dole & Sinatra, 1998; Tobias, 1994).

The quantitative examinations of participants' text preference revealed a stronger

preference for refutation text structures over the expository text. Results also indicated a significantly higher reading enjoyment as 38% "much" enjoyed reading refutation texts while only 24% "much" enjoyed reading expository text. Interviews with regards to text preference were inconclusive, but participants did report experiencing greater interest and cognitive engagement with the refutation text. The researcher's initial hypothesis that the majority of students will view the refutation text structures more positively than traditional expository texts was supported by quantitative data but qualitative data resulted in mixed results. Interviews were generally inconclusive. Open-answered questions about text preference showed favoritism toward refutation text structures. The mixed results suggest that text preference needs to be explored further.

The results suggest that refutation texts are likely to have greater power with promoting conceptual change in LDS youth holding doctrinal misconceptions than do expository texts. It was discovered that in every case across all topics, the refutation text means were higher than expository text means in post and delayed posttest. These mean score differences were found to be significant at an *a priori* of .05 and suggest that the refutation text may have more strongly aided students in overcoming doctrinal misconceptions listed in pretests. For example, at pretest, most participants were found with misconceptions surrounding the topic of baptism. After refutation text interventions, these same participants elicited partial or correct knowledge at posttest. Though some of the same occurrences happened with those exposed to expository text statements, the magnitude of change was higher 61 % greater for the group reading refutation texts. Recall the mean scores of both groups: refutation group scores at posttest ($M = 27.72$)

and expository text group scores at posttest ($M = 23.6$).

While this shift in knowledge is enough to show statistical significance at an *a priori of* .05, it still does not indicate a full acceptance or change to new conceptions by those reading refutation texts. Delayed posttests indicated that changes in conception did not last as many returned to previous misconceptions that were corrected at posttest (see Table 4.12). This was likely due to the robust nature of the misconceptions. Previous research affirms a return to a misconception when the misconception is deeply entrenched and accepted by an individual (Broughton et al., 2010; Palmer, 2003; Tyson, 1997). Research also shows that a return to misconceptions is more likely over time (Guzzeti et al., 1993). The results of this study align with current literature. Posttest data indicated a return to misconceptions in delayed posttests for all topics across both text types.

It was discovered, however, that those reading refutation texts had a lower percentage of decline in delayed posttests than those reading expository texts (see Table 4.11). This suggests that refutation texts have greater long term effects on conceptual change than expository texts. Furthermore it was discovered that interactions were happening with topic interest and refutation text groups. The likelihood of conceptual change increases among participants of high topic interest and an even greater likelihood of conceptual change occur when participants are of high interest and exposed to refutation texts.

Topic-specific findings of the study indicate that misconceptions surrounding concepts of baptism were the most prevalently returned to misconception among

participants of both expository and refutation text groups. This is likely due to the common nature of the topic of baptism, a topic that is taught repeatedly to LDS children (Church of Jesus Christ of Latter-day Saints, 2004, 2008). The misconception (baptism washes away sins) was held by in 86% of participants. Further research on the reasoning and origin of the misconception, targeting why such misconceptions are so widely held, is suggested.

The same questions of origin could be asked about the misconceptions of faith and grace. The findings revealed that 54% of participants had no conception of the topic of grace. This was shocking to the researcher, as it revealed that LDS high school age youth are in need of education on grace concepts. Furthermore, the interventions of the study revealed that refutation text had stronger power to help participants acquire new knowledge than did expository texts (see Table 4.11). The overall frequency tests indicated that a change in conception (whether the change in conception was derived from the acquisition of new knowledge or the overwriting of misconceptions) was occurring to a much greater degree with refutation texts. This finding supports a need for further research into the power of refutation text structures for aiding knowledge acquisition. However, the study also recorded that changes in conception did not last, as many participants returned to previous responses of 'no conception' that were indicated at pretest. This return to no conception mirrored statistical patterns of other participants who returned to misconceptions of baptism and faith. The finding suggests that memory may also be influencing a return to prior misconceptions in addition to the robustness of a misconception. It is highly likely that some students could not remember the concepts

gained from a text that they had read 6 weeks earlier.

The doctrinal topic of grace provided an interesting finding within the study. Delayed posttest results of grace Concept 3 showed an increase in misconceptions above what was previously observed in pretest. This increase was only seen in the expository text reading group. The researcher assumes that the expository text may have triggered a past misconception that was taught, or perhaps the individuals misread the expository reading. This finding could be a key component to answering additional questions about misconception origin. Perhaps misunderstood expository texts play part in misconception creation. Further investigation is needed in this phenomenon.

A New Approach in Religious Curriculum

The main purpose of this study was to examine refutations texts' power for creating conceptual change in common doctrinal misconceptions held by LDS youth. Topics of misconceptions were specifically selected by the researcher because of their prominent existence in teenage youth. A misconception about the cleansing power of baptism, for example, leads to a failed understanding of the importance of the Holy Ghost as the cleansing agent. Doctrinally, the LDS church teaches that the reception of the Holy Ghost by the grace of the Lord brings a remission or cleansing of sin (Bednar, 2002). Each week, members of the LDS church gather to partake of the sacrament of the Lord in order to renew baptismal promises and to be cleansed again from their sins by the power of the Holy Ghost (Church of Jesus Christ of Latter-day Saints, 2004). Youth with misconceptions about the cleansing of sin from baptism may be missing the true doctrinal

teaching that forgiveness and cleansing from sin may come each week by the power of the Holy Ghost (Church of Jesus Christ of Latter Day Saints, 2008). The results of this study confirmed that a significant amount of LDS teens hold the misconception that baptism washes away our sins. The results of this study also verified refutation texts as a viable means to help LDS seminary students overcome this misconception.

The results of this study are particularly meaningful to LDS seminary curriculum writers, as the present study used the exact phrases of current Seminary curriculum for the expository texts in the control group (see Appendix D). The wording of refutation texts were also derived from these statements, with the only difference in text manifesting itself in the actual statement of refutation (see Appendix E). The results of the present study indicate that the current curriculum, which uses expository text structures, does not as significantly create conceptual change as that of the refutation text structures. Furthermore the results of this study indicate a significant difference in expository text's ability to aide in knowledge acquisition when compared to refutation text. For example, students learning the concept of grace for the first time will actually acquire more correct understanding when reading a refutation text structure than an expository text. This study confirmed this example as it found that refutation texts more commonly helped students with no conception move to partial or correct conceptions in the core doctrine of grace. In addition, there was some evidence in the present study that showed misconceptions being created after reading the current expository test structured curriculum. The findings of this study provide meaningful evidence that curriculum writers should consider using refutation writing structures in textbooks, manuals, handbooks, and reference guides.

Recently, leadership in The Church of Jesus Christ of Latter-day Saints made a plea for Seminaries and Institutes to look for ways to more effectively teach the doctrines of LDS theology (Eyring, 2004). The results of this study found refutation text structures to be a more effective method of written curriculum than the current expository text structures used. These findings have strong educational implications for Seminaries and Institute curriculum writers who are engaged in updating current student resource manuals. The study results confirm the alternative hypothesis (refutation texts have higher power for creating conceptual change than expository texts) and gives additional evidence supporting the call for new and more effective approaches in Religious Education curriculum. Refutation text structures must be inserted into new curriculum.

Implications for Education

It was previously noted that implications of the findings of this study are of particular interest to curriculum writers in Seminaries and Institutes. Curriculum containing refutation texts may be more interesting to students. It is also significantly more effective than current expository curriculum in promoting cognitive processing for conceptual change and knowledge acquisition. Implications for instruction involve the need for teachers to help students recognize personal misconceptions, while providing then with refuting arguments that clearly teach the more scientific or doctrinally accepted explanation.

For example, a teacher asking for definitions surrounding the concepts of faith may have a student whose response elicits a misconception. The teacher may normally

validate the effort of the response and then teach a more correct definition. The implications of this study using refutation texts suggest that greater teaching may occur if the teacher is explicit in letting the class know that such a comment is a common misconception that is not correct. The identification of the misconception is an essential factor to refutation text's ability to promote conceptual change. Validating a student's comment without clearly identifying and refuting the misconceptions contained therein may not lead to correct understanding, even if correct information is presented.

The implications of the present study are also of interest to educational researchers seeking to study means for conceptual change. The study implies that text is still a viable method for promoting conceptual change, despite educational shifts toward other modes of instruction (Broughton et al., 2010). Educational teachers and administrators should consider this finding when seeking methods of curriculum delivery. The present study evidences the power of a text as it shows that even when a text is read only once, it may still have some significant cognitive effects on the conceptual change of readers 6 weeks later. Overall, the present study is found to have implications for educational curriculum writers, teachers, researchers, and administrators.

Limitations of the Study

A limitation for the current study is found in the demographics and sample size of participants. The 100 participants were primarily Caucasian from middle-class families. Previous research has shown that students from these types of families are generally successful in diverse academic settings (National Research Council, 1998). In addition,

the participants in the present study were enrolled in a private religious school. Therefore the results of this study may reveal a different trend across more diverse student populations of other schools. The sample size was also relatively small when compared to the overall worldwide enrollment of LDS seminary students. The sample did represent nearly the entire population of the local private school in which the study was enacted, but this is a small sample of the worldwide student population. Further research using more diverse LDS student populations are warranted to investigate whether these findings would be replicated in larger, more diverse student populations.

A second limitation of this study is that the interventions were constrained by time. Though pilot studies verified the time allotments as appropriate, participants were aware of time limits created by specific class schedules. As the researcher was fortunate to be welcomed into school classrooms, time constraints had to be maintained by preset school bells. This significantly limited the interview length and depth. It also may have limited participants' efforts in answering question items, as they were aware of and anticipating bell schedules. In general, the amount of time was sufficient for conducting the intervention and assessments for the study, but more time could have influenced results, as conceptual change is a gradual, effortful process (Mason, 2007). Furthermore, had students not been anticipating the end of class, more time might have been spent on engaging with the intervention texts. Past research suggests that this increase of engagement may increase the likelihood of conceptual change occurring (Diakidoy et al., 2003; Dole & Sinatra, 1998).

A third limitation of this study was found in the actual refutation text statement

creation. The researcher created the statements of refutation according to the counsel and direction from other researchers with experience in refutation text studies. As mentioned in earlier literature reviews, research shows that refutation text structure plays a major factor in its effectiveness (Tippett, 2010). It is difficult to know if the text structure of the refutation text interventions were as effective as they could have been. It is also difficult to discover if less conceptual change had among other topics was the result of misconception robustness or poor refutation text structure. This limitation will always be had in text structure studies (Diakidoy et al., 2003).

A fourth limitation to this study is in relation to the interview questions about thought processes while reading refutation text. It is possible that thoughts are more correctly recognized in the moment, rather than after the fact. Hence, some previous researchers used think-aloud measurements that were aimed to determine what was happening in the mind of a student right then (Kendeou & van den Broek, 2008). Though the present study interview methodology is in line with former refutation text studies (Mason & Gava, 2007), it is possible that the accuracy of post reading interviews is limited due to the passage of time.

Future Research

This study documents refutation text's power for creating conceptual change in LDS youth who hold doctrinal misconceptions. Though there has been much research on conceptual change (Vosniadou, 2008) and refutation text (Tippet, 2010), this study sought to specifically look at refutation text's effect on conceptual change in LDS

religious education topics. This line of specific focus in research is new, and much more research is needed to verify the differing aspects of LDS religious education versus secular subjects.

In the present study, the researcher explored refutation text's effect in relation to common misconceptions held by LDS high school age youth. Findings indicated that a significant percentage of youth had misconceptions about faith, baptism, and grace concepts. Though the present study is concerned with overcoming misconceptions through text structures, the researcher found no research studies on LDS doctrinal misconceptions. Further research is needed to examine how wide spread doctrinal misconceptions are had in LDS youth and investigations should be made as to possible origins of these misconceived notions. The present study found that 86% of participants had the same misconception of baptism. This suggests that there must be some type of common instruction that is misleading the majority of LDS youth. Limitations of this study do recognize that this may be a specific misconception toward a local LDS population, but more research is needed to determine the magnitude and origins of misconceptions.

Further research is also needed to investigate high school-age youth's perceived text structure preferences. Time restraints and small sample size limited the present study from having more in depth discussions as to why students preferred refutation text structures. Furthermore, the study had mixed results in qualitative and quantitative findings. This could be the result of random selection of interviews, or it could have been an indication of incongruences in students' perceived written and spoken preferences.

More investigation is needed to reveal the true meaning of participants' preference of refutation texts.

Similarly, it appears that refutation text preference may be linked to its ability to create topic interest. The results of this study observed that more participants experienced an attention, interest, thoughtfulness, or mental conflict increase with refutation texts than with the expository texts. It appears that these feelings created greater interest in the refutation text, as these emotions were listed reasons for why participants preferred refutation text structures. These findings supported claims by Mason and Gava (2008) that refutation text may be promoting topic interest in participants with initially lower topic interest at pretest. This hypothesis opens the door for additional research seeking to determine refutation text's effects on participants with no topic interest. Such research would aid applications for poorly motivated and interested students who struggle to find desire to engage with present curriculums.

A specific finding of the present study raised questions about refutation text's power for aiding knowledge acquisition. It is important to note that in generally accepted terms, conceptual change refers to a simple restructuring and replacement of knowledge, while knowledge acquisition refers to gaining conception of something not previously known (Chinn & Brewer, 1993; Dole & Sinatra, 1998; Posner et al., 1982; Sinatra & Broughton, 2011; Vosniadou & Brewer, 1987). The present study discovered that refutation text was more powerful than expository text in bringing participants with no conception to a state of partial or correct conception. This refutation effect is in need of specific investigation with regards to curriculum and instruction for student learning.

Though past research is replete with evidence of refutation text's effects on conceptual change (Guzzeti et al., 1993), new research needs to specifically investigate its ability to aide correct knowledge acquisition.

Past research signifies refutation text's ability to cognitively co-activate ones misconceptions with new conceptions (Kendeou & van den Broek, 2008), but the present study now questions whether this co-activation occurs when there is no conception held by the learner. Perhaps the statement of misconception within the refutation text itself creates a momentary misconception that is coacting with the correct information presented. This affect might more deeply teach a concept to the new learner who has no conception of the topic. Further research is needed to exhaust the validity of this possible phenomenon.

Similarly, research is needed to discover possible negative effects of expository texts structures currently used in LDS curriculum. The present study saw some statistical evidence supporting the idea that expository texts may actually create misconceptions. Obvious limits are placed on this assumption, when considering expository texts in general, as these textual statements' topic variety and word structure is nearly infinite in their enormity. However, with regards to the specific study, a possibility of misconception creation from current expository text within LDS curriculum is possible. Future research may focus on current expository text statements to see if knowledge acquisition on new topics developed misconceptions in learners.

Conclusion

This study indicates that refutation text may provide heightened topic interest and be a significant intervention for promoting conceptual change related to LDS doctrine. Refutation text has also been shown to be a preferred text type among LDS high school age youth. These findings lead the researcher to encourage LDS curriculum developers and instructors to work toward using this intervention to increase students' understanding and application of the scriptures. It is important that LDS Seminary students gain correct conceptions of core religious doctrines and principles that can enable them to withstand the flood of filth that permeates modern society.

Refutation text is one intervention that this study has shown to be effective in accomplishing this goal. It is hoped that the results of the study will eventually impact LDS learners' classroom experience in preparing to "study the scriptures…understand them…and live accordingly" (Monson, 2009). Results of this study should benefit teachers, researchers, and curriculum writers within religious and secular subjects, particularly those who practice and teach LDS religious education to the private LDS church educational system of Seminaries and Institutes.

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APPENDICES

Appendix A

Questionnaire Used to Measure Topic Interest

Questionnaire used to Measure Topic Interest

Please mark how you feel in relation to the statements listed below. Circle the number that best matches your personal feeling.

1. I would be excited about studying the doctrines of Baptism, Faith, and Grace in seminary classes.
   Not at all Not too much   Not sure   Somewhat   Very much
       1   2   3   4   5

2. I think that there are many more relevant topics than baptism, faith, and Grace in seminary classes.
   Not at all Not too much   Not sure   Somewhat   Very much
       1   2   3   4   5

3. I think it is important to know how we receive God's Grace.
   Not at all Not too much   Not sure   Somewhat   Very much
       1   2   3   4   5

4. I think that during seminary classes some time should be devoted to talking about baptism.
   Not at all Not too much   Not sure   Somewhat   Very much
       1   2   3   4   5

5. I am not interested in knowing more about baptism.
   Not at all Not too much   Not sure   Somewhat   Very much
       1   2   3   4   5

6. I think that faith is a worthwhile and deep topic of religion.
   Not at all Not too much   Not sure   Somewhat   Very much
       1   2   3   4   5

7. I want to learn religious doctrines and want to be involved in discussing them.
   Not at all Not too much   Not sure   Somewhat   Very much
       1   2   3   4   5

8. Grace is an interesting topic that I enjoy talking about.
   Not at all Not too much   Not sure   Somewhat   Very much
       1   2   3   4   5

9. Knowing the doctrines of Baptism, Faith, and Grace is not important to me.
   Not at all Not too much   Not sure   Somewhat   Very much
       1   2   3   4   5

10. I am wholehearted in learning about my faith.

Not at all	Not too much	Not sure	Somewhat	Very much
1	2	3	4	5

Appendix B

Religious Concept Inventory

Religious Concept Inventory

Please provide a short answer (3 or 5 sentences) to each of the following questions.

1. What is faith?

2. What does it mean to have faith?

3. What promises are made at baptism?

4. What does baptism do for us?

5. What is Grace?

6. How do we receive Grace?

Please circle all the correct answers that apply.

7. What does baptism by immersion do for us?
    a. It shows our willingness to go to the depths of obedience even unto death
    b. It witnesses the death of a person's sinful life and the rebirth into a spiritual life
    c. It teaches us the earth's burning at the Second Coming
    d. It cleans us of our sins.
    e. It opens the way for us to receive the Holy Ghost
    f. I don't know

8. Divine grace is _____.
    a. given only to those who are baptized in mortality
    b. a means of help or strength given through the bounteous mercy and love of Jesus Christ
    c. made possible through the atoning sacrifice of Jesus Christ
    d. why there is no effort required on our part to be worthy to dwell with Heavenly Father
    e. a way that individuals receive strength to do good works that they otherwise would not be able to maintain
    f. an enabling power that allows men and women to have eternal life after they have expended their own best
    efforts
    g. I don't know

9. To be reconciled to God means _____.
    a. to forgive each other
    b. to be called and chosen
    c. to become clean and worthy to return to Him
    d. to suffer the full measure for one's own sins
    e. I don't know

10. Faith is _____.
    a. A belief in things not seen
    b. Involves action and is different than belief
    c. A principle of power that allows us do all necessary things
    d. Manifest in your beliefs, not your actions
    e. Centered in Jesus Christ
    f. I don't know

Appendix C

Refutation Text

Refutation Text

Faith

The Apostle Paul taught that "faith is the assurance of things hoped for, the evidence of things not seen" (Hebrews 11:1). Alma taught: "If ye have faith ye hope for things which are not seen, which are true" (Alma 32:21). Many people think that faith and belief is the same thing or that faith is a stronger form of belief. But this is not true. Faith involves action based on beliefs, whereas belief describes what you think. Faith is manifest in what you do or by the way you live. In order for your faith to lead to salvation, it must be centered in the Lord Jesus Christ (Acts 4:10–12; Moroni 7:24–26; Articles of Faith 1:4). You can exercise faith when you have a correct idea of his character, an assurance that He exists, and a knowledge that you are striving to live His commandments. The Savior promised, "If ye will have faith in me ye shall have power to do whatsoever thing is expedient in me" (Moroni 7:33).

Grace

The word *grace,* as used in the scriptures, refers primarily to the divine help and strength we receive through the Atonement of the Lord Jesus Christ. The Apostle Peter taught that we should "grow in grace, and in the knowledge of our Lord and Saviour Jesus Christ" (2 Peter 3:18). Some people assume that only those who believe in Christ will receive his Grace. You may hold similar beliefs. However, this is not correct. All people are granted grace because of Christ's resurrection. His Grace grants divine power that allows all people to receive life after death. This Grace is not just to believers, but also to all people who have lived or will live on the earth. It is freely given to all! However, the phrase "after all we can do" teaches that effort is required on our part to receive the fullness of the Lord's Grace and be made worthy to dwell eternally with Him. Our effort involves following the Lord's commands to obey His gospel, which includes having faith in Him, repenting of our sins, being baptized, receiving the gift of the Holy Ghost, and enduring to the end (John 3:3–5; 3 Nephi 27:16–20; Articles of Faith 1:3–4).

Baptism

Baptism is the first saving ordinance of the gospel (see Articles of Faith 1:4). Through baptism and confirmation by priesthood authority, you became a member of The Church of Jesus Christ of Latter-day Saints. When you were baptized, you showed your willingness to follow the Savior's example. Many people believe that baptism washes away their sins. But this belief is incorrect. Washing away sin, known as remission of sins, comes after baptism when people have received the Holy Ghost. Though baptism does not wash away your sins, it opens the door to receiving a remission of sins through the mercy of the Savior. To receive a remission of your sins, you must exercise faith in Jesus Christ, be sincerely repentant, and strive always to keep the commandments. Then comes the remission of sins by fire and by the Holy Ghost (1 Nephi 31:17). With this

blessing, you can be permitted eventually to live in the presence of Heavenly Father.

All who seek eternal life must follow the example of the Savior by being baptized and receiving the gift of the Holy Ghost. And then are [we] in this strait and narrow path which leads to eternal life" (2 Nephi 31:17–18), but that baptism does not assure eternal life. We will receive eternal life if we endure to the end, keep our covenants and receive other ordinances of salvation. When you were baptized, you entered into a covenant with God. You promised to take upon yourself the name of Jesus Christ, keep His commandments, and serve Him to the end (see Mosiah 18:8–10; D&C 20:37).

Appendix D

Expository Text

Expository Text

Faith

      The Apostle Paul taught that "faith is the assurance of things hoped for, the evidence of things not seen" (Hebrews 11:1; see footnote *b*). Alma made a similar statement: "If ye have faith ye hope for things which are not seen, which are true" (Alma 32:21). Faith is a principle of action and power. In order for your faith to lead you to salvation, it must be centered in the Lord Jesus Christ (see Acts 4:10–12; Mosiah 3:17; Moroni 7:24–26; Articles of Faith 1:4). You can exercise faith in Christ when you have an assurance that He exists, a correct idea of His character, and a knowledge that you are striving to live according to His will. The Savior promised, "If ye will have faith in me ye shall have power to do whatsoever thing is expedient in me" (Moroni 7:33). Faith in Jesus Christ can motivate you to follow His perfect example (see John 14:12).

Grace

      The word *grace,* as used in the scriptures, refers primarily to the divine help and strength we receive through the Atonement of the Lord Jesus Christ. The Apostle Peter taught that we should "grow in grace, and in the knowledge of our Lord and Saviour Jesus Christ" (2 Peter 3:18). Because of the Fall, everyone will experience temporal death. Through grace, made available by the Savior's atoning sacrifice, all people will be resurrected and receive immortality (see 2 Nephi 9:6–13). But resurrection alone does not qualify us for eternal life in the presence of God. Our sins make us unclean and unfit to dwell in God's presence, and we need His grace to purify and perfect us "after all we can do" (2 Nephi 25:23). The phrase "after all we can do" teaches that effort is required on our part to receive the fullness of the Lord's grace and be made worthy to dwell with Him. The Lord has commanded us to obey His gospel, which includes saving faith in Him, repenting of our sins, being baptized, receiving the gift of the Holy Ghost, and enduring to the end (see John 3:3–5; 3 Nephi 27:16–20; Articles of Faith 1:3–4).

Baptism

      Baptism is the first saving ordinance of the gospel (see Articles of Faith 1:4). Through baptism and confirmation by priesthood authority, you became a member of The Church of Jesus Christ of Latter-day Saints. When you were baptized, you showed your willingness to follow the Savior's example. He too was baptized, even though He was without sin. As He explained to John the Baptist, He needed to be baptized in order to "fulfill all righteousness" (see Matthew 3:13–17). All who seek eternal life must follow the example of the Savior by being baptized and receiving the gift of the Holy Ghost. And then are [we] in this strait and narrow path which leads to eternal life" (2 Nephi 31:17–18). We will receive eternal life if we endure to the end, keep our covenants and receive other ordinances of salvation.

Immersion is symbolic of the death of a person's sinful life and the rebirth into a spiritual life, dedicated to the service of God and His children. It is also symbolic of death and resurrection. (See Romans 6:3–6.) When you were baptized, you entered into a covenant with God. You promised to take upon yourself the name of Jesus Christ, keep His commandments, and serve Him to the end (see Mosiah 18:8–10; D&C 20:37). Because you have been baptized, you can receive a remission of your sins. You can be forgiven through the mercy of the Savior. To receive a remission of your sins, you must exercise faith in Jesus Christ, be sincerely repentant, and strive always to keep the commandments. With this blessing, you can be permitted eventually to live in the presence of Heavenly Father.

Appendix E

Refutation Text/Expository Text Rating

Refutation Text/Expository Text Rating

1. How much did you enjoy reading this text?
   Not at all Not too much   Not sure   Somewhat   Much
      1   2   3   4   5
2. How much do you enjoy reading religious texts?
   Not at all Not too much   Not sure   Somewhat   Much
      1   2   3   4   5
3. Which text would you prefer to read and why? **Text one** or **Text two**?

Appendix F

Open-Ended Interview Questions

Open-Ended Interview Questions

1. Was there anything in these texts that made you think?
2. What statements from the text caught your interest?
3. Which text statement did you prefer?
4. Why did you like/dislike what you had read?

Appendix G

Five-Question Math Distracter Activity

Five-Question Math Distracter Activity

(Distracter Activity 1-Fath)
Directions: Solve each equation.
1) $x + 82 = 112$
2) $29 + y = 114$
3) $7 = a - 91$
4) $x - 12 = 47$
5) $x + 45 = 98$

(*Distracter Activity 2-Baptism)*
1) $4 = a - 43$
2) $67 = a - 33$
3) $x - 14 = 17$
4) $24 + y = 123$
5) $x + 34 = 117$

(*Distracter Activity 3-Grace)*
1) $x + 29 = 38$
2) $49 = a - 7$
3) $z - 18 = 130$
4) $18 + y = 9$
5) $34 - x = 17$

Appendix H

Personal Information

Personal Information

ID#_____   Male/Female   Age:_____

Grade_____

(Normal RCI would Follow… See APPENDIX B)

Appendix I

Factor Beyond the Scope of This Study

Factor Beyond the Scope of this Study

Epistemological Beliefs and Conceptual Change

When students are confronted with new knowledge they activate more than just their prior knowledge surrounding the topic of interest. They also cognitively activate beliefs about knowledge itself (Mason & Gava, 2007, 2008). Beliefs about knowledge and knowing are individuals' representations about the nature, organization, and source of knowledge (Hofer & Pintrich, 2002). These beliefs about knowledge are described as epistemological beliefs. Epistemological beliefs have been described by scholars as multidimensional, though literature indicates an agreement on four general epistemological dimensions (Chinn et al., 2011; Hofer & Pintrich, 1997; Mason & Gava, 2007). The first two dimensions regard the nature of knowledge (e.g., simple, complex). The next two dimensions regard the nature of knowing (e.g., changing, certain).

The nature of knowledge concerns beliefs about the simplicity versus the complexity of knowledge (Mason et al., 2008). This first dimension looks at the degree to which knowledge is conceived as multifaceted or interconnected. Some individuals' epistemological beliefs lend to a view of knowledge as simple facts while others see knowledge as complex interrelated concepts (Hofer & Pintrich, 1997). The second dimension in the nature of knowledge concerns individuals' beliefs about the certainty or uncertainty of knowledge (Chinn et al., 2011). Some see knowledge as stable and constant while others view knowledge as changing and evolving. Those who see knowledge as stable and constant are said to have less sophisticated epistemological beliefs than those who view knowledge as changing and evolving (Mason & Gava,

2008). Scientific institutions, for example, view knowledge as evolving and permit

fundamental theory change in response to newly discovered information (sophisticated

epistemic beliefs) whereas many religious institutions view fundamental beliefs as

absolute (less sophisticated epistemic beliefs) and therefore do not permit fundamental

belief change (Chinn & Brewer, 2000).

The two belief dimensions that regard the nature of knowing concern the source

of knowledge and the justification of knowledge (Mason et al., 2008). The source of

knowledge refers to the authority of the dispenser of knowledge as well as the

relationship between the knower and the known (Hofer & Pintrich, 1997). Individuals'

beliefs about the source of knowledge range from believing that knowledge resides

outside ones' self to the belief that knowledge is constructed by one's self (Mason et al.,

2008). Many religious institutions, for example, believe that God is the dispenser of all

truth through enlightenment of the human mind, whereas scientific institutions see the

individual as the source of knowledge construction through interactions, observations,

and experimentation in the world around them (Chinn & Brewer, 2000).

The justification of knowledge is the next dimension of the nature of knowing and

it concerns the evaluation of knowledge claims and the use of evidence to support such

claims (Chinn et al.,, 2011). Mason and colleagues (2008) described the justification of

knowledge as ranging between the belief that observation and authority justify

knowledge "to the belief in the use of rules of inquiry and evaluation of expertise [justify

knowledge]" (p. 292). These epistemic beliefs about the nature of knowledge and the

nature of knowing are believed to affect the cognitive processes associated with

conceptual change for students who read refutation text as a tool for correcting misconceptions (Mason et al., 2008).

The survey below is taken from Mason's (2008) study as an example of how epistemological beliefs may be measured in religious education. The researcher determined that developing and proving this measurement tool would be beyond the scope of this dissertation study. It is included herewith for those seeking to do further research in conceptual change of religious beliefs or doctrines.

Beliefs about Religious Doctrines

Please mark how strongly you agree or disagree with the statements listed below. Circle the number that best matches the strength of your belief.

1. All religious doctrine questions have only one right answer.
       strongly disagree   disagree   unsure   agree   strongly agree
                1   2   3   4   5

2. LDS Religious doctrine is always true.
       strongly disagree   disagree   unsure   agree   strongly agree
                1   2   3   4   5

3. There are some questions that even religious doctrines cannot answer.
       strongly disagree   disagree   unsure   agree   strongly agree
                1   2   3   4   5

4. Prophets always agree about what is true in Religious doctrines.
       strongly disagree   disagree   unsure   agree   strongly agree
                1   2   3   4   5

5. New discoveries can change what prophets' think is true.
       strongly disagree   disagree   unsure   agree   strongly agree
                1   2   3   4   5

6. Sometimes prophets change their minds about what is true in doctrine.
       strongly disagree   disagree   unsure   agree   strongly agree
                1   2   3   4   5

7. Once prophets have the taught doctrine, then that becomes the only doctrinally correct answer.

      strongly disagree disagree   unsure   agree   strongly agree

           1   2   3   4   5

8. Prophets knew pretty well everything about doctrine; there is not much more to know.

      strongly disagree disagree   unsure   agree   strongly agree

           1   2   3   4   5

9. Ideas in LDS Religious doctrines sometimes change.

      strongly disagree disagree   unsure   agree   strongly agree

           1   2   3   4   5

10. The ideas in prophetic writings sometimes change.

      strongly disagree disagree   unsure   agree   strongly agree

           1   2   3   4   5

11. The most important part of religion is arriving at the right answer.

      strongly disagree disagree   unsure   agree   strongly agree

           1   2   3   4   5

12. Some ideas in LDS religion today are different than what prophets used to think.

      strongly disagree disagree   unsure   agree   strongly agree

           1   2   3   4   5

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