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Effective Implementation of Teacher Training: Is it a Heuristic or an Algorithmic Process?

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Effective Implementation of Teacher Training: Is it a Heuristic or an Algorithmic Process?

by

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Dissertation

Presented to the Faculty of the Graduate School of

The University of Texas at Austin

in Partial Fulfillment

of the Requirements

for the Degree of

Doctor of Philosophy

The University of Texas at Austin

December 2006

This dissertation is dedicated to the teachers.

I have had many and I am grateful to them all.

Thank you for teaching me what yes feels like.

I am happy to report that it is now

unmistakable.

Acknowledgements

I would like to take this opportunity to acknowledge the contributions of some special people without whom this dissertation would not be what it is. First, I am forever grateful to my advisor, Dr. Claire Ellen Weinstein, who convinced me to set this goal and supported me throughout. She has had a tremendous impact on my life and I will never forget her. I would also like to extend my gratitude to my dissertation committee: Dr. Marilla Svinicki (who wisely made me include autonomy support), Dr. Keenan Pituch (who did not laugh when I asked stupid questions), Dr. Diane Schallert (who believed deeply in my underlying premise), and Dr. Phyllis Robertson (who taught me about Bilingual education and also about staying cool under pressure).

I am also deeply grateful to my family, who started me on this path, especially to my Aisha, who is living proof that it doesn't take a Ph.D. to be brilliant but indulges me anyway. Can you believe one of us is a doctor? I am so very grateful to all of my friends, but none more than Courtney and Kisha, who endured endless hours of listening to me talk through this process and graciously acted like they were interested. Thank you for being my touchstones now and always. And Jack, whenever I think of the year it took to write this I will think of you and smile. You have been my sanctuary.

Effective Implementation of Teacher Training: Is it a Heuristic or an Algorithmic Process?

Publication No._____

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The University of Texas at Austin, 2006

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Providing quality education for our students is one of the great challenges of our time. In this endeavor, teachers and the quality of their instruction is key. A common mode to achieving quality instruction is training teachers to update instructional practices. Training has traditionally been evaluated by perceptions of the training itself. Yet less is known about the effectiveness of teacher training in terms of transfer into classroom practices and impacts on student learning. The purpose of this dissertation was to investigate the nature of implementation of teacher training (heuristic or algorithmic) and its effects on student achievement. Training with a new early elementary reading initiative, Reading First, was employed to examine (1) the influence of teacher characteristics on their implementation, (2) the potential mediating effect of the nature of implementation on the relationship between teacher characteristics and student achievement, and (3) the potential moderating effect of quality on the relationship between the nature of implementation and student achievement. These research questions

were investigated in two separate studies using the same methodology, one with English-speaking classrooms and one with Spanish-speaking classrooms.

For Research Question 1, I found that there were teacher characteristics that predicted implementation of training for both studies. Teachers' Flexible Thinking and Autonomy Support were both associated with English-speaking classroom implementation. For Spanish-speaking classrooms, teachers' attitude toward the program affected their implementation. For Research Question 2, I found that the nature of teachers' implementation could predict student achievement in reading. For both studies, using the features of effective instruction had a positive impact on student achievement. For the English-language study, implementing SBRI content heuristically was associated with higher student achievement and teaching SBRI content was found to negatively impact student achievement. For Research Question 3, I found that quality of innovations does impact student achievement in reading. For the English-language study, teachers who were heuristic when teaching SBRI content, increases in student achievement depended on the quality of those innovations. For the Spanish-language study, the impact of a heuristic approach to implementation on student achievement depended on the quality of teachers' innovations with content.

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Chapter 1

Introduction

Student learning is the common goal of education. Although many factors may impact student learning, perhaps that most important and most controllable factor is the instruction that they receive. To achieve the goal of student learning, high quality instruction is key. Thus, teachers play a central role in student learning, by providing high quality instruction that meets the needs of their students. However, research in the area of effective instruction is expanding and continually evolving, necessitating that teachers continually update their practices. Targeted teacher training interventions are a common means to disseminating information and facilitating improvements in instructional practices. Promisingly, some teacher training interventions have been shown to be effective means to facilitate change in classroom instruction (Klinger, 2004; Van der Sijde, 1989). This current focus by policymakers and administrators on teacher training interventions continues to be promising for two reasons.

First, it represents the recognition that teachers need to continually update their instruction, as evidenced by an evolving understanding of effective practices and disappointing student achievement. However, traditional instructional models often persist in classrooms despite both theoretical progress in the field as well as extensive research findings that support more current models of classroom instruction (Carver, Klahr & Mahwah, 2001; Klinger, 2004). Professional development opportunities have provided tools for teachers to change their practices for decades, but for the most part those changes have either not been implemented or they were enacted with significant

alterations to the original intent (Dyer, 1999; Hargreaves & Evans, 1997; Klinger, 2004; Scileppi, 1988). Therefore, despite learning about new methodologies, teachers are often not changing their instruction and large-scale reform has been elusive. This is one key reason that instructional reform efforts have been ineffectual in producing the desired improvements in student achievement (Spring, 1997). If ideas for change do not get translated into practice then such reform efforts will continue to have minimal impact. Second, it represents recognition that teachers are the gatekeepers of most change efforts, controlling implementation at an instructional level in individual classrooms (Datnow & Castellano, 2000). If teachers do not transfer and apply training content, real and lasting change will probably not happen.

After reviewing the literature, research on the effectiveness of teacher training interventions appears to be incomplete. Most evaluations of the effectiveness of training have been administered immediately following training and have focused on teachers' perceptions of the quality of training and/or their attitudes toward changing their practices in the future (Showers, 1990; Rossi, Freeman & Lipsey, 1999; Weiss, 1997). Although this is valuable information, it does not provide a complete picture. What a teacher expects to do with the content and what they actually do with it may be very different. Little research has been done that takes a more longitudinal approach and analyzes training effectiveness in terms of classroom implementation (Klinger, 2004; Showers, 1990). Such an analysis is one of the only ways to measure actual instructional change over time. Furthermore, little research has focused on the quantity or quality of implementation. More research that focuses on training effectiveness in terms of actual instruction, or implementation, is needed.

In education, the benchmark for successful implementation of training lies with student achievement. Without improvement in student outcomes, reform efforts are considered to have failed (Fullan, 2005). To date, few studies link effective implementation of training with student success, one of the only ways to mark our progress toward the common goal of improving student achievement. To that end, this study used a different conceptualization for research in teacher training by analyzing not only the implementation stage of the change process itself but also the nature of that implementation and certain key factors that may have contributed to its success or failure within the context of student achievement. In order to examine the effects of teacher training on student achievement, teachers' implementation of a new reading initiative, Reading First, was examined. Student achievement was measured by improvement in reading scores over the course of one school year.

The theoretical question that drove this inquiry was whether effective transfer and implementation of training is a more heuristic or a more algorithmic process? That is, are students more successful when teachers use an algorithmic, standardized approach to implementing a new program or are students more successful when teachers use a heuristic approach and adapt or modify the new program materials and methods for their own classes?

Using the algorithmic approach to implementation, teachers teach the new content exactly as it was presented in training in order to be successful. Interpretation or modification of training content would be assumed to lead to less effective implementation, which in turn might lead to lowered student achievement. This approach

relies on a formula for success. Uniformity is key to success in the algorithmic approach, with the goal being standardized instruction that is consistent with the training content.

Using the heuristic approach to implementation, teachers implement training through a flexible, individualized process. In fact, using this approach, teachers take the perspective that effective implementation relies on flexibility in order to be successful. From this perspective, training content needs to be modified and adapted by teachers during implementation to meet their needs and the needs of their students in order to improve achievement. In other words, modification of training content is hypothesized to lead to a higher probability of success. Individual interpretation and modification is key to this approach, with the goal being differentiated instruction that is consistent with the intent of the training but also meets the perceived needs of both the teacher and the students.

Prior research has not adequately addressed algorithmic versus heuristic approaches to the implementation of training content, although a few theorists have identified similar categories for instructional styles (Datnow, 1998; Drach-Zahavy, 2004). The purpose of this study was to use this comparison to investigate implementation approaches as they relate to student achievement. Based on related existing research, it was hypothesized that the heuristic approach to implementation would be more successful as evidenced by a positive association with increases in student achievement.

In order to assess heuristic versus algorithmic approaches, the nature of teachers' implementation was measured by the quantity of their innovative instruction, based on Janssen's theory of Innovative Work Behavior (2004). Innovative Work Behavior has been correlated with several favorable employee outcomes in organizational settings,

including performance (Frese et al., 1996; Oldham & Cummings, 1996; Organ, 1988). For this study, innovation in instruction provided a measure of relative novelty of teachers' instructional approaches to implementation: higher innovative instruction scores were used to indicate a more heuristic approach and lower innovative instruction scores were used to indicate a more algorithmic approach. For this study instructional innovation was defined as: The degree to which teachers intentionally modify, create, and apply new instructional ideas, processes, products, or procedures in order to benefit student learning or teacher role performance. This study was also designed to build on Janssen's theory by applying it in an educational setting.

Additionally, it is probable that the nature of teachers' implementation was at least partially related to certain individual characteristics (Datnow & Castellano, 2000). A second component of these studies was to examine these possible associations. Principal among the teacher variables investigated were orientations toward flexible thinking and perceived autonomy support. Research has shown that a tendency toward cognitive flexibility, also often defined as receptivity to change, impacts motivation and can lead to change in behaviors (Stanovich, 1997). For this study, flexible thinking was hypothesized to be related to the nature of implementation of training content, with less flexible teachers exhibiting more algorithmic behaviors and more flexible teachers exhibiting more heuristic behaviors.

In addition, teachers' perceived autonomy support might impact their implementation of training. Perceived autonomy support is based on Cognitive Evaluation Theory, which suggests that when we engage in a behavior, the context plays a role in the initiation and regulation of that behavior (Deci & Ryan, 2002). Therefore, it

is likely that teachers' perceptions of these contextual factors may influence their instructional choices during the implementation of training. It was hypothesized that teachers' perceptions of autonomy support would affect the nature of implementation, resulting in a more heuristic approach to implementation.

Motivational factors may also have a strong influence on teachers' implementation. Specifically, research has shown a relationship between teachers' perceived competence, or situational self-efficacy, and their performance or behaviors (Pajares, 1996; Schunk, 2005; Tschannen-Moran & Woolfolk-Hoy, 2001). Therefore, teachers' perceived competence related to the training that they received was included as an additional teacher-level predictor of type of implementation in the studies. In addition, teachers' attitude toward the program itself was predicted to impact their implementation. This hypothesis was based on previous findings that have suggested that attitudes do impact behavioral choices, particularly in the face of educational reform (Corrigan, 2001; Fullan, 2000; Hargreaves, 1992).

Finally, language of instruction was considered as a determining variable for both students and teachers. Research has shown that there are differences in the nature of native-language and second-language instruction, student achievement in reading, as well as the individual characteristics of teachers and students from different sociocultural backgrounds (Goldenberg, Rueda & August, 2006). Therefore, it was likely that language of instruction would predict both teacher implementation and student outcomes. To account for these potential differences, and to enable comparison of results, two separate studies examining the same constructs and using the same methodology were conducted, one with English-only classrooms and one with Bilingual classrooms. The results of these

two studies may offer insight into the nature of implementation of training and its effect on student achievement by language of instruction.

The following graphic (Figure 1) depicts the hypothesized relationships between the predictor variables (teacher characteristics and implementation) and the outcome variable (student achievement in reading) for both of the studies. Note that the implementation of Scientifically Based Reading Instruction (SBRI) included several variables that were hypothesized to have distinct impacts on student achievement. The relationship between teacher characteristics and student achievement in reading was predicted to be mediated by both congruence with SBRI guidelines and innovations of SBRI. In addition, the relationship between innovation of SBRI and student achievement was predicted to be moderated by the quality of the innovations. This conceptual model was consistent across both studies, differing only in the language of instruction and assessment.

Figure 1.

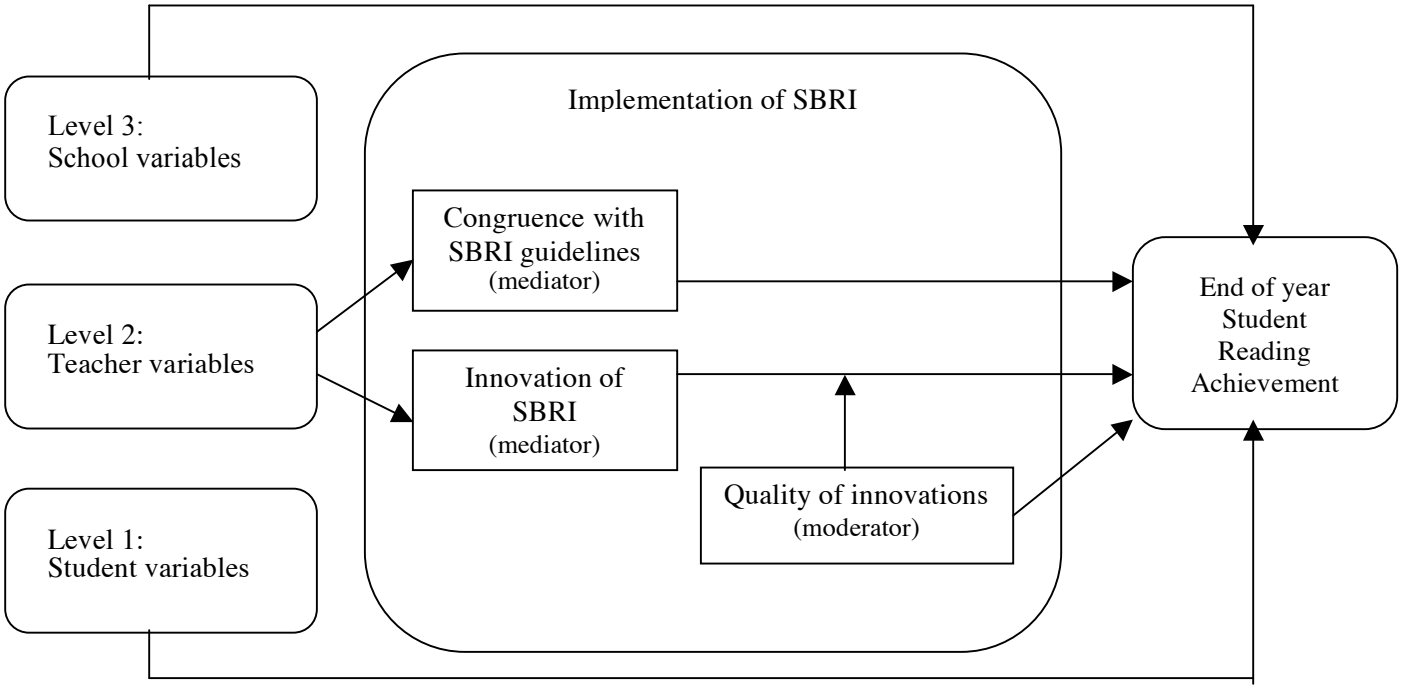


Figure 1: The conceptual for the studies.

The Proposed Studies

These studies explored the effects of teachers and their teaching on student achievement. However, students are situated in environments that may affect outcomes. Student-level variables may depend to some extent on their classroom environment. Because of this, additional dependence between subjects for this study was likely, leading to "nested" data. Therefore, an analytical method that accounted for this dependence between subjects by including the environment as an additional level of analysis was most appropriate for this inquiry. For this reason, a multilevel model, Hierarchical Linear Modeling (HLM) (Raudenbush & Bryk, 2002), was used to analyze the data gathered in both of these studies.

These studies were designed to answer the following research questions:

1. To what extent do teacher characteristics (flexible thinking, perceived autonomy support, attitude toward SBRI, and perceived competence with SBRI) predict their implementation of training (congruence with SBRI, innovation of SBRI and the quality of innovations)?

2. To what extent do congruence with SBRI and innovation of SBRI mediate the relationship between teacher characteristics (flexible thinking, perceived autonomy support, attitude toward SBRI, and perceived competence with SBRI) and students' achievement in reading?

3. To what extent does the quality of teachers' innovations of SBRI moderate the relationship between innovation of SBRI and students' achievement in reading?

Chapter 2

Review of the Literature

The following sections include a review of the theoretical, conceptual, and empirical literatures on second-language learners, the implementation of training, as well as the predictor variables included in this study for students, teachers, and schools. First, I will briefly discuss second-language learners. Next, I will discuss the implementation of training, including approaches to implementation and assessing implementation approaches. Then, each of the predictor variables will be discussed, beginning with student achievement, proceeding to the primary teacher variables of interest and ending with school-level variables.

Second-Language Learners

This dissertation investigated the implementation of a reading initiative and its impact on student learning. Two groups of students were used to assess the impact of implementation, those from English-only classrooms and Bilingual classrooms. Concerning the Bilingual group, this section will provide a brief overview of relevant terms, the learning context, and the importance of researching second-language learners independently. However, the research background for second-language learners will be considered within specific domains for the reminder of this literature review. For example, when discussing student achievement, relevant literature for both groups of students will be reported within that domain.

Terms

The students who participated in the Bilingual classroom portion of this dissertation study will be referred to as *second-language learners*. This term refers to students from homes where a language other than the dominant societal language is used. These students are required during schooling to develop some level of proficiency in another language, thereby becoming second-language learners. In contrast, students who are not second-language learners will be referred to as *native-language* students. It should be noted that second-language learners' proficiency with English might be at various levels, although by definition they are not fluent in the dominant language (Rivera, 1994). Occasionally, these students may also be referred to as *language-minority* students. Language-minority students are students whose native language is different from the dominant language. However, these students are not necessarily still learning the second language and may already be fluent (Hakuta et al, 1996). In contrast, students other than language-minority will be referred to as *language-majority* students. These terms will only be used when discussing specific research studies as a means of providing accuracy in interpretation of the research. That is, if the researchers refer to these students as language-minority then I shall do the same for precision. However, although representing subtle differences in meaning, these differences are not relevant to the goals of this study and these terms can be assumed to be interchangeable for the purpose of this dissertation.

In addition, the term *bilingual education* will be used to refer to school programs intended to serve the needs of second-language learners by providing instruction in both the students' native language and the second language (August, 2006). For example, a bilingual education program might teach part of the day in English and part of the day in

Spanish, in an effort to help students acquire not only content knowledge but second-language knowledge as well. The participants in this study are from bilingual school programs. Therefore, the terms *Bilingual classrooms* or *Bilingual students* will be used to distinguish this group of students from the English-only sample. However, students will receive monolingual reading instruction in their native language, Spanish.

Learning Context

The number of second-language learners is American schools is increasing every year. Of the total number of students who speak a language other than English at home, Spanish speakers are by far the largest group of language-minority students, at 72% (National Center for Education Statistics, 2002). Therefore, understanding the learning process with second-language learners, particularly Bilingual students, is very important. This includes understanding how their development is like their native-language peers as well as the domains where they have a unique developmental course. There are many factors that may affect learning for second-language learners. This learning process is a multidimensional paradigm. For any student, there can be a host of dynamic influences on learning, including individual characteristics, underlying cognitive abilities, and educational background. In particular, there are a few influences that are especially salient when considering second-language learners.

First, there are factors in the educational context that may influence the learning of second-language learners. For instance, a total of 60% of second-language learners attend schools where more than 30% of the student body are second-language learners as well (National Center for Education and Statistics, 2002). That is, second-language

learners tend to attend the same schools. Thus, they tend to be grouped for instruction. However, this grouping can lead to disparity in instruction and potential social isolation. It is possible that this pattern of segregation may impede the ability of schools and students to meet rising standards (August, 2006). In other words, schools with higher concentrations of second-language learners are required to meet the needs of students in terms of learning content and mastering a second language. It seems reasonable that schools with high concentrations of second-language learners, and therefore a more demanding instructional burden, may have more difficulty demonstrating sufficient annual yearly progress, as required by new federal laws, compared to other schools with lower concentrations. Therefore, the educational context may impact student learning.

Second, the learning of second-language learners may be influenced by their native language abilities. Research shows that second-language learners are subject to additional influences from their level of language-proficiency in their native language (August & Shanahan, 2006). That is, language-proficiency is the foundation upon which more abstract and complex constructs, such as school content, are scaffolded (Mehler, Pallier & Christophe, 1998). If students do not understand language then how are they to glean an understanding of the content? Sufficient native language proficiency is necessary for any student. However, for second-language learners, the understanding of a new language (and content) is necessarily predicated by a sufficient understanding of the native language. Research has shown that the learning of a new language is made far more effective and efficient when there is sufficient understanding of the meaning and mechanisms of the native language (Genesee & Gandara, 1999). Therefore, if students do not have sufficient language proficiency in their native language, they are at risk of

negative influences on their learning of both content and a second language. Thus, their level of language-proficiency in their native language may influence the learning of second-language learners.

Last, research has suggested a link between the sociocultural context in which children grow up and their learning. A sociocultural approach to learning emphasizes the role that social and cultural experiences play in the acquisition, organization, and use of knowledge (Gauvain, 1998). Gauvain found that the learning of all children is affected by their sociocultural context. For many second-language learners particularly, the importance of sociocontextual influences may be more salient, as these factors have been linked to poverty, low school quality, perceived low social status, and incompatibility between home and school environments with this population specifically (August & Shanahan, 2006). These factors may influence the learning of second-language learners, although to varying degrees. For example, particularly the influence of poor quality of schooling and instruction has been shown to impact student learning. Research has shown the importance of quality of instruction to student achievement (Datnow & Castellano, 2000). That is, students who receive high quality instruction learn more and achieve at higher rates. Therefore, the sociocultural context within which second-language learners navigate can impact their learning.

Importance

We have seen that second-language learners possess a unique set of sociocultural and cognitive influences that may influence their learning. For this population of students, there may be many factors that influence not only their learning but their

schooling as well. It is likely that second-language learners will receive different instruction that their native-language peers. In addition, it is possible that second-language instructors may possess a unique set of characteristics. Therefore, language of instruction may be an important predictor of the nature of implementation as well as student achievement. For this reason, language of instruction was considered as a determining variable in this study. This dissertation examined the effects of the nature of implementation of training on the achievement of both second-language learners and their native-language peers.

Because this dissertation studied second-language learning within particular domains, the following sections will provide more information about research with second-language learners for each domain. For instance, the next section will discuss the implementation of training and will include information regarding what research has suggested about implementation with second-language learners specifically.

Implementation of Training

Teachers are the centerpieces of change efforts through their control over actual classroom practice (Fullan, 1993; Klinger, 2004). Therefore, many current reform initiatives are directed at teachers and their active involvement in these efforts is considered to be critical (Datnow & Castellano, 2000). It seems clear that school reform must address the core processes of teaching and learning if real and lasting change is to occur (Elmore, 1996). Teachers must implement reform directives in order for such efforts to succeed.

However, teachers are often resistant to reform directives. Many researchers have documented the negative reaction of teachers when top-down mandates have been imposed on them (e.g., Bailey, 2000; Fullan, 1991; Sarason, 1990, 1996). These negative reactions can vary in severity. Sikes (1992) found that the most common reaction of teachers was to ignore the innovation and carry on as before. Teachers have reported being skeptical that externally developed solutions can work in their particular, local contexts (Bailey, 2000). Given these findings, it is not surprising that most efforts at education reform have been unsuccessful in producing change on a large-scale (Datnow & Castellano, 2000).

Yet, the literature shows some promising findings that can be used to reduce teacher resistance. Numerous researchers have shown that if teachers see a change as their own, rather than coming from an external group, they are more likely to implement it faithfully (Datnow & Castellano, 2000; Fullan 2002; Sarason, 1996). However, reform directives often do come from external sources. Encouragingly, over the course of several studies with K-12 public school teachers, Fullan (2002) has found evidence that even when teachers are told what to implement, if they feel that they have some control over the process of implementation they are more motivated to participate. He concludes that teachers' resistance to reform efforts may be a reflection of their need to own the changes that they implement. That is, they need ownership in order to be motivated and the path toward ownership is paved with their control over the implementation process.

This raises an interesting question about whether or not teachers are transferring and implementing what they have learned in training. Typically, evaluation of teacher training has provided an incomplete picture of its effectiveness in practice. Data

regarding teacher implementation is sparse and incomplete. Yet experts agree that studying program implementation is an important component of measuring any program's impact in the field (Rossi, Freeman& Lipsey, 1999; Weiss, 1997). To date, much of research in this area considers the acquisition of content as the primary (and in many case the only) concern, leaving out implementation in practice altogether (Klinger, 2004). Researchers tend to measure whether or not teachers have learned the training content but have focused little on their use of this content in their classrooms. In order for successful implementation of training to occur, teachers must first learn the content, but this is only the first step and evaluating the effectiveness of training based on this step only would likely provide an inaccurate conclusion. In addition, many assessments of training effectiveness have focused on teacher attitudes toward the training experience, which can contribute to the body of knowledge on this topic but leaves out a crucial component: implementation (Little, 1998; Showers, 1990). What a teacher expects to do with the content and what they actually do with it in practice may be very different. Evaluation of the effectiveness of training should include analysis of the outcomes in terms of classroom implementation (Showers, 1990). Mathison (1992) recommended that future research on teacher training should expand evaluation into real classrooms and take a longitudinal perspective of implementation, looking at changes in practice. Investigating the process of implementation of training appears to be an important next step in examining educational reform effectiveness.

Although of interest to researchers for many years, the feasibility of studies that examine implementation in actual practice have inhibited growth in this area (Anderson, DeDreu & Nijstad, 2004). However, the advent of new instruments to measure

implementation and innovation recently has generated renewed interest in research that examines implementation of training and its success (Janssen, DeVliert & West, 2004; West, 2002). This line of research is gaining momentum in the fields of both educational psychology and organizational change.

To date research on the implementation of training has not focused enough on the implementation process itself. Yet, information about the nature of implementation, quantity and quality, could assist in developing more effective teacher training models and programs. Researchers might ask: Are teachers using training content in their own classrooms? What is their implementation like? And which features of their implementation are more or less effective?

When investigating the nature of implementation of training, teachers' instructional choices are key. After all, teachers implement at the classroom level through a process of changing their instruction in some way (Datnow & Castellano, 2000). Research concerning the nature of this change in instruction could reveal much about effective implementation and ultimately about its relationship to student outcomes. Instruction is at the heart of implementation. In fact, implementation of training could likely be assessed by the instructional choices teachers make.

Approaches to Implementation

Instructional approaches to implementation have been classified in various ways by researchers. One way they have been classified is by teachers' involvement with and agency in, or active participation in, the implementation process itself. Datnow (1998) contends that teacher agency in school reforms, in the form of implementation, can be

characterized as ranging continuously from passive to active participation. Thus, instruction can be classified by level of participation in the implementation process, on a scale ranging from low participation (more passive) to high participation (more active). That is, assuming teachers are implementing, a teacher who falls on the low participation end of the scale may participate in the implementation process in a more passive manner (where they "just do it" instructionally), while a teacher who falls on the more active end of the scale may implement in a more active manner (where they think about and adapt the innovation). Datnow (1998) hypothesizes that the nature of their implementation, or how they use the training content, methods, or strategies in their classrooms, is determined by teachers' relative agency in the process. A new approach to research on the implementation of training might ask: How is a higher or lower level of participation in the implementation process associated with student achievement?

Support for this type of classification of implementation processes can be found in a study from organizational change literature. Researchers surveyed 70 healthcare employees (mostly nurses) in Israel, all working within the same organizational framework (Drach-Zahavy, Somech, Granot & Spitzer, 2004). The goal of the study was to discern which of two approaches was a more effective means of implementing innovation in the workplace. Effectiveness was determined by data gathered from different stakeholders in the healthcare setting through interviews and questionnaires. Drach-Zahavy et al. (2004) compared two types of implementation processes aimed at augmenting work performance: bureaucratic and integration. The bureaucratic approach was characterized as the standardization of work processes and the minimization of deviations from those standards. In contrast, an integration approach was described as

promoting a sense of autonomy and decentralized decision-making. The results indicated that the effectiveness of each approach depended on the criteria chosen for effectiveness. The bureaucratic approach led to more favorable appraisals by supervisors, hypothesized to be a result of compliance with the expectations of the organization. However, the integrated approach faired better in terms of job performance as measured by patient responses. In other words, the patients of the employees who took an integrated approach to implementation reported that those employees fulfilled their job requirements more than those who took a bureaucratic approach. These mixed findings led researchers to recommend a combination of the two processes as a superior implementation approach (Drach-Zahavy et al., 2004). Based on this literature, it appears likely that research on training effectiveness that includes an examination of different types of implementation will provide useful information about its effectiveness. Although this study conceptualizes a categorical classification for comparison, as opposed to a continuous characterization of implementation in Datnow's study, both studies share a focus on *types* of implementation and how they may impact outcomes. This research study took this perspective, investigating the effectiveness of different types of implementation on student outcomes.

There have been two distinct types of implementation hypothesized so far in this review. The Datnow (1998) study classified approach to implementation by more active or more passive participation in the process and the Drach-Zahavy et al study (2004) categorized implementation as either bureaucratic or integrated. This study will combine both of these classifications into a new conceptualization for types of implementation. Datnow's and Drach-Zahavy's types of implementation can be restated as ranging from

more to less flexible. From this perspective, a less flexible approach to implementation would involve passive participation (passive) and a more uniform, standardized implementation process (bureaucratic). A more flexible approach to implementation would be characterized by more active participation (active) and a more individualized, original, and modified implementation process (integrated).

For this study, these two sides of an implementation continuum that ranges from more to less flexible will be called *heuristic implementation* and *algorithmic implementation* respectively. However, these classifications will not be mutually exclusive; rather they are hypothesized to be continuous. Representing these constructs as independent may mask potentially important overlaps that could contribute to further understanding of implementation and its effects on students. Therefore, heuristic implementation and algorithmic implementation will be considered to represent two sides of the same continuum. This study will determine that a teacher is more algorithmic in their type of implementation if they fall within the bottom third of the flexibility continuum and more heuristic in their type of implementation if they fall within the top third of the flexibility continuum. Teachers who fall within the middle third of the flexibility continuum will be determined to be a combination of algorithmic and heuristic in their implementation approach.

Using this new conceptualization, the more algorithmic approach to implementation would require teachers to teach new training content, methods, or strategies in a standardized manner, exactly as it was presented in training, in order to be successful. From this perspective, interpretation or modification of training content would reduce the effectiveness of the training and lead to less effective implementation in terms

of student outcomes. This approach relies on a formula for success, much like a cookbook procedure. Uniformity is key to success in the algorithmic approach, with the goal being homogenous instruction that is consistent with training.

As we have seen, the advantages to an algorithmic approach are uniformity and standardization. These characteristics can be desirable from an organizational perspective, especially in large-scale educational reform. When policy and curriculum experts confer to develop a reform initiative that they believe will be effective, their intention is often that it be implemented faithfully and without significant alteration to the original intent (Little, 1993). The fear is that alteration can change the intended outcomes. As seen in the Drach-Zahavy et al. study (2004), supervisors rated employees who were using the bureaucratic approach to implementation as more effective implementers, confirming that compliance is often the goal from an institutional perspective. In addition, it would presumably be easier to train for an algorithmic approach because everyone would be expected to implement the same material in the same way.

Another advantage of the more algorithmic approach is that, from a measurement standpoint, effectiveness is measured more easily if a blueprint exists for assessment (McCoy & Reynolds, 1998). The algorithmic approach provides this blueprint. That is, if teachers are supposed to do A, B, and C, then evaluators can simply assess whether or not there are doing A, B, and C. The more heuristic approach to implementation would presumably be harder to assess as it is individualized and would look different for most teachers. Particularly in the case of educational reform, which needs to reach thousands of schools and teachers, a more algorithmic approach has the advantages of uniform compliance to the intended reform and ease in measurement.

A more heuristic approach sees teachers as more flexible implementers. In fact, this perspective relies on flexibility in order to be successful. They argue that implementation needs to be a dynamic process of modifying and adapting training content to meet teachers' needs and the needs of their students in order to improve achievement. In other words, they believe that modification of training content will lead to a higher probability of success. However, modifications need to be of high quality. Modifications that are not appropriate could possibly negatively impact student achievement. From this perspective, appropriate modifications would include individualization of content, methods, or strategies that is in line with the needs of teachers or, particularly, students. Individual interpretation accomplished through critical thinking and creative modification are key to this approach, with the goal being differentiated instruction that is consistent with the intent of the training but is also individualized to meet the needs of both the teacher and the students. Modification that is based on individualizations to meet student needs is seen as the most likely to produce success.

As a result, implementation of innovation is not regarded as a uniform process but a creative one. This explanation is in line with existing research that shows that teachers are generally flexible in their classroom practices, although the extent and nature of their flexibility is relatively unknown. Researchers have long recognized that effective teachers tend to adapt policies or reforms to meet the needs of themselves and their students (McLaughlin &Talbert, 1993; Tyack & Cuban, 1995). Indeed, teachers feel to some extent bound by what they feel they must do to respond to their students' needs

(Helsby, 1999). A more heuristic approach to implementation would allow such adaptations and indeed encourage them.

A more heuristic approach to implementation of training, with adaptability and flexibility as key components, has been linked to creativity in organizational change literature. Theorists are beginning to examine effective implementation and its relationship to creativity. Specifically, West has found that creativity is an essential part of a successful implementation process (West, 2002). He contends that creativity is prerequisite to a heuristic approach to implementation. Creativity is thinking about new things, implementation is about doing new things (West & Rickards, 1999). Therefore, implementation requires thought before action. According to West, implementation itself does not necessarily need forethought, but in order for innovation to be successful, it needs to include at least some creative reflection first. So, the effectiveness of implementation seems to be linked to the creative thinking that precedes it. This would suggest that a heuristic model of implementation, which would include creative adaptations and flexible use of content, would be more effective than the somewhat mechanical approach to implementation used with more algorithmic approaches.

One very important advantage of a more heuristic approach to implementation of training is that is appears to be related to higher student achievement. Logically, it follows that individualization of instruction to meet the learner's needs would lead to higher student achievement. Preliminary studies have confirmed this common sense hypothesis. One qualitative case study with 49 public elementary school teachers in California concerning the implementation of Success for All, a national research-based early literacy prevention program, examined how teachers' individual differences shaped

implementation in the classroom (Datnow & Castellano, 2000). Over the course of one school year, they conducted interviews with all participating teachers regarding their reading instruction, as well as observed their classroom teaching. Researchers found two important emergent themes: almost all teachers made adaptations during implementation, and most teachers complained that the program constrained their autonomy and creativity. Specifically, researchers found that adaptability and flexibility in instructional implementation were correlated with increases in student outcomes. In fact, they noted that creativity and flexibility in implementation were some of the hallmarks of effective teaching in this study. This study examined this relationship further, investigating the association between teacher characteristics, the nature of their implementation, and student achievement.

Another study in New Jersey found similar results. This study investigated the relationship between public elementary school teachers' implementation of America's Choice, a standards-based comprehensive school reform program, and gains in student achievement (Supovitz & May, 2004). Data collection included surveying 114 general public school elementary teachers who taught language arts as part of their daily instruction, along with achievement data (on a state-mandated standardized test) for 1,572 first through third grade students. Researchers found that students achieved at higher rates for teachers who believed that students could learn, adapted their instruction accordingly, and actively implemented the basic tenets of the new program in their classrooms. In addition, teachers who were judged to be high quality implementers (measured by teachers' self reports as well as a composite score for congruence with all tenets of America's Choice) had the highest rates of student achievement (Supovitz &

May, 2004). These findings suggest that quality adaptations along with high fidelity during implementation leads to higher student achievement. Perhaps the most effective approach to implementation is one that includes fidelity to the program and quality adaptations as well. This study examined this hypothesis.

In addition, a more heuristic approach seems to follow the inclination of effective teachers to modify program content, methods, materials, and strategies. The Datnow and Castellano (2000) study found that teachers who felt constrained and therefore did not alter curriculum or materials to meet the needs of their students reported lowered motivation for the implementation. Teachers at all testing locations complained that the lack of flexibility and creativity in the curriculum was impeding their motivation, particularly when they felt that their students' needs demanded otherwise. "The accommodations made by teachers appear to be a natural response to the incorporation of an externally developed program" into a contextualized practice (Datnow & Castellano, 2000, p. 791). While almost all teachers made at least some adaptations to the content in practice, they were encouraged not to adapt and reported feeling constrained as a consequence. Preliminary research indicates that teachers are more effective, in terms of student achievement, if they can be at least somewhat flexible in their instructional choices. The teachers in these studies also often reported that they preferred this method of adapting what they learn in training.

The studies I just described are provocative but have not yet adequately addressed the implementation process itself or the nature of teachers' instructional change in response to reform directives. The nature or type of implementation described in these studies can be classified as ranging from more to less flexible, or a more algorithmic to a

more heuristic approach. The purpose of this study was to use these classifications as a barometer of success to investigate implementation approaches. When researching the nature of implementation and its effectiveness, effectiveness can and should be determined by student outcomes. If the benchmark in educational reform is student success, then it follows that the implementation approach that increased student outcomes the most would be the one deemed more effective. As such, the nature of implementation was included in the model as a possible mediator between individual teacher variables and student outcomes.

Implementation and Language of Instruction

After a review of the research in the field of implementation of training, no studies that specifically examined implementation by language of instruction were found. More research in this area is needed. However, as implementation of training implies making instructional choices, I will review relevant literature that is related to the instruction that teachers provide, considering their language of instruction.

There are two main influences on the instructional choices that teachers make. First, teachers tend to make instructional choices that meet the needs of their students, adapting as necessary to provide what their students need (Helsby, 1999). Indeed, as we saw in the Datnow and Castellano study (2002), teachers felt confined when they could not adapt their instruction to meet the needs of their students. Therefore, it is likely that the teachers in this study will teach in a way that they feel best meets the needs of their students. It is these student needs that may distinguish a difference between second-language and native-language instruction. Previous research has indicated that there are potential differences in instruction that best serve the needs of minority-language students

(Lesaux & Geva, 2006). Among others, Ortiz (2002) has identified elements for successful instruction that are particular to second-language learners. These elements will be outlined in a subsequent section of this review but it is clear that language does influence the instructional needs of students. Research has indicated that second-language students may have different needs than their native-language peers, and that teachers tend to teach in ways that are best for their students. Therefore, it is likely that the instruction that teachers provide will be different according to the language, at least in part. Hence, the instruction that second-language students receive may be different than the instruction that native-language students receive. If this is the case, then teachers' implementation of training may be different depending on the language of instruction.

These potential differences may impact either teachers' choice to implement at all or the nature of their implementation. When considering the nature implementation, adaptations of the training content would imply a more heuristic approach to implementation. In typical educational settings, second-language teachers need to adapt traditional curriculum for their students. For example, oftentimes second-language teachers need to translate materials from English to Spanish in order to make them useful for their students, thus altering the materials and perhaps the content of training during implementation. If second-language teachers are adapting the content to meet the needs of their students, it seems reasonable that they may be more heuristic in their approach to implementation. However, these potential adaptations depend on the curriculum and the amount of alteration that is required. It may also be that, if the curriculum is judged not to be appropriate for second-language learners by the teachers, it will not be used in practice at all.

Second, teachers tend to make their instructional decisions based on their individual characteristics, beliefs, cultural background, and perceptions of the world around them (Corrigan, 2001; Fullan, 2000; Hargreaves, 1992). These determinants of decision-making may influenced, at least in part, by sociocultural influences. A sociocultural perspective emphasizes the role that social and cultural experiences play in the choices that individuals make and their behavior regulation (Gauvain, 1998). In particular, sociocultural influences have been shown to impact second-language teachers' attitudes, perceptions, and behaviors (Goldenberg, Rueda & August, 2006). If these influences are linked to behaviors, then perhaps instructional choices are also party determined by sociocultural factors. That is, it has been suggested that the teachers in this study may make different instructional decisions based on their sociocultural influences and these influences may be different for second-language teachers and for native-language teachers. Decision-making during implementation may be partly determined by the sociocultural experiences and expectations of the teachers in this study. Thus, there may be differences in implementation according to language of instruction. In particular, it may be that implementation will be different between the Bilingual classrooms and English-only classrooms based on potential differences in the influences of their sociocultural backgrounds.

Therefore, the teachers in this study may implement training in ways that are particular based on their language of instruction. These potential differences may be based on different student needs or sociocultural influences. Consequently, language of instruction was included in this study as a potential contributing variable. This study contributed to the body of understanding about implementation of training by examining

differences and/or similarities according to language of instruction. The nature of the implementation of training was investigated in two separate studies, one with English-only classrooms and one with Bilingual classrooms. In order to examine the nature of implementation by language of instruction, the same two categories for the nature of implementation were used, heuristic and algorithmic. These constructs were measured the same way for the entire data set, English-only and Bilingual.

Assessing Implementation Approaches

In order to assess the nature of implementation, an examination of teachers' instructional choices is necessary. As seen in the previous section, instructional choices during implementation can be classified as either more algorithmic or more heuristic in nature. In other words, teachers may implement training in their classrooms in an ordered, standardized way or in a novel, creative, and flexible way, or in ways that overlap these categories. Their relative originality in the implementation process can be likened to their innovativeness. The definition of innovation in a work setting is "the intentional introduction and application … of ideas, processes, products, or procedures which are new … and which are designed to benefit" stakeholders (West & Farr, 1990, p. 4). According to West, innovation is novelty in work behavior. In lay terms, innovation is the introduction of *new ways of doing things*. If innovation represents new ways of doing things, then it seems like an appropriate measure of the relative newness of teachers' instructional choices during implementation. That is, teachers may find more novel ways to implement training content, which would be more innovative (more heuristic) or they may choose to implement in a more standard manner, which would be less innovative

(more algorithmic). Therefore, in order to assess the nature of implementation, innovation can be used as the benchmark. Are teachers being innovative? A higher innovation score would represent a more heuristic manner of implementation, while a lower innovation score would represent a more algorithmic manner of implementation. Innovation served as the measure of the nature of implementation for this study.

Innovation

Literature concerning innovation is concentrated in the field of organizational change. Many researchers have examined innovation in professional settings (Frese et al. 1996; Janssen, 2000; 1996; Oldham & Cummings, 1996; Organ, 1988). The current theoretical consensus among such researchers is that the innovation process encompasses both the development of creative ideas and the implementation of those ideas (Axtell et al., 2000). This means that innovation is a creative process but one that also necessarily involves behavioral outcomes: innovation is creativity that leads to action. Perhaps the most well known innovation theorist, Janssen (2000) refers to this combination of creativity and action as Innovative Work Behavior. His theory is built upon the idea that individual characteristics affect group outcomes, which has had tremendous implications in business in terms of training and productivity. Innovative Work Behavior has been defined as the intentional creation, introduction and application of new ideas, processes, products, or procedures, within a role, group, or organization, in order to benefit role performance, the group, or the organization (Janssen, 2000). This definition has been condensed by Janssen and others to: the voluntary creative behavior by employees that leads to on-the-job innovations (Janssen, 2000; Dorenbosch, van Engen, & Verhagen,

2005). Therefore, innovative work behavior assumes the presence of creativity, receptivity to change and implementation.

Innovative Work Behavior has been studied in many ways but always in terms of a relationship between innovative work behavior and increased organizational change (Unsworth & Parker, 2003; Janssen, 2000; West & Farr, 1990; Amabile, 1988). That is, these theorists are interested in and postulate a relationship between innovation at work and effective change. This theory seems in line with conceptions in education that suggest that there may be a relationship between the nature of implementation (innovation) and improved student outcomes. However, this link has yet to be established empirically. Innovation has just begun to be supported empirically and has not yet been studied explicitly in an educational setting. This study contributed to the growing field of innovation by testing these theories in an educational setting and applying these theories to teachers during the implementation process.

Innovative Instruction

As noted earlier, innovation was used in this study as the measure of the nature of implementation. Any assessment of the implementation process should examine teachers' instructional choices to provide a more complete picture of its effectiveness. I used a new conceptualization that combined innovation and instruction, which I refer to as innovative instruction, to capture teachers' instructional choices related to the implementation process. I used innovative instruction to assess the degree to which teachers were implementing what they learned in training in a more heuristic or more algorithmic manner.

In this study, innovative instruction was defined similarly to Innovative Work Behavior but in the context of education. Because this study was concerned with student outcomes rather than organizational outcomes, I added to Janssen's definition that the primary benefit would be to students. Therefore, the definition of innovative instruction for this study was: *The intentional creation and application of new instructional ideas, processes, products, or procedures in order to benefit the student or the teacher's job performance*. In the context of implementation of training, teachers were considered innovative instructors if they were using the content in ways that were not explicitly taught in training. During implementation of training content, if teachers were adapting ideas, processes, products, or procedures then they were considered to be innovating instructionally. However, innovative instruction was be confined simply to direct instruction. Teachers do many things daily that relate to their instructional choices but do not necessarily bring them in direct instructional contact with students. Therefore, innovative instruction during implementation was inclusive of all aspects of instruction and included innovative: language, management, resources, communication, collaboration, assessment, or the use of technology. As long as the teacher was modifying or adapting the material to use it in a new way, then they were being innovative. In addition, teachers implementing training content in their own way based on either their own needs of the needs of their students were classified as innovative. Even if their efforts fail, *trying new things* was the key to innovative instruction. The quality of implementation will be considered in a subsequent section of this review.

The more teachers alter, modify, or adapt the original training content to meet the needs of the students or their own needs, the more innovative their instruction was

considered. For example, a teacher receives a teacher's curriculum manual on phonics instruction during training and is expected to use the lessons in sequence without alteration. The manual begins with simple letter sounds. Instead of starting at the beginning, based on her assessment of her students needs, she decides to skip ahead to the section on digraphs because she knows that her students already are familiar with individual letter sounds. This teacher would be an innovative instructor and as such would be considered to be more heuristic in her implementation style. On the other hand, if the same teacher had done as the new curriculum expected and begun at the first page of the teacher's manual, despite her students' familiarity with simple letter sounds, she would have been less innovative instructionally and would be considered to be more algorithmic in her implementation of training content. The measurement of innovative instruction was on a continuum, with more incidences of innovative instruction leading to a higher heuristic score and less incidences of innovative instruction leading to a more algorithmic score.

Measuring Innovative Instruction

My conceptual framework and definition of innovative instruction is drawn directly from Janssen's theory of Innovative Work Behavior. Innovative Work Behavior has been measured using several different scales. The study conducted by Janssen in 2000 developed and tested an Innovative Work Behavior Scale. This scale was based on Scott and Bruce's (1994) scale for individual innovative behavior in the work place and modified to include three stages of innovation from the work of Kanter (1988). These three stages are idea generation, idea promotion, and idea realization. Nine items addressed these three constructs, with three items on each scale. The items were scored

using a seven-point Likert type scale, from "never" to "always". The scale was completed by both the workers and their supervisors. The three dimensions included were found to have high intercorrelations (ranging from .76 to .87) so they were combined into an overall measure of Innovative Work Behavior.

Building on the previous work of organizational change theorists, an instructional innovation scale was developed based on the foundational theory behind Janssen's scale to measure Innovative Work Behavior. Specifically, items were created that reflected the three stages of innovation (idea generation, idea promotion, and idea realization) in an educational setting. Specifically, items will ask if teachers are *trying different things, generating their own ideas*, and *continually changing* their instruction. It was hoped that the results of this study would contribute to the fields of implementation of training as well as organizational change. Items were adapted to include appropriate language and contexts for educational settings. This new scale extended Janssen's work and was used to measure the relative innovativeness of teachers' implementation of training. More details of this new instrument and its development will be provided in the methods section of this proposal.

Quality of Innovative Instruction

This study assessed the degree to which teachers were implementing what they learned in training in a more heuristic or a more algorithmic manner. This will be measured by the extent to which teachers are innovating in their implementation of training. Yet an inquiry into innovative instruction and its association with student outcomes should also consider the quality of those innovations. If teachers are innovating

in their instruction, but doing it poorly, that seems likely to negatively impact student learning.

To date, few studies have associated the quality of innovation to behavioral outcomes. In organizational change literature, one study has linked quality of innovation to improved performance. This research, which sampled 349 engineers in a large electronic equipment company, examined whether the same factors that contributed to innovation in the workplace would also contribute to quality performance and efficiency (Miron, et. al., 2004). These researchers discussed the paradox that while innovation is about trying new things, which sometimes involves working around the rules, quality of innovations or quality of performance requires adherence to a set of rules or standards. In fact, they defined quality as completely meeting these respective standards (Miron, et. al., 2004). These researchers found that *some* structure, in the form of set standards for performance, was needed to enable highly innovative employees to obtain high quality performance. That is, innovators performed better when they followed at least some rules when they were innovating. The authors hypothesized that the particular rules that innovators followed influenced the quality of their performance. This dissertation study examined this hypothesized relationship further, investigating the association between quality of innovations and teacher performance as well as student outcomes.

If high quality innovation depends on adherence to a set of rules, then the standards should fit the context. As mentioned earlier, the benchmark by which effective implementation of training is judged is improvement in student achievement. Therefore, the rules that govern effective implementation of training, and the quality of innovation

as well, should be based on student needs. For this study, the standard for high quality innovation were determined by the extent to which innovations met student needs.

Based on the Special Education Research Project (SERP) and developed in partnership with the Vaughn Gross Center for Reading and Language Arts, a set of standards for appropriate adaptations of reading instruction has been created. These characteristics of appropriate instructional adaptations include those that are both relevant to student needs and effective for students (SERP, 2003). These standards were originally developed to guide special education teachers in making high quality modifications of curriculum, methods, or strategies that were in line with student needs. However, because modifications and adaptations of instruction can be considered to be innovative instruction, these standards for appropriateness of adaptations can be used to assess quality of innovations as well. For this study, innovations that are high quality were those that were considered to be both *relevant* to students' needs and *effective* for students.

Measuring the Quality of Innovative Instruction

In order to measure the quality of innovations, original survey items were created. The purpose of these items was to measure the extent to which teachers' innovations in implementation are both relevant to student needs and effective for students. It was hoped that this new scale would contribute to and build upon Miron's work on the quality of innovations and its association to work performance, by applying her theories in an educational setting. More details of this new instrument and its development will be provided in the methods section of this proposal.

Student Variables

This review of the literature will now turn toward students and their achievement. As noted earlier, student gains are the benchmark for success in any educational reform movement. The goal is always to improve learning and achievement for students (Little, 1993). This study was designed to evaluate the effectiveness of different techniques for implementation of training. To lend more meaning and applicability to the results of this study, effectiveness was assessed by improvement in student achievement. In other words, implementation was considered successful in proportion to improvement in student performance.

Student Achievement

As discussed earlier, the effectiveness of implementation of training has not been adequately researched (Showers, 1990). In addition to limited research on implementation, even fewer implementation studies have examined student achievement as the outcome. However, evaluation should include analysis of student outcomes in order to adequately assess the effects of implementation (Showers, 1990). Evaluation should expand into the real world and take a longitudinal perspective of implementation, looking at changes in practice *and* changes in learning (Mathison, 1992). If student gains are the goal, then closer examination of the impact of implementation on students is warranted. This section will review literature concerning student achievement as it relates to both teachers and implementation of training.

This study hypothesized that student achievement was correlated with teachers' instructional choices during implementation of a new program. Fortunately, this relationship has been studied, although findings are preliminary. Several studies have indirectly linked implementation to student outcomes. The previously mentioned study where researchers studied the impact of the Success for All program found that schools with high levels of implementation also had the highest levels of improvements in student achievement (Ross, Smith & Casey, 1997). In addition, a comprehensive study of implementation of 10 reform designs found that schools that were only partially implementing the new program were more likely to evidence low student improvement, and that high implementing schools were more likely to evidence significant improvement in student outcomes (Stringfield et al, 1997). It appears that implementation is at least partially related to student gains, although this relationship was not linked directly. It is possible that schools that implement at high rates also have other characteristics that may impact student achievement. This study examined more closely the relationship between teachers' instructional choices during implementation of a new program and their effects on student achievement. While all possible contributing variables could not be included, several control variables at the student, teacher, and school level were included in the model to better isolate the effects of teachers' implementation on student achievement and increase the probability that any effects found were due to teachers' implementation. These control variables will be discussed in more detail later in this review.

The previously cited study in New Jersey did find support for the hypothesis that implementation of training is directly related to gains in student achievement (Supovitz &

May, 2004). In this qualitative study researchers found strong evidence that the implementation of a program is an important determinant of its effects on student outcomes and that the primary predictors of implementation were teacher-level factors, not school-level variables (Supovitz & May, 2004). They contend that variation in implementation is driven to a greater degree by the practices of individual teachers than by school-level variables, which leads to improvement in achievement. These authors hypothesized that teachers drive implementation and their instructional choices have a direct impact on student achievement. This finding is encouraging but should be extended and confirmed with more research.

It is also likely that implementation may impact student achievement through congruence with the guidelines of the new program. In other words, the extent to which teachers are following the rules of the new program may impact student achievement as well. In Maryland, a study investigating the impact of Direct Instruction found that only one out of six schools implementing the new program had high fidelity in implementation and those same schools also experienced consistently greater student gains than other schools (Berkeley, 2002). It appears that student gains may also related to the extent to which teachers' implementation is congruent with program directives, although these findings are preliminary and this line of research needs further investigation. This study examined congruence with the guidelines of a new program explicitly and assessed the impact of congruence with each of the guidelines on student achievement.

In addition, outcomes that are clearly defined appear to be more useful in interpreting data. In the previously mentioned Drach-Zahavy study (2004), perhaps identifying more narrow criteria for implementation effectiveness would have lead to

more useful applied results. Recall that the results indicated that the effectiveness of each approach to implementation depended on the criteria chosen for its effectiveness. For example, if patient satisfaction or rate of health improvement were the criteria for successful implementation then the results may have indicated that the integration approach was more effective than the bureaucratic approach by virtue of the ratings given by patients in the study. The integrated approach, by definition, allowed nurses to meet the individualized needs of patients. This is similar to teachers' work environments, where they are dynamically striving to meet ever-changing student needs. In educational settings, student outcomes are the benchmark for effectiveness. As a result of the findings from Drach-Zahavy and his colleagues, this study used clear criteria, improvement in students' reading scores on the Texas Primary Reading Inventory (TPRI) and Tejas Lee, to measure the success of implementation.

Each of the studies discussed here provides important information concerning the association between student achievement and implementation of change initiatives. However, there is limited empirical research that shows a clear correlation between implementation and student achievement. This study contributed to this line of research, seeking to establish a more direct link between teachers' implementation and student achievement and test the hypothesis that implementation of training is related to student success. To test this hypothesis, clear criteria for effectiveness, student achievement in reading, was included in the model as the outcome measure.

Reading Achievement

To assess the success of implementation, student achievement in reading will be used as the outcome in the conceptual model. This study will examine the effect of

implementation of a Scientifically Based Reading Instruction (SBRI) program on student achievement in reading.

Reading First is a national early reading grant initiative, based on SBRI, that is funded by No Child Left Behind (No Child Left Behind, 2002). The purpose of Reading First is to ensure that all children in America learn to read well by the end of third grade so they are prepared to achieve their full academic potential (Leading for Reading Success, 2005). Reading First involves the implementation of SBRI through grants and strategic, systematic professional development aimed at improving teachers' knowledge and use of content, methods, and strategies in reading instruction. The premise of Reading First is that directed change in teachers' instructional practices will lead to increases in student achievement in reading.

Reading First is based on SBRI, the parameters of which were established by the National Reading Panel (NRP), organized by the Director of the National Institute of Child Health and Human Development (NICHD) in consultation with the Secretary of Education. This national panel of experts was convened in 1997 to assess the status of research-based knowledge in reading.

The NRP took into account the foundational work of the National Research Council's (NRC) report on Preventing Reading Difficulties in Young Children (Snow, Burns, & Griffin, 1998). The NRC summarized research literature relevant to the critical skills that are instrumental in the acquisition of beginning reading skills for struggling readers. However, the NRC did not specifically address *how* critical reading skills are most effectively taught. The NRP sought to expand on the NRC's work and develop a set of standards for effective reading instruction for all students.

The NRP undertook a comprehensive, formal analyses of the experimental and quasi-experimental research literature relevant to a set of selected topics judged to be of central importance in teaching children to read. In order to review a massive body of research literature (100,000 studies since 1966), the NRP developed a set of screening standards for inclusion of research studies into the review process.

To be included in the database, studies first had to measure reading as an outcome. Reading was defined to include: reading real words in isolation or in context, reading pseudowords that can be pronounced but have no meaning, reading text aloud or silently, and comprehending text that is read silently or orally. Second, studies that were selected for review had to meet the following criteria: published in a refereed journal, focused on reading development from preschool to 12th grade, and used an experimental or quasi-experimental design with a control group. This screening process identified a small set of research studies that were then subjected to detailed analysis, sometimes including a meta-analysis if enough literature existed. If meta-analysis was not possible, a qualitative analysis was carried out by the NRP to provide more information.

The NRP report (1999) included recommendations for reading instruction in many different areas, including but not limited to: alphabetics (phonemic awareness instruction and phonics instruction), fluency instruction, and comprehension (vocabulary instruction, text comprehension instruction). Each of these areas of instruction was analyzed and a set of common recommendations for effective instruction were issued, based on the combined research findings. These recommendations were then used to develop what is now referred to as the guidelines of SBRI, which include the features of effective reading instruction (the instructional components) and the essential elements of effective reading

instruction (5 content areas).

Guidelines of SBRI:

- Include 90 minutes per day of uninterrupted time for literacy instruction
- Use assessment data to monitor student learning and inform instruction
- Provide differentiated instruction to meet students' needs
- Provide systematic (planned and sequenced) and explicit (modeled) instruction
- Include the 5 essential components of effective reading instruction
    1. Phonics
    2. Phonemic Awareness
    3. Fluency
    4. Vocabulary
    5. Comprehension

As these recommendations for reading instruction are based on research findings that indicate their effectiveness, it is likely that teachers who are following these guidelines will have students who have high reading achievement. Therefore, the guidelines of SBRI will be used as the benchmark of successful implementation in this study. The teachers that will participate in this study will be from schools that have received Reading First grant funds and therefore have also received extensive training in the guidelines of SBRI. This study used these guidelines to measure how much teachers were using what they learned in training. The extent to which teachers' reading instruction is congruent with the guidelines was considered to be the extent to which they are implementing SBRI.

However, it should be noted that the NRP findings have not been without controversy. In light of the rigorous standards for inclusion, many studies were excluded from the review. It is the view of some leading reading researchers that important aspects of reading instruction are not represented in the Features of Effective Instruction (Allington, 2002; Cunningham, 2002). The NRP recognized this possibility, stating that "only a small fraction of the total reading research literature met the Panel's standards for use in the topic analyses" and that the absence of other topics should not be interpreted as indicating that they have no importance or that instruction in these other areas may lead to greater student achievement (National Reading Panel Report, 1999, p 3).

It is probable that other instructional components may be contributing to student success that are not measured by congruence with the guidelines of SBRI. For instance, the guidelines of SBRI are based on research that for the most part is considered to be outcome-based, as opposed to process-oriented in nature. Outcome-based research is that which is more "componential" in nature, assessing a stable index of skills or strategies (Yaden, et.al., 2000). The primary focus of this research is to verify relationships between variables and student achievement. In contrast, a process-oriented perspective of reading instruction emphasizes the ongoing simultaneity of input into a student's literacy experience (Erickson, 1990). Process-oriented research tends to be more interpretivist, often qualitative, and describes a multifaceted, layered nature of literacy acquisition. Many process-oriented studies were excluded from the NRP report. Consequently, process-oriented research has shown correlations between aspects of reading instruction and student achievement that have not been represented by the SBRI guidelines. This body of literature is extensive, but a few representational examples follow. Several

studies have established a relationship between the manner of teacher Read Alouds and their differential impact on students' understandings (e.g., Dickinson & Keebler, 1989; Teale, Martinez & Glass, 1989). This suggests that the *way* a teacher reads to their students can impact their learning above and beyond simply *if* they are reading to their students. In addition, several process-oriented studies have found that play interventions can have a direct impact on written language development in students if the teacher provides quality opportunities to read and write in contextualized situations (Hall, 1991; Christie, 1991). That is, teachers may provide valuable literacy learning opportunities outside of the traditional direct-teaching framework. In light of process-oriented research findings, there may be factors that affect student achievement in reading that are not included in the SBRI guidelines. Therefore, using the SBRI guidelines to assess effective reading instruction may not detect certain effective features of reading instruction. Therefore, an open-ended question was also be included in this study, which addressed any other instructional components that teachers felt contributed to their students' success in reading.

To measure reading achievement, each student's pre-scores (from the beginning of the school year) were used as a covariate. This helped to see more clearly the effects of teachers' instruction on their students' achievement relative to their starting points. Each students' post-scores (from the end of the school year) were used as the outcome.

Reading Achievement for Second-Language Learners

The majority of research on the topic of literacy acquisition has been done with English speakers. Thus, the basic framework for understanding literacy development is derived from research conducted with monolinguals. However, the trajectory of literacy

acquisition, as well as the variables that impact these trajectories, may be different for second-language learners, at least to some extent. The previous section outlined the Scientifically Based Reading Instruction (SBRI) that will be used as the outcome in this study. Yet the question remains, will the guidelines for SBRI be effective for second-language learners specifically?

The majority of research in this area has focused on second-language learners and their literacy acquisition in a second language. However, this study will investigate literacy acquisition for second-language learners within their native language. In other words, Bilingual students will receive reading instruction in Spanish. Of the research that has examined native language literacy acquisition among second-language learners, results seem to indicate that there are many similarities with their native-language peers.

The National Reading Panel (National Institute of Child health and Human Development, 2000) found that explicitly teaching the five components of reading, discussed in the previous section, was beneficial for all students. In addition, the Panel found that using the features of effective instruction was also beneficial for all students (National Institute of Child health and Human Development, 2000). It appears that teaching the five content components may be effective *because* they were taught explicitly. The features of effective instruction include differentiation of instruction (individualizing) as well as teaching systematically (planning and sequencing) and explicitly(modeling and scaffolding). Therefore, delivering effective reading instruction need include the combination of instruction in the five content areas *by means* of the features of effective instruction. This combination has been shown to be effective for both native-language and second-language learners. However, that instruction in these

components of literacy has been shown to be effective for all students does not mitigate the fact that they need to be adapted and modified to meet the needs of second-language learners specifically (Shanahan & Beck, 2006). In particular, oral language proficiency has been shown to be particularly important for second-language learners and effective instruction should include multiple opportunities to practice oral language (Lesaux & Geva, 2006; Shanahan & Beck, 2006).

While more research is needed in this area, there is also evidence that other instructional methodologies may be beneficial for second-language learners specifically. Ortiz (1984) suggested fostering a home-school connection and tailoring instruction to cultural contexts. In addition, many studies have addressed alternative instructional strategies and have fond some success, such as encouraging reading aloud to children and tutoring or mentoring (Escamilla, 1994;Ulanoff & Pucci, 1999). However, these studies lack the empirical evidence necessary to provide verifiable alternatives for effective second-language instruction.

While some contradictory research evidence is present, the bulk of research does indicate that the same basic literacy processes are at work for both native-language and second-language learners *when they are taught in their native language.* Thus, research has suggested that the elements of effective reading instruction are similar across languages. These elements are included in SBRI and were implemented in the participating English-only and Bilingual classrooms. Therefore, it may be reasonable hypothesized that teaching these components of reading instruction will result in higher student achievement in reading for all students. This study tested this hypothesis, paying special attention to differences or similarities according to language of instruction.

Struggling Reader Status

Children who struggle with reading in the early grades often remain behind their peers throughout school, and academic progress in all subjects suffers (Snow, Burns & Griffin, 1998). Reading difficulties, especially in the early grades, can impact students for the rest of their lives. Reading difficulties can be found among every group of students, although some students with certain demographic characteristics are at greater risk of difficulties than others (see the next section) (Snow, Burns & Griffin, 1998). Precisely how students' become struggling readers is not yet fully understood, but what is known is that struggling readers require reading instruction that is tailored to meet their individual needs (Snow, Burns & Griffin, 1998). The needs of struggling readers may or may not require radically different *types* of instructional strategies, but they may at the least call for more intensive instructional support.

Recall from the previous section that the guidelines for Scientifically Based Reading Instruction (SBRI) were based on the work of the National Research Council's (NRC) report on Preventing Reading Difficulties in Young Children (Snow, Burns, & Griffin, 1998). The NRC report provided a summary of research relevant to the critical skills that are instrumental in the acquisition of beginning reading skills for *struggling readers*. However, using this report as a framework to develop a set of strategies for *all* readers makes an assumption: that instructional strategies that are effective for struggling readers will also be effective for readers who are reading on grade level. This is an important distinction and one that is debated in the field. There is currently not a consensus on whether or not this assumption is supported empirically. However, because

struggling readers have been found to have different needs (at the least, more intensive instruction) then it is likely that struggling readers will achieve at different rates than other students. In other words, struggling readers may achieve at different levels despite receiving the same traditional instruction (in this case SBRI). For this reason, struggling reader status was included in the conceptual model as a student-level predictor (control) of reading achievement.

Race/Ethnicity

Considerable evidence points to an achievement gap between the literacy achievement of white students and diverse students (Au, 2003). For this study, diverse students will be defined as students with a non-white race/ethnicity. Diverse students are performing at consistently lower rates than white students, especially in the early grades of elementary school. Recently, the National Assessment of Educational Progress (NAEP), a large-scale, federally-funded study of student achievement in grades K-12, found that non-whites (African-American, Hispanic, and American Indian) showed a pattern of lower reading achievement than their white counterparts (Donahue et. al., 1999). These differences were consistent across grade levels and ability groupings. For example, first grade struggling readers who were white were struggling less than their non-white peers. These differences in reading achievement may be due to many different factors, including familial, social, economic, or educational factors. While it is not known, one cause for this disparity in reading achievement may be the mismatch between cultural and school-based definitions of literacy, in expectations for instructional practices and the roles of teachers and parents (Jacob & Jordan, 1987; Tharp, 1989).

Research in this area suggests a multifaceted causal relationship between race/ethnicity and school achievement (Au, 2003). Yet time and again, the same findings are reiterated. Reviews of the literature by Allington (1991) and Fitzgerald (1995) found repeated evidence that diverse students performed at lower levels than their white peers on assessments.

In addition, students with certain demographic characteristics are at greater risk for reading difficulties (Snow, Burns, & Griffin, 1998). This topic was addressed in the previous section, but underscores the importance of the association between race/ethnicity and student achievement in reading. In the climate of growing demands and higher standards for all students, differences based on students' race/ethnicity can have an important impact on their achievement. For these reasons, students' race/ethnicity was included as a predictor variable (control) in the study.

Teacher Variables

Having reviewed implementation and student achievement, this discussion will now turn toward teachers. Teachers' implementation of training depends on many factors. Teachers are likely to react to directives according to certain individual characteristics. These characteristics influence the way they perceive situations and, accordingly, the instructional choices they make, which potentially impacts their students' learning. Because this study was interested in teachers' instructional choices during implementation of training and the variables that contribute to those choices, individual teacher variables were included as predictors of both implementation and student achievement. The following section reviews the literature for the teacher

variables that will be included in this study. This section will first review research on cognitive and motivational factors that have been shown to influence teachers and their instruction, followed by teacher background variables that may have an impact.

For each of the cognitive and motivational factors discussed in the next section, it was possible that there may have been differences for teachers according to their language of instruction. That is, teachers who teach in the English-only classrooms or Bilingual classrooms may have different characteristics, or be influenced by the characteristics included in this study to different degrees. The measurements for all of the following individual characteristics were self-report and based on teachers' *perceptions* of their experiences. Research has suggested that perceptions are based at least in part on sociocultural influences (Goldenberg, Rueda & August, 2006). As mentioned earlier, these sociocultural influences, and therefore perceptions, may be different for the two groups of teachers in this study. This study examined such potential differences by investigating the relationship of these teacher characteristics with their implementation of training for both English-only and Bilingual classroom teachers. As these potential differences have not been expressly studied for any of these variables, the results contributed to a preliminary understanding about teachers and how their characteristics influence their instructional choices for different languages of instruction.

Cognitive Flexibility

The cognitive characteristics of individuals have been shown to influence the decisions they make. Such cognitive characteristics and/or processes have been classified in different ways in the literature. For instance, different categorizations can distinguish

the relative changeability of these cognitive processes. Martin and Rubin (1995) call this changeability cognitive flexibility. That is, Martin and Rubin have theorized a form of cognitive processing that is related to adaptability. Cognitive flexibility encompasses an individual's (a) awareness that in any given situation there are options and alternatives available, (b) willingness to be flexible and adapt to the situation, and (c) self-efficacy or belief that one has the ability to be flexible (Martin & Anderson, 1998). In other words, cognitively flexible people feel confident to, have the ability to, and are willing to change. Additionally, cognitively flexible people are willing to try new things, encounter unfamiliar situations, and adapt behaviors to meet contextual needs (Martin & Anderson, 1998). In a study with 247 college undergraduates, the Cognitive Flexibility Scale was used to examine the relationship between cognitive flexibility and rigidity in behaviors. The authors found that cognitive flexibility was a significant predictor of behavioral rigidity. They hypothesize that cognitive flexibility is related to openness to change (Martin & Rubin, 1995).

Like Martin, other researchers have hypothesized a connection between flexible thinking and receptivity to change. Stanovich and West identified similar components of flexible thinking that could be combined into a theoretical framework, which could represent an individual's receptivity to change. They refer to this theory as Active Open-Minded Thinking (Stanovich & West, 1997). Active Open-Minded Thinking combines several sub-constructs (openness to ideas, openness to values, cognitive rigidity, categorical thinking, absolutism, and dogmatism) into an overall indicator of receptivity to change. It is hypothesized that if an individual is a more active open-minded thinker (more flexible), then they are more open to belief and behavioral changes. Likewise, if an

individual was not a very active open-minded thinker (not very flexible), then they are more cognitively rigid and resistant to belief change (Stanovich & West, 1997).

These hypotheses were supported in Stanovich's (1997) study with 349 undergraduate college students. Specifically, the participants were given argument evaluation tasks and were measured on their ability to remain open to new ideas in the face of contradicting evidence. The results of this study indicate that Active Open-Minded Thinking, as an indicator of receptivity to change, was a significant predictor of performance on reasoning tasks. That is, the authors hypothesized that the results of this study confirm the relationship between flexible thinking, receptivity to change, and behavioral choices (Stanovich, 1997). It appears that changes in thinking can lead to changes in behavior. The theory of cognitive flexibility and its association with change in attitudes, beliefs, and ultimately behaviors has been supported by several studies (Martin & Rubin, 1995; Roloff & Berger, 1992; Duran, 1992). However, this construct has not yet been applied to teachers and their thinking or behaviors. This study will examine the relationship between teachers' cognitive flexibility and their instructional choices during implementation of SBRI.

Cognitive flexibility has also been related directly to teachers and implementation of training, although results are preliminary. One qualitative study investigated teachers' receptivity to change in the context of implementation of a bullying intervention curriculum. In a study with 37 elementary schools, Kallestad and Olweus (2003) found that teachers' receptivity to change and cognitive flexibility were significant predictors of both the quantity and quality of their implementation. They hypothesized that teachers were the key agents in the change process and that their openness to change was an

important predictor of the extent and nature of that change (Kallestad & Olweus, 2003). This study has interesting implications but more research is necessary to confirm these results. This dissertation study investigated the relationship of teachers' cognitive flexibility to their implementation of training. It was likely that cognitive flexibility in teachers would impact their instructional choices, and as such it was included as a predictor variable of interest in the model.

Autonomy

Having considered how cognitive aspects of teachers and their teaching may impact their implementation, let us now turn our attention to motivational determinants of behavior. Motivation has been defined as the process whereby goal-directed activity is instigated and sustained (Pintrich & Schunk, 2002). In common terms, it can be seen as the drive or will to achieve something. This drive may originate internally or externally, depending on the person and the situation (Bandura, 1998). Although there is variation in context, individual differences in *perceptions* of those contexts have been shown to affect motivation accordingly (Deci & Ryan, 2002). Perceptions can impact an individual's motivation, which can in turn impact their choices. Furthermore, many researchers have shown that an individual's perceptions can be classified and used to predict motivation and behavior (Tschannen-Moran & Woolfolk-Hoy, 2001; Smylie, 1990).

Deci and Ryan (2002) have identified a generalizable theory of perceptually driven motivation called *causality orientations.* Causality orientations fall under the conceptual umbrella of Self-Determination Theory, which considers individual variables and contextual variables that might impact motivation. Deci and Ryan theorize that an

individual tends to be oriented toward certain perceptions, which lead to certain choices. "There seem to be substantial individual differences in people's interpretations of, or orientations to, initiating and regulating events" (Deci & Ryan, 1985, p.110). In other words, people may respond differently to the same situations according to their causality orientations.

Causality orientation has been developed based on previous theories of causality in the field of motivation. Several researchers have studied the nature of causation in behavioral choices. Particularly, deCharms (1968) identified internal perceived locus of control as a theory of perceived personal control over oneself and the environment. Like Deci & Ryan, deCharms asserts that, within the context of the same situation, individuals may be oriented toward feeling either internally motivated, with a sense of control, or externally motivated, with less control over themselves and their environment based on their locus of causality. That is, an individual may feel more or less controlled regardless of the context, which may then affect the individual's motivation. Deci & Ryan (1985) have further classified these tendencies toward perceived causality into three subcategories of orientations: autonomy, control, or impersonal. An autonomous orientation is one where individuals tend toward perceiving situations as within their control, a controlled orientation is one where individuals tend to perceive situations as controlled by external forces, and an impersonal orientation is one where individuals tend to perceive situations as out of their control.

Based on motivational theory, research that has examined causality orientations has established a link between causality orientations and behavioral choices. In the preliminary study that Deci & Ryan (1985) conducted, the General Causality Orientations

Scale was developed and tested with 636 university undergraduate students and found to have internal consistency and validity, with ∝ ranging from .744 to .694. Causality orientations were found to impact several emotional and attributional variables, but most notably, certain behaviors were found to be related to causality orientation. Of particular importance in this context, the *autonomous* orientation was found to be related to individual initiative (Deci & Ryan, 1985). The authors note that on unstructured tasks, student with high autonomy scores seemed more comfortable taking initiative and engaging in topics. Other studies have used the same scale and confirmed the relationship of causality orientations to behavioral choices in various domains, including weight management, exercise, and pro-social behavior engagement (Gange, 2003; Rose et al., 2003; Williams et al., 1996).

Autonomy in particular, or the lack thereof, seems to have the greatest impact on motivation (Williams et al., 1996). That is, both the controlling orientation and the impersonal orientation are likely to have adverse affects on motivation while an autonomy orientation is more likely to have a motivating affect. The relative autonomy of the perception determines the extent of its effect on motivation. Therefore, causality orientations can be further classified by their impact on motivation as either autonomous or not autonomous. Hence, causality orientations would have two categories: autonomous and not autonomous (including both controlled and impersonal). Researchers have modified the three causality orientations in this manner in several previous studies to better address their research questions (Williams et al., 1996; Gagne, 2003). This conceptualization of causality orientations, as either autonomous to not autonomous, was used for this study.

Teacher Autonomy

Teachers tend to work in autonomous environments simply by nature of the social construct of schools, where they close their classroom doors and work in relative isolation, performing as independents (Hargreaves, 1992). They also have a higher degree of professional autonomy than many other professions (Kirby et al, 1992). Therefore, the amount of personal autonomy teachers feel may have a substantial impact on their actions simply because they have the potential freedom to act upon it. That is, teachers have the potential ability to act autonomously.

It appears that teachers want to act autonomously. In the qualitative study discussed previously, which examined the implementation of an early literacy intervention, researchers found that the majority of teachers did not like the constraints put on them by the program, complaining that it impeded their creativity and autonomy, and in some cases their overall enjoyment of teaching (Datnow & Castellano, 2000). There were some teachers who refused to be constrained by the program, and so did not adhere to the intent or basic premise of the innovation closely and therefore did not have the student gains other teachers who did implement faithfully did (2000). Preliminary results indicate that autonomy is related to both implementation and possibly student outcomes, yet more evidence is needed to confirm this hypothesis and its potentially positive or negative effects on student achievement.

This study was concerned with teachers and the nature of their implementation of SBRI. One of the primary questions of interest was the extent to which teachers act autonomously in their instructional choices during implementation. Therefore, causality orientation toward autonomy was included as a predictor of implementation style in the

model. The General Causality Orientations Scale was used to determine teachers' causality orientations.

Autonomy Support

Related to Self Determination and Causality Orientation Theory, which determines autonomy, Deci and Ryan (2002) also theorized Cognitive Evaluation Theory. This theory suggests that when we engage in a behavior, the context plays a role in the initiation and regulation of that behavior. Cognitive Evaluation Theory describes how contextual factors may affect motivation. An environment may either support autonomy or may be more controlling. For example, within the context of a school, a principal may encourage teachers to participate in the decision making process or not. Deci and Ryan contend that this would impact the intrinsic motivation of teachers. Thus, if the principal was using language that was controlling, such telling teachers that they "must do" something, then this is hypothesized to have a negative impact on motivation for teachers. Conversely, if the principal asked teachers to do something and emphasized the reasons why they should, then this would be more autonomy supportive. Controlling language will undermine intrinsic motivation whereas autonomy-supportive behaviors will foster it (Deci & Ryan, 1985, 2002).

This theory expands deCharms' ideas of locus of causality, mentioned in the previous section. Recall that deCharms (1976) that individuals with an inner locus of causality perceive choices and events as originating from within. The opposite would be true for an external locus of causality; individuals would perceive their choices as being directed by others. Thus, Deci and Ryan (2002) proposed that motivation is determined

by where an individual places the locus of causality. An inner locus reflects autonomy, while an external locus reflects being controlled (deCharms, 1976). Therefore, the environment can facilitate the perception of an inner locus of causality, and an autonomy supportive environment, by providing direction that is informational rather than controlling (Deci et al., 1982; Deci et al., 1991; Flink, Boggiano & Barrett, 1990).

Autonomy support is based on contextual factors that impact the freedom and ability of individuals to act independently in a given environment (Deci & Ryan, 2002). However, it is the perceptions of those contextual factors that impact behavioral choices. Context does not determine the choices, but it can certainly impact the perceptions, which in turn have been shown to impact the choices that individuals make (Deci & Ryan, 1987). Therefore, autonomy support is perhaps more accurately referred to as perceived autonomy support, as it is the perceptions of the individuals that determines the amount of support they feel, not necessarily the objective amount of support present.

Many studies have suggested a connection between perceptions of environmental support and behavioral choices (Deci & Ryan, 2002; Gange, 2003; Williams et al., 1996). One study examined both autonomy and perceived autonomy support. In this study with college students, perceived autonomy support was found to be related to intrinsic motivation and behavior regulation for those who were engaging in pro-social behavior (Gange, 2001). For these individuals, the amount of contextual support that they perceived to act independently did influence their independent actions. That is, if the participants in this study felt that they were supported, they tended to act in a way that was more autonomous. This finding may have important implications for this study. This dissertation study examines the implementation of teacher training. In this case, the

implementation of training necessarily involves acting autonomously, as teachers are independent actors who choose and engage in actions behind closed doors. Yet this implementation of training also involves a certain amount of choice, which requires intrinsic motivation to enact. It seems reasonable, based on existing research, that the amount of perceived autonomy support that teachers feel will contribute to not only whether or not they implement the training they received but also the nature of their implementation.

This study examined the nature of implementation, heuristic and algorithmic, and it was likely that perceived autonomy support may have influenced the amount of modifying and adapting of the training content that teachers felt that they could do. This, in turn, was likely to impact the nature of their implementation of the training content. Therefore, perceived autonomy support was included in the model as a possible predictor of implementation. The Perceived Autonomy Support: Climate Questionnaire (short form) was used to measure this construct (Deci & Ryan, 1991).

Perceived Competence

Another motivational construct that may impact teachers' implementation is their perceived competence. Two general kinds of competence have been identified: that which is objective, as in ability, and that which is subjective, as in perceived ability. Perceived ability is an individual's beliefs about their capabilities. What one believes they can do and what they can actually do may be very different. However, there is a relationship between the two. An individual's competence to act is correlated with their

perceived competence to act (Smylie, 1990). That is, our beliefs about our abilities influence our abilities in action.

Perceived competence has been shown to have an influence on motivation in previous research (Pajares, 1996; Tschannen-Moran & Woolfolk-Hoy, 2001). Our beliefs about our abilities, or perceived competence, have also been referred to as situational self-efficacy. Efficacy had been defined in the literature in numerous ways, but taken together, these definitions have been summarized and applied to teachers as "beliefs that individual teachers hold about their own capacities or abilities to act" in certain situations (Smylie, 1990, p.49). Thus, self-efficacy can be equated with *context-determined* perceived competence, or confidence in certain situations. Theorists agree that the amount of confidence one feels is likely to depend on the situation (Bandura, 1986). For example, a teacher may feel very confident in their ability to teach math to second graders but not at all confident to teach the same subject with eighth graders. That teacher may make different instructional choices based on whether she is teaching the second grade or the eighth grade class. In fact, teacher efficacy had proved to be related to many educational outcomes such as teachers' persistence, enthusiasm, commitment, and instructional behavior, as well as student outcomes such as achievement (Pajares, 1996; Tschannen-Moran & Woolfolk-Hoy, 2001).

The relationship of perceived competence to behavioral choice is of particular interest in this study. Bandura (1986) asserted that confidence in one's ability to behave effectively was related to flexibility and behavioral choices. "People process, weight, and integrate diverse sources of information concerning their capability, and they regulate their behavior choice and effort expenditure accordingly" (Bandura, 1986, p.212). It

appears that individuals must believe to some extent that they can do something before they will expend effort trying. Similarly, Richmond and McCroskey (1989) assert that an internal motivational state is prerequisite for the willingness to adapt or change behaviors. Perceived competence may be related to cognitive flexibility in that even if an individual is willing to be flexible, they also need to believe that they are able to bring about the desired behavior in order to begin to act (Martin & Anderson, 1998). It seems that perceived competence is related to the willingness to act and, by extension, the ability to act.

Perceived competence has been related to teacher's instructional choices in the literature specifically. These findings support previous research that work performance is related to perceived competence (Smylie, 1990) yet places them in an educational context. In particular, several studies have linked perceived competence and educational innovation, showing that teacher efficacy to some extent determines the quantity and quality of implementation of innovation (Ghaith & Yaghi, 1997; McLaughlin & Marsh, 1990). Perceived competence in teachers has also been linked to student achievement outcomes. In a study reviewed earlier with elementary teachers in New Jersey who were implementing a new curriculum, researchers found that there was a significant link between student achievement gains and teachers' perceived preparedness to teach the innovation (Supovitz & May, 2004). They found that for every unit of increase in teacher self-reported competence as a result of training, students got 2.6% more answers correct on the state-mandated achievement test. Thus, there appears to be a relationship between perceived competence and instructional choices, reaction to change, and student outcomes. However, these relationships need to be evaluated more fully. For this study,

teachers' perceived competence to implement SBRI was included in the model as a predictor of the implementation of training.

Teacher Background Variables

Having reviewed cognitive and motivational variables that may impact teachers' implementation, the next section will focus on teachers' individual background variables. This study included as control variables those background variables that have been shown in the literature to most affect the way teachers perceive situations and, accordingly, affect the choices they make. Particularly, years of teaching experience, grade level taught, and the educational background of teachers was included. These background variables have been shown to be related to individual differences in teachers, which has been shown to be highly correlated with instructional choice (Berends, Bodilly & Kirby, 2002; Supovitz & May, 2004).

Teaching Experience

As teachers gain more experience, and consequently more expertise, it is likely that their perceptions and instructional choices will change accordingly. Research has consistently found differences between teachers with varying degrees of experience on a variety of outcomes (Grissmer & Nataraj, 1997; Smith & Bourke, 1992). In the context of this study, the influence of experience level on teacher learning, receptivity to new ideas, and implementation are particularly important.

When considering implementation of training, the learning that takes place in the training setting is prerequisite to the implementation process. Prior research has shown that teachers approach learning differently according to their level of experience. For

example, novice teachers and veteran teachers approach training differently, in terms of their pedagogical knowledge and their beliefs, which in turn can affect their instructional choices (Patrick & Pintrich, 2001). In general, veteran teachers have more of an experiential base upon which to build new knowledge, a framework of actual practice within which to work. Newer teachers' beliefs have been shown to be largely shaped by their own experiences as students, while veteran teachers' beliefs are more affected by their professional experiences (Borko & Putnam, 1996). Teachers' content knowledge also varies by experience and can affect their learning and instruction. Less subject matter knowledge can lead to more emphasis on facts and procedures, while more knowledge can lead to a more conceptual, problem-solving approach (Borko & Putnam, 1996). These different approaches to the learning process may influence the way teachers acquires and interpret training content and consequently the way they make use of it.

Experience level has also been shown to affect teachers' receptivity to new ideas. In particular, one study conducted in Switzerland found that the way teachers respond to reform is correlated with their career stage (Huberman, 1989). This study of the life cycles of teaching took a longitudinal perspective of teachers' beliefs and instructional practices and investigated K-12 teachers on a variety of variables that may be affected by career length. Huberman (1989) found that receptivity and attitude toward change was directly related to teachers' level of experience. It appears that teachers approach change differently according to their experience. Researchers have found that although experienced teachers possess more content knowledge, they are often more resistant to change than newer teachers (Borko & Putnam, 1996). In a study with 385 Israeli secondary-school teachers, researchers investigated several variables that may contribute

to work attitudes and found that teachers with more teaching experience had increased resistance to change (Rosenblatt, Talmud & Ruvio, 1999). It appears that experience is related to receptivity to change, which may potentially affect instructional choices.

Overall, these findings indicate that teachers' level of experience influences their learning, implementation of innovation, and receptivity to change. Therefore, years of teaching experience was be included in the model as a potential predictor (control) of implementation of SBRI.

Grade level

Because instructional content depends on student needs, there are necessarily differences in instruction at different grade levels. That is, teachers will be teaching different content and they will be teaching in a different ways according to the grade level they teach. In addition, their beliefs and attitudes are likely to be different according to the grade level they teach. One study investigated a continuum of beliefs about teaching and how those beliefs were related to classroom practices. This empirical study looked at 137 PreK-3rd grade teachers in Kansas City and found that their beliefs about what were good practices varied across all grade levels, with the differences getting significantly larger at the older grade levels (Vartuli, 1999). Researchers also concluded that instructional practices varied greatly, but in a way that was consistent with the grade level taught. It appears that there is a link between grade level and beliefs, as well as grade level and instructional practices. Grade level seems to be at least one determinant of instructional choices. For this reason, the grade level that teachers teach was be included as a potential predicator (control) of implementation in the study.

Educational Background

Teachers' educational background has been shown to be related to their attitudes, beliefs and instructional choices. Educational background refers to the preparation teachers had prior to their teaching experience. Currently, due to the shortage of teachers across the nation, the standards for certifying teachers are changing. The traditional four year university degree leading to state certification has now been appended in many states by alternative certification programs in an effort to recruit more teachers to the profession. These alternative certification routes allow individuals with bachelor degrees in subjects other than education to obtain teaching positions and receive additional coursework and training while they are teaching, in a "learn as you go" model. The quality of these programs varies. Some are extensive and offer ongoing support, mentoring, and integrated coursework, but most are relatively superficial and last only a few weeks (Darling-Hammond et al., 2002). This variation in the quality of alternative certification programs has been shown to be related to a number of teacher outcomes (Darling-Hammond et al., 2002; Reynolds et al., 2001). Because alternative certification programs are a relatively new phenomenon, research in this field is at its beginning. However, several studies have shown differences among traditional certification teachers and alternative certification teachers.

The literature shows that educational background is related to teachers' perceived competence and self-efficacy. A quantitative study in New York examined 2,956 teachers' perceptions on a variety of teaching-related topics (Darling-Hammond et.al., 2002). One of these variables was teachers' perceived preparedness relative to their certification route. The researchers found that there were individual teacher differences

that were attributable to the type of certification they had received. The graduates of university programs reported feeling more prepared, which correlated to higher self-efficacy. It appears that teachers who receive traditional certification feel more efficacious. As noted earlier, self-efficacy can affect teachers' beliefs and attitudes, which may in turn affect their instructional choices.

Preliminary research has shown that certification route may directly affect instructional choices. One of the preciously mentioned studies, which examined implementation of a literacy curriculum, assessed implementation directly and examined contributing factors to its success or failure (Supovitz & May, 2004). Of the teachers they surveyed, there was a significant difference in the amount and the quality of implementation for teachers who had received a certification in the grade level and subject they were currently teaching compared to teachers who were teaching with either alternative forms of certification or without official certification. Supovitz and May (2004) also found that student outcomes were related to the type of certification that teachers' had received, with traditional certification resulting in higher levels of student achievement. These results indicate the teachers' certification route may impact their implementation of new programs, but this hypothesis needs further examination. Because type of certification has been shown to be related to teachers' beliefs and attitudes as well as their implementation of training, it was be included as a predictor (control) in the study.

School Variables

In addition to student-level and teacher-level variables, school-level variables have also been linked to student achievement. This section will review the potential impact of school Socio Economic Status on student achievement.

Socio Economic Status

Socio Economic Status (SES) has been found to be highly correlated with learning outcomes. It is difficult to tell in any given situation which of many possible variables might be mediating this relationship, however the impact of SES on student learning is well documented. For example, from the beginning of kindergarten, students from low households scored significantly lower than their more affluent counterparts on measures of reading achievement (Lee & Burkam, 2002), and this problem was especially pronounced for non-white students from low SES households (Jencks & Phillips, 1998; Snow, Burns, & Griffin, 1998). Furthermore, this gap in academic achievement between students form low and high SES households persists throughout their educational careers. Students from low SES households receive lower grades and lower scores on achievement tests; they are more likely to be placed in lower curricular tracks and special education programs; and they are less likely to graduate from high school or enter into higher education than students from higher SES households (Mayer, 1997; McLoyd, 1998). For these reasons, SES was included as a predictor of student achievement in the study. However, although this was a student-level factor, it would be difficult to obtain the individual SES of each student for this study. Therefore, the

average SES of each school was be included as a potential predictor (control) of implementation in the study.

Conclusion

Many researchers have studied teacher training with the intention of improving training models to better facilitate instructional change at the classroom level, and consequently improve student achievement. However, research on training effectiveness has only begun to look at implementation; the relationships between teachers' implementation of training and student outcomes have only begun to be empirically established. It would be valuable to better understand the effects of teacher characteristics on implementation and the effects of their implementation on student achievement. More research is needed that addresses these constructs directly to better understand how training content, methods, and strategies are used in real classrooms. An enhanced understanding of the implementation process would be a first step toward designing more effective training models that encourage teachers to improve their instructional practices, eventually leading to improvements in student achievement.

As such, this study investigated implementation of a Scientifically Based Reading Instruction (SBRI) program in kindergarten, first grade, and second grade classrooms. Teacher variables that were likely, based on the literature, to have an impact on their implementation of SBRI were included in the model. The teacher variables of interest were flexible thinking, autonomy, perceived autonomy support, attitude toward SBRI, and perceived competence with SBRI. This study also investigated the implementation process itself to ascertain the effectiveness of different approaches to implementation for

student achievement. Specifically, congruence with SBRI guidelines, innovation of SBRI, and the quality of innovations were assessed for their impacts on student achievement in reading. Preliminary research findings indicate that it is likely that these variables will be important determinants of student achievement.

In addition to implications in the field of teacher training, the study has implications in the fields of organizational change and reading research. Results from this study might be used to offer insight into the process of change in an educational setting and better facilitate large-scale instructional reform. Results might also be used to better understand reading achievement and its determinants, potentially leading to improved instructional strategies that better meet student needs.

Yet, there were limitations. Although it was the goal of the model to explain a large portion of the variance in student achievement, it was not possible to examine and measure all of the possible variables that may have contributed to teachers' implementation or to students' achievement in reading. Particularly, due to the individual nature of implementation of training, assessments of teachers and their instruction is a not precise science. Many variables may contribute to teachers' instructional choices. Other variables that might be considered in future studies include teacher expertise or school culture. In addition, reading achievement is a complex proposition that has many potential contributing variables. Other variables that might be considered in future research include the quality of prior reading instruction. Furthermore, based on results from the model, more research will need to be done that examines more closely the nature of implementation, perhaps through qualitative methodology. First, however, the

question remains: how well does the model accurately reflect teachers' implementation of SBRI and its effects on students' achievement in reading?

Chapter 3

Methods

Participants

Participants for this study were public elementary school students, teachers, and literacy coaches in the state of Texas who teach at schools who have received Reading First grant funds. Specifically, kindergarten, first, and second grade teachers were sampled because of their involvement with the Reading First grant, which targets Scientifically Based Reading Instruction (SBRI). Although third grade teachers participate in Reading First, they were not included because third grade students are required to take the Texas Assessment of Knowledge and Skills (TAKS) test and this may have affected teacher implementation of the training program.

Reading First is a federal grant initiative, funded by No Child Left Behind (2002), to improve early reading instruction in public schools through instructional methods that are research-based. The goal of the program is to implement SBRI in every school to help all children read on grade level by the third grade (No Child Left Behind, 2002). Schools that received Reading First grant funds were chosen for this study for several reasons. First, schools that have qualified for a Reading First federal grant are required to provide ongoing instructional training to all participating teachers. Teachers received recurring training and materials concerning the guidelines of SBRI (see Appendix A) and were expected to implement those components into their daily reading instruction as a term of the grant. As implementation of training is central to the goals of this study, sampling

from teachers who received frequent training with a coherent message was likely to make acquisition of the training content more consistent. In turn, it was likely that the training would have been more effective, allowing the focus of this study to remain on the implementation of training content, rather than on the content itself. Additionally, Reading First schools are required to have a Local Campus Coach, who oversees the implementation of the grant and has direct access to all literacy instruction through frequent observations of instruction and ongoing feedback. The Coaches were a secondary source of data for this study, in addition to the teachers themselves, providing an insider's viewpoint that was not a self-report.

Sample Size

When determining sufficient sample size for multilevel models, each of the levels must be considered. When using a 3-level model, as in this study, adequate sample size at the highest level, Level 3, is especially important (Raudenbush & Bryk, 2002). However, due to the nature of data collection at the school level (from Coaches), discussed in the next section, a balance between sufficient sample size and practical feasibility was necessary. Therefore, a minimal amount for Level-3 was determined to be 10 schools. The lower levels of analysis were not as critical but still needed relatively high sample size, approximately 10 times the size of the level above. That would have meant approximately 100 teachers and approximately 1000 students. Because this study only sampled 3 grade levels (kindergarten, first, and second) from each school, and considering survey response rates, I needed to use a cluster sample and sample all teachers at each grade level at each school in order to achieve sufficient sample size at

Level-2. The number of teachers at each grade level tends to vary by school, but a reasonable assumption was that there would be 5 teachers per grade level. If there were 5 teachers at each of 3 grade levels, that would yield 15 teachers per school. In addition, each student within each of those classrooms was sampled. With some variation, early elementary classrooms tend to have about 20 students.

Therefore, the projected sample size for *data collection* was 10 schools x 15 teachers at each school x 20 students for a total of 10 Coaches, 150 teachers, and 3000 students. However, it was unlikely that every teacher would respond to the survey. Average response rates tend to be closer to 50% (Dillman, 1996). That meant that it was likely that only 7-8 teachers would participate from each school. However, because Dillman's principles (1996) for increasing response rates were used, the predicted rate of response to the teacher survey was 60%. Consequently, it was expected that about 90 teachers would participate. Because all student data gathered was from a third party, a 100% collection rate was likely. Hence, the final projected sample size for *participation* was 10 Coaches, 90 teachers, and 3000 students.

Procedures

Two web-based surveys were used to collect data for this study. Considering the need for participants from multiple sites, a data collection method that offered broad geographic distribution was a necessity. Therefore, access to participants as well as participants' access to the survey was best suited to web-based methods. Survey Monkey (www.surveymonkey.com) was used to administer the online survey and collect summary data.

This study presented minimal risk to participants and those who chose not to participate simply did not respond to the survey. In addition, this study was confidential, with all identifying information for participants deleted prior to any review or analysis of the data. Therefore, *Exempt Review Procedures* and *Waiver of Documentation of Consent* were requested and granted from the Institutional Review Board.

I first contacted the target school district, which is located in a mid-sized border town in southwest Texas, to gain permission to conduct this study with their teachers. This district was chosen for its participation in Reading First, as well as ease in accessing Coaches via an active supervisor who was eager to participate in this study. This supervisor provided contact information for Coaches. The coaches provided the contact information for the kindergarten, first grade, and second grade teachers on their campuses. Because data collection included gathering information from both teachers and Coaches, the following section will outline the procedures for each separately.

Teacher Survey Procedures

Once I had their contact information, I contacted the teachers directly via an email, on April 26th, 2006. (see Appendix B for teacher correspondence). This first email informed them that they had been chosen to participate, informed them of the confidential nature of their participation, and provided them with a link to the online survey. At this time, teachers were assigned a numerical code that was used throughout data collection and analysis in order to provide confidentiality in responses. It was estimated that it would take teachers about 20 minutes to complete the survey.

In order to improve response rates, Dillman's Principles (1996) using multiple contacts were employed. All teachers received the initial contact described above, after which, during the month of May, non-responders received up to three follow-up emails to encourage them to participate. Each follow-up email included a link to the survey for participants' convenience in responding. Although the data collection was confidential, it was possible to determine who had logged onto the survey website because as teachers accessed the survey their pre-assigned code number were automatically registered. In addition, in order to determine the best timing for the reminder emails, the overall rate of responses over time was tracked. When the response level plateaud, the next round of reminders was sent to non-responders. The follow-ups were spaced about 1 week apart. The teacher portion of the data collection was completed on May 25th, 2006.

Teacher Measures

Each teacher completed a 34-item online questionnaire, which included items addressing each of the teacher variables (see Appendix C for the complete survey). Original items were created to measure teacher background variables, attitude toward SBRI, and perceived competence with SBRI. The items for flexible thinking, autonomy, and perceived autonomy support were drawn from existing instruments, described further in this section.

A pilot study was conducted to assess the validity of the teacher survey items. The study sample consisted of 9 public elementary school teachers (3 teachers from kindergarten, first, and second grade) in a school district in central Texas. An email was sent to participants stating the purpose of the study, asking for their voluntary

participation, and providing them with a link to the online survey. The procedures for the pilot study followed the procedures for data collection from teachers outlined in the previous section. Cognitive interviews were conducted with 2 public school teachers (first and second grade) to assess the formatting of the surveys as well as interpretability of each if the items. Results from these cognitive interviews were used to identify any problematic items and adjust the language, formatting, and content as needed.

Overall, the teachers thought the survey was easy to understand and questions were easy to answer. However, both teachers commented on 1 item (within the attitude toward SBRI scale) as difficult to understand. Therefore, this item was reworded. Both teachers also discussed the use of spacers for easier readability and consequently additional blank webpages were added to provide better spacing. In addition, the survey items were analyzed for psychometric properties. Item analysis included descriptive statistics, including the means, standard deviations, and frequency distributions of all of the sales. The small sample size of the pilot study limited testing for internal reliability. However, further psychometric examination of the questions were conducted after the larger study is compete, including intercorrelations matrices and Cronbach alphas for each of the survey scales. Results of these item analyses may prompt deletion of some of the survey items before hypothesis testing is conducted.

For the pilot survey, original items had been created to develop an attitude toward change scale to measure teachers' general attitude toward instructional change. Based on the literature (Stanovich, 1997), this construct was predicted to be associated with teachers' implementation of SBRI. However, when descriptive statistics were calculated

for this scale from the pilot study, results from the attitude toward change scale indicated that all of the items were skewed toward the more heuristic side of the scale. That is, all of the teachers who responded to the survey answered these items in a way that did not provide variability in responses and was consistently heuristic. On a 5-point scale, with 5 being more heuristic, the average score across all items was a 4. This scale did not discriminate well between more and less heuristic teachers. Consequently, the decision was made, based on consultation with professors and teachers, to drop this scale from the teacher survey. The next section provides more detail concerning the scales that were included in the teacher survey.

Teacher Background

The teacher background section of the survey consisted of 7 items, which were all closed-ended questions. These items addressed years teaching in public school, years teaching at current school, amount of SBRI training received, and the frequency with which the Coach visits their classroom and observes their teaching. Each of these items was scored from 1-5, with 1 representing the least frequency and 5 representing the most frequency. For the items addressing which grade level they teach, responses were coded as kindergarten = 1, first grade = 2, second grade = 3. The method of certification was similarly coded as ranging from no certification = 1to 5 year university-based certification = 5.

Attitude toward SBRI

Attitude toward SBRI was assessed using four closed-ended items that asked how much teachers wanted to use SBRI in their classrooms, how much they planned to

implement it exactly as it is supposed to be used, if they believed that SBRI needed to be altered in order to be effective, and how much they endorsed the philosophy behind SBRI. Each of the responses to these questions was scored on a scale ranging from 1 = not at all true of me to 5 = very much true of me. All four items were added together to compute a total attitude toward SBRI score.

Autonomy

The motivational orientation toward autonomy was measured using an adapted version of Deci and Ryan's (1985) General Causality Orientations scale, which measures an individual's orientation toward being autonomous, controlled, or impersonal across various domains. The original scale consisted of twelve vignettes followed by three response choices each, which respondents rate according to how typical that response would be for them on a Likert-type 5-point scale ranging from 1 = not at all true of me to 5 = very much true of me. Each of the three responses represents one of the types of orientations. The original instrument calculated a sub-score for each of the three types of orientations, with each sub-scale found to have reliability estimates of .74, .69, and .74 (Deci & Ryan, 1985). This study utilized six of the twelve original vignettes, which were slightly modified only to place them in educational contexts. These modified items were the same ones used in a study by Angela Vaughn (2005). In addition, instead of three sub-scores, one score was computed that represented the total number of responses for a participant that were autonomous, as opposed to not autonomous (both controlled and impersonal response choices). Higher scores indicated that a respondent had a more autonomous orientation and lower scores indicated that a respondent had a less

autonomous orientation. Using a continuous variable followed more closely the assumptions of this analysis and allowed easier interpretation of results.

Perceived Autonomy Support

Perceived autonomy support was measured using Deci and Ryan's (2002) Cognitive Evaluation Scale, which they have situated by context as the Work Climate Questionnaire. This scale consisted of 6 questions, asking about how much respondents felt supported to act independently in their work environment. Respondents rated these items according to how much they agreed with that response on a Likert-type 5-point scale ranging from 1 = not at all true of me to 5 = very much true of me. Higher scores indicated that a respondent felt more supported to act autonomously and lower scores indicated that a respondent felt less supported.

Flexible Thinking

The scale that was used to measure flexible thinking was developed by Stanovich (1997). This scale originally consisted of six subscales, which were compiled to create a composite score of Active Open-Minded Thinking. The original combined subscales had an overall reliability of .90. The six sub-scales included flexible thinking, categorical thinking, dogmatism, absolutism, and openness of values and openness of morals. As the focus of this study is related to cognitive flexibility, two of the subscales were deemed relevant and only flexible thinking and categorical thinking were used. These two sub-scales had 13 items total and were scored using a Likert-type scale ranging from 1 = do not agree at all to 5 = very much agree. The scores from each were added together to form a combined flexible thinking score.

Perceived Competence

Perceived competence was measured using four closed-ended items that addressed how successfully participants felt they could implement SBRI in their language arts instruction, how prepared they felt to use SBRI, how much they felt that the training they received prepared them to implement SBRI, and how confident they felt that they could implement each of the six SBRI guidelines individually. Each of the responses to these questions was scored on a scale ranging from 1 = not at all true of me to 5 = very much true of me. All four items were added together to compute a total perceived competence score.

Coach Survey Procedures

Coaches were contacted via a pre-notification email, informing them that they had been selected to participate in this study, stating the general purpose of this research, and asking for their voluntary participation. On April 18th, 2006, this email was sent directly to Coaches and asked that they respond via email with their willingness to participate within ten day (see Appendix D for Coach correspondence). As Coaches agreed to participate, a packet of materials was mailed to them directly at their schools. This packet contained an introductory letter including more information about the study and its objectives, details of the constructs being observed and how they are distinct (congruence with SBRI, innovation of SBRI, and quality of innovations), observation checklists to use to observe teachers and summarize results quickly, an answering guide for help in answering the survey items online accurately, and an example of a completed observation checklist of "Mrs. Davis" (a fictitious teacher) to use for training purposes (see Appendix

E). The purpose of the training survey was to familiarize Coaches with using the observation checklist and also with rating teachers using the online survey. The online training survey asked that Coaches rate Mrs. Davis using the example completed observation checklist that they were sent to determine their answers. After answering each item, the correct answers were provided along with a rationale as to why that was the best choice. This practice survey included a range of instructional behaviors and responses that represented a range of possible observations that the Coaches may have encountered. Completion of this practice survey was mandatory before Coaches rated the teachers on their campuses using the online surveys. On May 1st, 2006, an email was sent to the Coaches with a link to the online training survey. After completion of the training survey, each Coach was sent an email containing the online survey links, one for each of the participating teachers on their campus. They were directed to access and complete the surveys before the end of the school year, 1 month away. It was estimated that it would take Coaches about 2 hours to complete all of the surveys, depending on the number of teachers on their campus and the length of the surveys (outlined in the next section).

All student data was collected from the Reading First contact person for the district. All student information was coded for confidentiality. Each student's name was deleted prior to submission of data. The numerical code that the district used for students was used for this study, as well as a letter to indicate which teacher's classroom they were in.

Coach Measures

Coach survey items addressed each of the variables within the implementation of SBRI variables, including congruence with SBRI, innovation of SBRI, and the quality of innovations. For each of these scales, original items were created. Due to the nature of the survey questions, the number of items that each Coach answered depended on their responses, as there were several skip rules within the online survey. At a minimum, Coaches complete 12 survey items, and at a maximum they completed 64 survey items for each participating teacher (see Appendix F for the complete survey).

A pilot study was conducted to evaluate the validity of the coach survey items. One Coach was surveyed who works directly with each of the teachers in the Texas school district who participated in the teacher survey pilot study. This Coach received the packet of materials reviewed in the previous section, however as time was limited, the Coach was not able to be trained prior to observing the teachers. She did go through the training survey prior to rating each of the teachers. A cognitive interview was conducted as the Coach completed the training survey to check for interpretability of the items and appropriate formatting. In addition, a cognitive interview was conducted with the same Coach as she rated and reported observations of two teachers. Results from these cognitive interviews were used to identify any problematic items and adjust the language, formatting, or content as needed. For example, the Coach reported that one of the survey items (on modeling) was not clear in its language. The language of this item was adjusted per her suggestion. The Coach also reported that the packet of materials were helpful in understanding what the expectations were but requested additional information about the

purpose of the study in the contact letter, which has been added. In addition, all of the Coach survey items were analyzed for their psychometric properties. Descriptive statistics were calculated for all of the scales, including the means, standard deviations, and frequency distributions. As before, the small sample size limited internal reliability testing. However, further psychometric examination of the items was conducted after the larger study was compete, including Cronbach alphas for each of the scales.

Congruence with SBRI

Congruence with SBRI was measured using closed-ended questions that addressed the extent to which each teacher followed the guidelines of SBRI. There was 1 survey item for each of the subcategories of the 6 guidelines, for a total of 12 congruence items. These subcategories are outlined in Table 1.

Table 1.

Subcategories of SBRI

SBRI Guideline	Subcategory
90 minutes of reading instruction	90 minutes of reading instruction
Use assessment data	Use assessment data to monitor student learning
	Use assessment data to inform instruction
Provide differentiated instruction	Provide differentiated instruction
Provide systematic reading instruction	Provide planned reading instruction
	Provide sequenced reading instruction
Provide explicit instruction	Provide modeled reading instruction
	Provide scaffolded reading instruction
Provide instruction in 5 essential components	Provide phonics instruction
	Provide phonemic awareness instruction
	Provide fluency instruction
	Provide vocabulary instruction
	Provide comprehension instruction

The subcategories within each guideline were added together to create a combined score for that guideline. This resulted in six Congruence scores, 1 for each guideline. Each of the responses to these questions was scored on a Likert-type scale ranging from 1 = never true of this teacher to 5 = always true of this teacher.

Innovation of SBRI

Innovation of SBRI was measured using closed-ended questions that addressed 3 aspects of innovation: the extent to which each teacher tried different things with SBRI, generated their own ideas, and continued trying new things. Each of these 3 questions was asked for each of the subcategories of the guidelines of SBRI, for a total of 36 Innovation items. The 3 Innovation items for each subcategory were added together to create a combined overall Innovation score for each guideline. This resulted in 6 Innovation scores, 1 for each guideline. Each of the responses to these questions was scored on a Likert-type scale ranging from 1 = never true of this teacher to 5 = always true of this teacher.

Quality of Innovation

Quality of innovation was measured using closed-ended questions that addressed 2 aspects of quality of innovation: the extent to which the efforts each teacher made to try new things was relevant to students' needs as well as how effective they were for students. Each of these 2 questions was asked for each of the subcategories of the guidelines of SBRI, for a total of 24 Quality of Innovation items. The 2 Quality of Innovation items for each subcategory were added together to create a combined overall Quality of Innovation score for that guideline. This resulted in 6 Quality of Innovation scores, 1 for each guideline. Each of the responses to these questions was scored on a Likert-type scale ranging from 1 = never true of this teacher to 5 = always true of this teacher.

Hypotheses

Research Question 1: To what extent do teacher characteristics (flexible thinking, perceived autonomy support, attitude toward SBRI, and perceived competence with SBRI) predict their implementation of SBRI (congruence with SBRI, innovation of SBRI, and the quality of innovations)?

Hypothesis 1(a): There will be a positive linear relationship between a tendency toward flexible thinking in teachers and a more heuristic manner of implementation of SBRI (high innovation and high quality of innovation).

Rationale*:* Because flexible thinkers tend to be open to change and novel ways of doing things (Stanovich & West, 1997), they will be more likely to implement SBRI in a more flexible way, in other words, more heuristically (Datnow, 1998; Drach-Zahavy et al., 2004). Likewise, teachers who are not flexible in their thinking will be more likely to be algorithmic in their implementation (low innovation and low quality of innovation), as the heuristic approach relies on flexibility and creativity. It is unknown what effect high flexible thinking will have on congruence with SBRI, although it is possible that a tendency toward flexibility may negatively impact compliance with rules or regulations of any kind. This association will be investigated on an exploratory basis.

Hypothesis 1(b): There will be a positive linear relationship between perceived autonomy support in teachers and a more heuristic manner of implementation of SBRI (high innovation and high quality of innovation).

Rationale*:* Because individuals who perceive that they are supported by their environment to act autonomously do tend to act more autonomously (Deci & Ryan, 1985), teachers will be more likely to implement SBRI in a way that is individualized to themselves and in a way that requires initiative, in other words more heuristically (high innovation and quality of innovation) (Datnow, 1998; Drach-Zahavy et al., 2004). Likewise, teachers who perceive lower levels of support to act autonomously will be more likely to be more algorithmic in their implementation (low innovation and low quality of innovation), as the heuristic approach relies on independent interpretation and initiative. It is unknown what effect perceived autonomy will have on congruence with SBRI, although it is possible that the perception that one is supported to act autonomously may negatively impact compliance with rules or regulations of any kind. This association will be investigated on an exploratory basis.

Hypothesis 1(c): There will be a positive linear relationship between a positive attitude toward SBRI and congruence with SBRI.

Rationale*:* Attitudes have been shown to affect behavioral choices, particularly in the face of school reform (Corrigan, 2001; Fullan, 2000; Hargreaves, 1992). Thus, it is likely that teachers who feel positively toward the program that they are required to use in their classrooms will tend to use it more frequently and with more fidelity than those who feel negatively toward it (high congruence). It is unknown what affect attitude toward SBRI

will have on the approach to implementation, but it is possibly that teachers will be more comfortable manipulating the program if they have a good attitude toward it (high innovation and quality of innovation). This hypothesis will be explored on an experimental basis.

Hypothesis 1(d): There will be a positive linear relationship between high perceived competence in teachers and a more heuristic manner of implementation of SBRI (high innovation and high quality of innovation).

Rationale*:* Individuals who perceive themselves as more competent are more likely to feel comfortable trying new things (Pajares, 1996; Tschannen-Moran & Woolfolk-Hoy, 2001). Additionally, because they are likely to have more experience and/or more expertise on which to base novel practices, which can lead to a feeling of confidence (Grissmer & Kirby, 1997; Smith & Bourke, 1992), they will be more likely to feel more motivated to implement SBRI in a more heuristic manner (Datnow, 1998; Drach-Zahavy et al., 2004). Likewise, teachers who do not perceive themselves as very competent will be more likely to be algorithmic in their implementation (low innovation and low quality of innovation), as the heuristic approach requires the confidence and motivation to try new things. It is unknown what effect high perceived competence will have on congruence with SBRI. It is possible that a tendency toward feeling competent may positively impact compliance with the guidelines, as an expression of confidence, or it may negatively impact compliance, with feelings of confidence leading to more individual interpretation and innovation. This association will be investigated on an exploratory basis.

Research Question 2: To what extent do congruence with SBRI and innovation of SBRI mediate the relationship between teacher characteristics (flexible thinking, perceived autonomy support, attitude toward SBRI, and perceived competence with SBRI) and student achievement in reading?

Hypothesis 2(a): There will be a significant positive association between teachers' flexible thinking and student achievement in reading, mediated by both congruence with SBRI and innovation of SBRI.

Rationale: Research has shown that teachers' instructional choices determine student outcomes more than individual teacher characteristics (Datnow & Castellano, 2000). Therefore, the association between teacher characteristics and student outcomes will likely be significant when teachers' implementation of SBRI is accounted for as a mediator. Teachers' flexible thinking will impact their students' reading achievement through their implementation of SBRI. Congruence with SBRI and innovation of SBRI will account for a significant portion of the relationship between teachers' flexible thinking and student achievement in reading.

Hypothesis 2(b): There will be a significant positive association between teachers' perceived autonomy support and student achievement in reading, mediated by both congruence with SBRI and innovation of SBRI.

Rationale*:* Research has shown that teachers' instructional choices determine student outcomes more than individual teacher characteristics (Datnow & Castellano, 2000).

Therefore, the association between teacher characteristics and student outcomes will likely be significant when their implementation of SBRI is accounted for as a mediator. Teachers' perceived autonomy support will impact their students' reading achievement through their implementation of SBRI. Congruence with SBRI and innovation of SBRI will account for a significant portion of the relationship between teachers' perceived autonomy support and student achievement in reading.

Hypothesis 2(c): There will be a significant positive association between teachers' attitude toward SBRI and student achievement in reading, mediated by both congruence with SBRI and innovation of SBRI.

Rationale: Research has shown that teachers' instructional choices determine student outcomes more than individual teacher characteristics (Datnow & Castellano, 2000). Therefore, the association between teacher characteristics and student outcomes will likely be significant when their implementation of SBRI is accounted for as a mediator. Teachers' attitude toward SBRI will impact their students' reading achievement through their implementation of SBRI. Congruence with SBRI and innovation of SBRI will account for a significant portion of the relationship between teachers' attitude toward SBRI and student achievement in reading.

Hypothesis 2(d): There will be a significant positive association between teacher perceived competence with SBRI and student achievement in reading, mediated by both congruence with SBRI and innovation of SBRI.

Rationale: Research has shown that teachers' instructional choices determine student outcomes more than individual teacher characteristics (Datnow & Castellano, 2000). Therefore, the association between teacher characteristics and student outcomes will likely be significant when their implementation of SBRI is accounted for as a mediator. Teachers' perceived competence will impact their students' reading achievement through their implementation of SBRI. Congruence with SBRI and innovation of SBRI will account for a significant portion of the relationship between teachers' perceived competence and student achievement in reading.

Research Question 3: To what extent does the quality of teacher innovations of SBRI moderate the relationship between innovation of SBRI and student achievement in reading?

Hypothesis 3(a): Among teachers for whom the nature of implementation of SBRI is more heuristic (high innovation of SBRI), student achievement will depend on the quality of the innovations. There will be a significant association between high quality innovation of SBRI and high student achievement.

Rationale: This is an experimental hypothesis. Because high innovators are more likely to interpret and use SBRI in a creative, flexible, and individualistic manner, their innovations of SBRI may be more likely to vary in quality. That is, they may be too creative or too individualistic and therefore stray from what their students need or what is effective for learning. Innovations that are high quality (relevant to student needs and effective) are hypothesized to be significantly associated with high student achievement

in reading. Similarly, innovations that are low quality are hypothesized to be significantly associated with low student achievement in reading.

Data Analysis

Hierarchical Linear Modeling (HLM) was used to analyze data for this study. This study investigates teachers, their instructional practices, and their effects on students. It was likely that teachers within a school would be more similar to each other than they would be to teachers at different schools. This may create additional dependence between subjects. In other words, teacher-level variables may depend to some extent on the school environment. For this reason, teachers were considered to be nested within schools. Similarly, student-level variables may depend on their classroom environment. Thus, students were considered nested within classes. If traditional linear regression were used to analyze data for this study, independence assumptions would be violated and there may be an increase in Type 1 error rates (Kreft & De Leeuw, 1998). Therefore, a multilevel model that accounts for this dependence between subjects by providing more accurate standard errors was most appropriate for this study. In the analysis, students served as Level-1, teachers as Level-2, and schools served as Level-3. However, this discussion will outline the plan of analysis in linear regression terms for practical readability. Readers interested in more detailed explanations of the multilevel models used to analyze data may refer to Appendix G.

Analysis

To aid in interpretation of the following section, a review of the conceptual model for the study is provided in Figure 2. The analysis included a significance test for each of the predicted associations in the conceptual model and each of the research questions were addressed accordingly. This section will outline the steps of analysis for testing each association predicted in the conceptual model.

Figure 2.

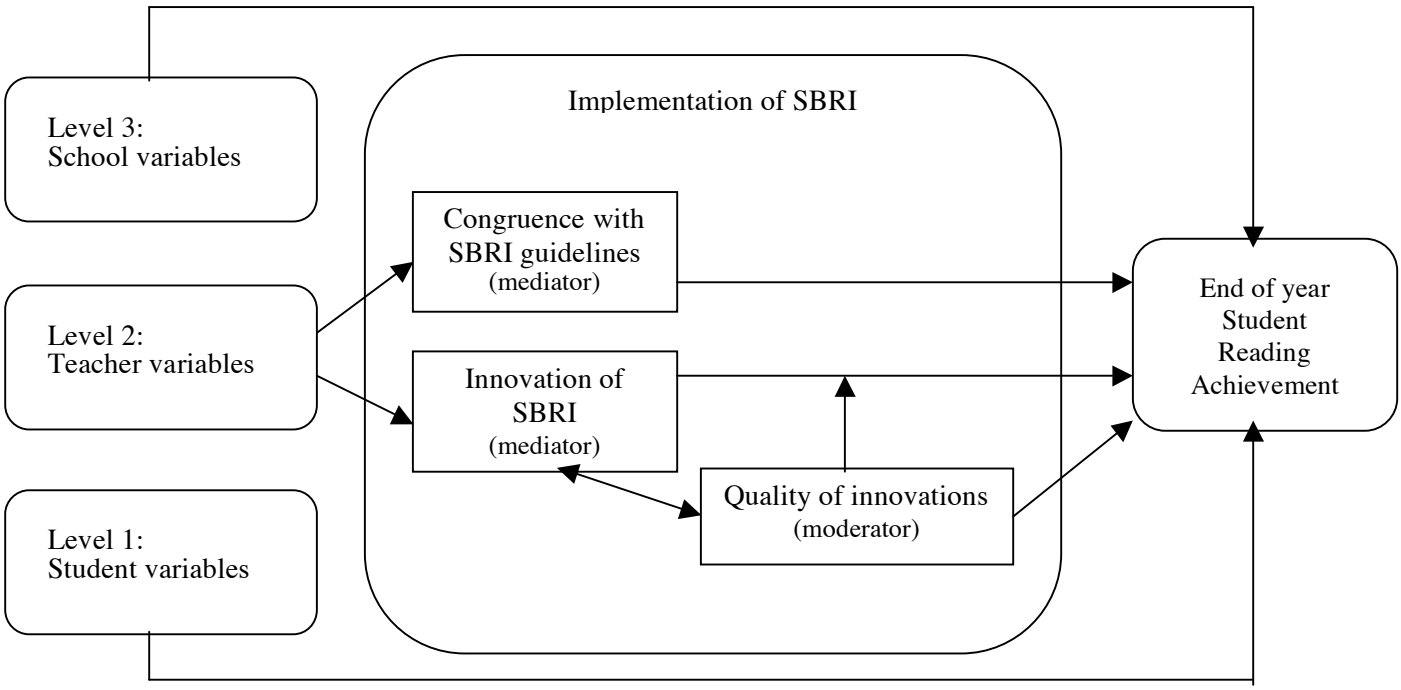


Figure 2: The conceptual model for the studies.

Model 1

First, the direct effects of the teacher variables of interest on congruence with each guideline of SBRI, innovations of SBRI, and the quality of innovations of SBRI

were assessed. Congruence with the guidelines of SBRI was regressed on each of the teacher variables of interest (flexible thinking, perceived autonomy support, attitude toward SBRI, and perceived competence with SBRI), along with the control variables for teachers and schools. Recall that congruence with SBRI includes congruence with the six guidelines of SBRI. As such, the direct effects of teacher variables on congruence were tested using six separate models, one for each guideline. The significance of each of the teacher variables of interest indicated the extent to which this teacher variable predicted congruence with each guideline of SBRI. Then, this process was repeated to determine the effect of the teacher variables of interest on innovation of SBRI. The significance of each of the teacher variables of interest in this model indicated the extent to which this teacher variable predicted innovation of SBRI. Last, this process was repeated to determine the effect of the teacher variables of interest on quality of innovation of SBRI. The significance of each of the teacher variables of interest in this model indicated the extent to which this teacher variable predicted the quality of their innovations of SBRI.

Model 2

The conceptual model predicted that the association between teacher variables and student outcomes would be mediated by two different variables. To preface, general mediational models are illustrated in Figures 3 and 4. The predictor variable (*X)* affects the mediating variable (*M*), which in turn affects the outcome variable (*Y)*. The direct effect of *X* on *Y* is represented by *c'*, and the indirect effect is represented by *ab*. The total effect of *X* on *Y* is represented by $c' + ab = c$.

Figure 3.

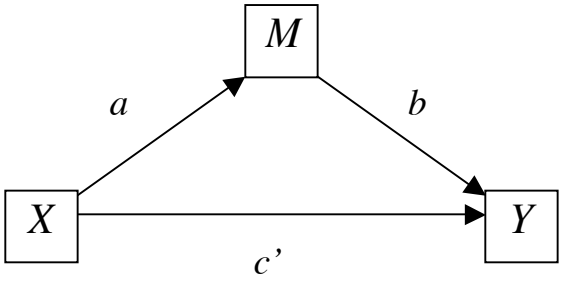


Figure 3. Mediation model in which the effect of X on Y is mediated by M.

To test mediation, *c* must first be assessed for the total effects of the independent variables (Figure 4). Hence, student reading achievement (*Y*) was regressed directly onto each of the teacher variables of interest (*X*), along with the control variables for students, teachers, and schools. The significance of each of the teacher variables of interest indicated the extent to which this teacher variable predicted student reading achievement, after accounting for the control variables. The impact of each of these teacher variables on student reading achievement must be significant in order to proceed to the next step of the analysis for that teacher variable.

Figure 4.

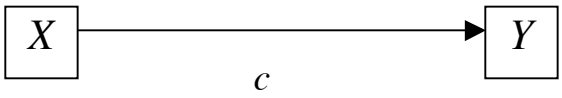


Figure 4. Model of the total effects of the independent variables.

For this study, both congruence with the guidelines of SBRI and innovation of SBRI were predicted to mediate the relationship between teacher variables and student

reading achievement. Therefore, in the next step of the analysis student reading achievement (*Y*) was regressed on the teacher variables of interest (*X*), congruence with each guideline of SBRI separately (*M*), innovation of SBRI (*M*), and the control variables. This provide an estimation of *c'*. The difference between the estimates of the coefficients for these two equations, or *c*-*c'*, estimated the mediator effect of the congruence with each guideline of SBRI and innovation of SBRI. Next, in order to test the significance of the mediational effects, the estimates of *c*-*c'* were divided by the Freedman-Schatzkin (1992) standard error. This was then compared to the *t* distributions. The Freedman-Schatzkin standard error is recommended for testing the significance of a combined mediational effect because research indicates that significance testing using this standard error reported the most accurate Type 1 error rates and the highest statistical power in most situations (MacKinnon, et al., 2002). To assess which of the mediators is most strongly related to student reading achievement, each of the mediator coefficients was multiplied by its standard deviation. This value indicated the change in student reading achievement associated with one standard deviation increase in each of the predicted mediators.

Model 3

The conceptual model predicts that the direction and strength of the association between innovation of SBRI and student reading achievement is moderated by the quality of innovations. To illustrate, Figure 5 depicts a general moderator relationship. In this diagram, the direct effect of the predictor on the outcome is represented by path *a*, the direct effect of the moderator on the outcome is represented by path *b*, and the interaction

effect of both the predictor and the moderator is represented by path *c*. The moderator hypothesis is supported if the interaction, *c,* is significant (Baron & Kenny, 1986).

Figure 5.

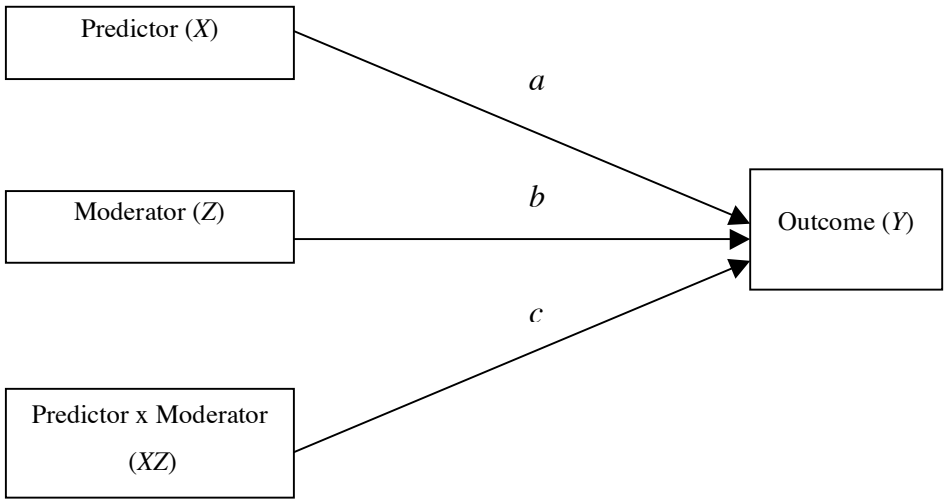


Figure 5. Moderation model in which the interaction effect of c is greater than the direct path of a or b individually.

In the study, the association between innovation of SBRI and student reading achievement was predicted to vary as a function of the quality of those innovations. Note that innovation of SBRI, before included in the model as a mediator, was now be used as a predictor variable. Student reading achievement (*Y*) was regressed on innovation of SBRI (*X*), quality of innovations (*Z),* and an interaction term for the combination of innovation of SBRI and quality of innovation (*XZ*), controlling for all of the student, teacher, and school variables. Significance levels of innovation of SBRI indicated the extent to which innovations of SBRI predicted student reading achievement, after

accounting for the control variables. Significance levels of the quality of innovations indicated the extent to which quality of innovation predicted student reading achievement, after accounting for the control variables. The moderator hypothesis was supported if the *XY* effect was significant. Any significant interaction indicated that quality of innovation moderated the relationship between innovation of SBRI and student reading achievement, after accounting for the control variables.

However, the impact that a moderator has on the outcome cannot be determined simply by testing the interaction of the moderator with the independent variable. Only the presence of a moderating effect can be estimated. But the strength of the moderating effect on student outcomes is an important part of the study. Therefore, to interpret this interaction, predicted levels of quality of innovation for students who scored one standard deviation above and below the mean achievement score were calculated. Results indicated the extent to which high and low levels of both innovation of SBRI and the quality of innovations affected student reading achievement.

Chapter 4

English-only Classrooms

Results

This chapter will present the results from the English-only classrooms portion of the data. I will begin with a discussion of the sample and the demographic make-up of the participants. I will then discuss the analyses of the data, including model building to answer the 3 research questions and the additional models that were tested during the analyses.

Participants

Response Rate

For both studies together, a total of 109 teachers were surveyed from 9 elementary schools in 1 school district in a border town in West Texas. The response rate for coaches reporting on teacher implementation was 100% for all 109 teachers. Of the 109 teachers sampled, 82 teachers responded to the self-report survey and 27 teachers did not respond for an overall teacher response rate of 75%. There were 2 teachers who did respond but were subsequently dropped from the sample because it was determined that they taught third grade, which is outside the criteria for inclusion in this study (kindergarten, first, and second grade). In addition, 5 teachers were dropped from the sample because they did not complete all of the survey items. There were 4 teachers who were also dropped from the sample because their student achievement data was not available, a requirement for analysis. It is unknown why their class achievement data was not reported to the district. This left 71 teachers who had complete data. Finally, the remaining sample was divided into 2 groups: English-only classroom teachers and Bilingual classroom teachers.

The final number of teacher participants from the English-only classrooms was 36. Broken down by grade level, there were 14 kindergarten, 10 first grade, and 12 second grade teacher participants.

For student participation, achievement data was gathered through the district. Because this study used the end-of-year (EOY) reading achievement score as the outcome and the beginning-of-year (BOY) reading achievement score as a covariate, it was necessary that all students that were included in the sample have *both* the BOY and EOY data available. It is impossible to determine why either data point might be missing, but missing achievement data in public schools is usually attributed to movement in the student population. Approximately 10% of the student data was dropped because one of the data points was not present. This resulted in a total of 1,265 students participating, 559 of which were used for the English-only classrooms portion of this study. Broken down by grade level, there were 207 kindergarten, 163 first grade, and 189 second grade student participants.

Demographics

All 9 elementary schools were represented in the English-only classrooms sample. The number of teachers who responded from each school ranged from 1 to 7, with an average of 4 teachers per school. The average number of years of experience for teachers was quite high at approximately 9 years, with 78% of teachers having 4 years of experience or more. Approximately 94 % of teachers in the sample received their teaching certification through a university-based program, with only 2 teachers out of the sample receiving alternative certification. Student demographics for this sample were not made available by the district but it can be reasonably assumed that they match the

demographics of the district overall, which reports student gender statistics (51% male and 49% female), ethnicity (79% Hispanic, 15% White, 5% African American, and 2% Asian/Pacific Islander), and economic advantage status (67% disadvantaged).

Descriptive Statistics for Variables

There are many variables included in these analyses, 8 of which were measured using survey instruments that were created expressly for this study. For the sake of brevity, a summary of the descriptive statistics for each is provided in Table 2, including the mean, standard deviation, and reliability statistics if applicable.

Table 2.

Descriptive Statistics for Variables in these Analyses

Variables		*Mean*	*Standard Deviation*	*Cronbach's Alpha*
Teacher Characteristics	Flexible Thinking	4.06	.621	.69
	Autonomy Support	3.39	1.21	.94
	Perceived Competence	4.04	1.10	.92
	Attitude toward SBRI	3.92	1.07	.70
Congruence with SBRI	Overall Content	4.42	.68	.84
	Overall Instruction	3.91	.84	.88
	90 minutes of instruction	4.62	.80	
	Assessments	3.97	.86	
	Differentiation	3.66	.98	
	Systematic Instruction	4.32	.82	
	Explicit Instruction	4.00	.95	
	Phonemic Awareness	4.18	1.07	
	Phonics	4.39	.87	
	Fluency	3.49	1.07	
	Vocabulary	4.15	.86	
	Comprehension	4.25	.84	
Innovation of SBRI	Overall Content	3.58	.83	.93
	Overall Instruction	3.47	.90	.95
	Differentiation	3.45	1.01	.97

	Systematic Instruction	3.50	.89	.95
	Explicit Instruction	3.46	.92	.96
	Phonemic Awareness	3.65	.94	.95
	Phonics	3.79	.84	.94
	Fluency	3.26	.99	.98
	Vocabulary	3.65	.88	.96
	Comprehension	362	.91	.97
Quality of Innovations	Overall Content	3.74	.80	.94
	Overall Instruction	3.72	.89	.94
	Differentiation	3.69	1.04	.98
	Systematic Instruction	3.78	.91	.98
	Explicit Instruction	3.70	.89	.97
	Phonemic Awareness	3.68	.90	.98
	Phonics	3.92	.85	.98
	Fluency	3.50	.94	.99
	Vocabulary	3.82	.87	.98
	Comprehension	3.76	.90	.98
Student Achievement	Beginning of year	.39	.31	
	End of year	.84	.23	

Note: Additional control variables were used in this study (grade level and school location). Because these variables were categorical, they were dummy-coded.

The congruence with SBRI scale was measured using 1 item, so reliability is only reported for the aggregate scales of congruence with overall content and instruction. However, the other implementation variables were measured using multiple items (3 for innovation and 2 for quality) so the reliability for those scales is reported. When interpreting the means for each variable, there are several considerations. The student achievement variables were converted from raw scores to percentages, so appropriate interpretation of these means requires that they be multiplied by 100. For example, the end of year (EOY) mean student achievement score is .84, which should be interpreted as 84% of required skills mastered. In addition, the teacher characteristic variables and implementation variables were measured using a 5-point Likert-type scale. Therefore,

interpretation of these means should take into consideration that it represents an average out of 5 points.

Analyses

The purpose of this study was to examine the relationships among teachers' individual characteristics, their instructional approach to the implementation of SBRI after training, and the reading achievement of their students. Each of the associations predicted by the conceptual model was tested during the analyses, resulting in 3 different analytical models. The following sections review the model building process and the results from each of the 3 models separately.

Model 1

Model 1 tested the predicted association between the teacher's individual characteristic variables (flexible thinking, perceived autonomy support, perceived competence with SBRI, and attitude toward SBRI) and their implementation of SBRI (congruence with SBRI, innovation with SBRI, and quality of innovations of SBRI). The level of significance for the association between each of the teacher characteristic variables with each of the implementation variables will indicate the extent to which that particular teacher variable predicts that type of implementation of SBRI. I hypothesized each of the teacher characteristic variables would positively predict a more heuristic approach to implementation of SBRI (positive associations with innovation and quality of innovation) and that they would negatively predict a more algorithmic approach to implementation of SBRI (negative associations with innovation and quality of innovation). Linear regression was used for this analysis.

There is more than 1 outcome variable for Model 1. The outcomes are all parts of the overall implementation of SBRI. These implementation variables can be broken down into either content or instructional components. That is, implementation of SBRI involves teaching certain content (phonemic awareness, phonics, fluency, vocabulary, and comprehension) and using certain instructional strategies (differentiation, systematic instruction, and explicit instruction). Therefore, all of the implementation variables can be broken down into 2 subscales: content and instruction. These classifications are summarized in Table 3.

Table 3.

Classification of 2 subscales of Implementation Variables

Classification	*Subscales*
Content	Phonemic Awareness
	Phonics
	Fluency
	Vocabulary
	Comprehension
Instruction	Differentiation of instruction
	Systematic instruction
	Explicit instruction

These 2 classifications (content and instruction) can be used to identify particular aspects of each of the 3 implementation variables (congruence with SBRI, innovation of SBRI, and quality of innovations). For instance, congruence with SBRI can be broken down into congruence with SBRI content and congruence with SBRI instructional components. For the remainder of these analyses, all 3 of the implementation variables will be broken down into 2 subscales: content and instructional components. By

classifying implementation in this way, results can be interpreted as either relevant to the content of SBRI or relevant to SBRI instructional strategies and methods, thus increasing interpretability and applicability. This classification resulted in a total of 6 subscales of the implementation variables. A summary of the division of the 3 implementation variables into the 6 subscales is presented in Table 4.

Table 4.

Division of Implementation Variables into 6 Subscales for Analyses

3 categories of implementation	*6 subscales of implementation*
1. Congruence with SBRI	1. Congruence with SBRI Content
	2. Congruence with SBRI Instruction
2. Innovation of SBRI	3. Innovation of SBRI Content
	4. Innovation of SBRI Instruction
3. Quality of Innovation of SBRI	5. Quality of Innovation of SBRI Content
	6. Quality of Innovation of SBRI Instruction

To simplify the language in this section, for the remainder of these analyses, the implementation variables will be referred to as either content or instruction. For example, when congruence with SBRI is discussed, the subscales will be referred to as congruence with content or congruence with instruction.

The first step of the analysis was to assess the direct affect of the control variables on the outcomes by regressing grade level and school location on each of the 6 implementation of SBRI outcomes. I found that grade level was significantly associated with some of the implementation subscale outcomes but not all of them. I also found that school location was not significantly predictive of any of the implementation outcomes. Because these tables are lengthy, results are summarized in Appendix J. Based on these results, and because the limited sample size jeopardized the stability of the model, the decision was made to include grade level as a control variable in subsequent analyses but drop school location as a control variable in order to reduce the total number of variables in the model to help preserve stability.

In the next step, I added all of the teacher characteristic variables to the model to test the association of teachers' individual characteristics with their implementation of SBRI (each of the 6 subscales was tested separately). I began by testing all of the teacher characteristic variables with the 2 congruence subscales as outcomes. Results showed that there was not a significant association between any of the teacher characteristic variables and their congruence with content (see Table 5). There was a significant positive association between teacher's perceived autonomy support and their congruence with instruction (b = .352, p = .004). However, none of the other teacher characteristic variables (flexible thinking, perceived competence with SBRI, and attitude toward SBRI) were found to be significantly associated with their congruence with instruction. These results are summarized in Table 6.

Table 5.

Results of the Model with Teacher Characteristic Variables Predicting Congruence with SBRI Content

Variables	*Coefficient*	*se*	*p Value*
Grade Level			
Kindergarten	.099	.279	.726
1st grade	.434	.315	.179
Teacher characteristics			
Flexible Thinking	.176	.201	.389
Autonomy Support	.117	.110	.298
Attitude toward SBRI	.083	.139	.553
Perceived competence with SBRI	-.041	.132	.761

Note. * $p < .05$.

Table 6.

Results of the Model with Teacher Characteristic Variables Predicting Congruence with SBRI Instructional Components

Variables	*Coefficient*	*se*	*p Value*
Grade Level			
Kindergarten	.333	.282	.248
1st grade	.718	.319	.032*
Teacher characteristics			
Flexible Thinking	.341	.204	.105
Autonomy Support	.352	.111	.004*
Attitude toward SBRI	.204	.140	.157
Perceived competence with SBRI	-.157	.134	.250

Note. * $p < .05$.

When the association of teacher characteristics with their innovation of content was tested, as before, none of the teacher characteristic variables were significantly associated with the content subscale (see Table 7). Similar to the previous model, the results for the instruction category of innovation of SBRI revealed positive significant results. Specifically, teachers' perceived autonomy support was significantly associated

with their innovation of instruction (b = .369, p = .004) and teachers' flexible thinking was significant as well (b = .486, p = .030). None of the other teacher characteristic variables were found to be significantly associated with the innovation of SBRI outcome. Results from this analysis are summarized in Table 8.

Table 7.

Results of the Model with Teacher Characteristic Variables Predicting Innovation with SBRI Content

Variables	*Coefficient*	*se*	*p Value*
Grade Level			
Kindergarten	-.003	.332	.992
1st grade	.377	.376	.324
Teacher characteristics			
Flexible Thinking	.169	.240	.486
Autonomy Support	.211	.131	.119
Attitude toward SBRI	.154	.165	.358
Perceived competence with SBRI	-.098	.158	.540

Note. * p < .05.

Table 8.

Results of the Model with Teacher Characteristic Variables Predicting Innovation with SBRI Instructional Components

Variables	*Coefficient*	*se*	*p Value*
Grade Level			
Kindergarten	.195	.295	.514
1st grade	.801	.334	.023*
Teacher characteristics			
Flexible Thinking	.486	.213	.030*
Autonomy Support	.369	.116	.004*
Attitude toward SBRI	.275	.147	.071
Perceived competence with SBRI	-.260	.140	.074

Note. * p < .05.

Last, the association of teacher characteristics with the quality of their innovations of SBRI content was tested. Different from findings in the previous models, teachers' perceived autonomy support was found to be significantly positively associated with the quality of their innovations with content (b = .253, p = .049). Similar to the previous model, the quality of innovations of SBRI revealed that teachers' perceived autonomy support was significantly associated with their innovation of instruction (b = .362, p = .007). None of the other teacher characteristic variables were found to be significantly associated with either of the quality of innovation of SBRI outcomes. Results from these analyses are summarized in Tables 9 and 10.

Table 9.

Results of the Model with Teacher Characteristic Variables Predicting Quality of Innovations with SBRI Content

Variables	*Coefficient*	*se*	*p Value*
Grade Level			
Kindergarten	.176	.312	.576
1st grade	.456	.352	.206
Teacher characteristics			
Flexible Thinking	.183	.225	.424
Autonomy Support	.253	.123	.049*
Attitude toward SBRI	.150	.155	.343
Perceived competence with SBRI	-.100	.148	.505

Note. * p < .05.

Table 10.

Results of the Model with Teacher Characteristic Variables Predicting Quality of Innovations with SBRI Instructional Components

Variables	*Coefficient*	*se*	*p Value*
Grade Level			
Kindergarten	.167	.314	.599
1st grade	.510	.356	.162
Teacher characteristics			
Flexible Thinking	.378	.227	.107
Autonomy Support	.362	.124	.007*
Attitude toward SBRI	.221	.156	.168
Perceived competence with SBRI	-.172	.149	.260

Note. * $p < .05$.

These results suggest that teacher' choices when it comes to implementing SBRI may be influenced by some of their individual characteristics. In particular, their perceptions of the environmental support they receive seems to impact their implementation for at least one subscale of each of the 3 implementation variables (congruence with SBRI, innovation of SBRI, and quality of innovation of SBRI). In addition, teachers' tendency toward flexible thinking seems to influence their innovation of the instructional strategies and methods of SBRI. The hypothesis that these teacher variables would positively impact their heuristic implementation was partially supported, as 2 of the teacher variables were found to have a positive significant association with both of the innovation outcomes. The hypothesis that these teacher variables would negatively impact their algorithmic implementation (negative associations with innovation outcomes) was not supported, as there were no teacher variables that were found to be negatively related to any of the outcomes in this analysis. An interesting trend that emerged from the data was that it appears that teachers' individual characteristics

influence their implementation of the instructional subscales more than they influence their implementation of the content subscales.

Model 2

Model 2 tested the predicted association between the teacher characteristic variables (flexible thinking, perceived autonomy support, perceived competence with SBRI, and attitude toward SBRI) and student achievement in reading. Specifically, I expected that this association would be mediated by 2 of the implementation variables, congruence with SBRI and innovation with SBRI. The following conditions must be met in order for mediation to occur: (1) the direct association between teacher characteristics and the 2 implementation of SBRI variables is statistically significant, (2) the association between teacher characteristics and student achievement is statistically significant, (3) the total association between the implementation variables and student achievement is statistically significant, and (4) the association between teacher characteristics and student achievement shrinks upon the addition of the implementation variables to the model.

To test for mediation, these 4 conditions were tested in order. Multilevel modeling (2-level HLM) was used for this analysis, as discussed in Chapter 3. The first condition was already tested in Model 1 and autonomy support and flexible thinking were found to be significantly associated with one or more of the implementation of SBRI outcomes (see Tables 6, 8, 9, and 10). The next step was to test the second condition, or test the main effect of the teacher characteristic variables on student achievement. First, a null model was tested, with only student achievement in reading included as the outcome. The null model represents the multilevel model without any predictor variables. This model

provides a baseline for all of the other models by providing initial variance estimates for Levels 1 and 2. Results are summarized in Table 11.

Table 11.

Results of the Null Model with EOY Reading Achievement as the Dependent Variable

Fixed Effect		*Coefficient*	*se*	*p Value*
Average class mean, γ_{00}		.845	.018	.000
Random Effect	*Variance*	*df*	χ^2	*p Value*
Class mean, u_{0j}	.009	35	141.336	0.000
Level-1 effect, r_{1j}	.045			

Next, the predictor variables were added to the model. The teacher characteristic variables were added at Level-2 along with the control variables, BOY (at Level-1) and grade level (at Level-2). This analysis revealed that none of the teacher characteristic variables were significantly associated with student achievement, after controlling for BOY and grade level (see Table 12). Therefore, because at least 1 of the conditions for mediation was not met, the mediation hypothesis was not supported. Failure to meet the conditions for mediation suggests that these implementation variables do not account for the association between teacher characteristics and student achievement in reading.

Table 12.

Results of the Model with Teacher Characteristic Variables Predicting Student Achievement in Reading

Fixed Effect	*Coefficient*	*se*	*p Value*
Intercept, γ_{00}	.649	.125	.000
Kindergarten, γ_{01}	.039	.033	.239
1st grade, γ_{02}	.049	.038	.202
Flexible Thinking, γ_{03}	-.005	.024	.848
Autonomy Support, γ_{04}	.013	.013	.334
Attitude toward SBRI, γ_{05}	.008	.016	.633
Perceived Competence with SBRI, γ_{06}	-.004	.016	.787
Effect of BOY, γ_{10}	.332	.033	.000

Note. * $p < .05$.

However, the results indicating that there was not a mediational effect present led me to wonder if the implementation of SBRI variables might have a direct impact on student achievement, as would have been tested by condition 3 in the mediation model. The following section describes how this association was tested, as a pot-hoc addendum to Research Question 2.

First, the null model from the previous analysis was used to establish a baseline for variability and error before adding predictor variables (see Table 11). Next, the 2 implementation variables that were being tested, congruence with SBRI and innovation with SBRI, were added to the model. These 2 variables were each broken down into the 2 sub-categories (content and instruction), for a total of 4 implementation variables. When the main effect of each of these variables with student achievement was assessed, along with the control variables, the results revealed that congruence with content was negatively associated with student achievement (b = -.082, p = .003). In terms of effect size, for every 1 standard deviation (.68) increase in teachers teaching all 5 of the content

areas, student achievement decreased by 6 percentage points. In addition, congruence with instruction was significantly positively associated with student achievement (*b* = .073, p = .040). For every 1 standard deviation (.84) increase in teachers using the instructional components of SBRI, student achievement increased by 6 percentage points. Innovation of content was also found to be positively significantly associated with student achievement (*b* = .064, p = .042). For every 1 standard deviation (.83) increase in teachers innovating with the 5 content areas, student achievement increased by 5 percentage points. Innovation of instruction was not found to be significantly associated with student achievement. See Table 13 for a summary of the results from this analysis. These results suggest that some implementation of SBRI variables may have an impact on student achievement in reading. Interestingly, it appears possible that the optimal positive impact on student achievement may be achieved through a combination of both congruence with instruction and innovation of content.

Table 13.

Results of the Model with Implementation Predicting Student Achievement in Reading

Fixed Effect	*Coefficient*	*se*	*p Value*	*Effect size*
Intercept, γ_{00}	.741	.083	.000	
Kindergarten, γ_{01}	.039	.029	.190	
1st grade, γ_{02}	.053	.032	.107	
Congruence with SBRI				
Content, γ_{03}	-.082	.025	.003*	.06
Instruction, γ_{04}	.073	.034	.040*	.06
Innovation with SBRI				
Content, γ_{05}	.064	.030	.042*	.05
Instruction, γ_{06}	-.061	.038	.120	
Effect of BOY, γ_{10}	.341	.032	.000	

Note. Effect size was computed by multiplying the coefficient by the standard deviation, effect sizes represent percentiles, * p < .05.

As planned for the original mediational model, the association of each of the individual subscales of implementation of SBRI with student achievement was also assessed. For this analysis, a large set of variables would need to be present in the model to test for significance (18 variables total). However, because of the limited sample size, the number of variables in the HLM model needed to be kept to a minimum in order to preserve power and decrease the chances of a Type 1 error. An analysis that can determine which combination of variables is optimal to assess significance and yet is most parsimonious is appropriate for this purpose. Therefore, before using HLM to test this model, a backward linear regression model was used for a preliminary determination of which of the 18 variables was significantly related to student achievement. Because linear regression can only analyze single-level data, average student achievement per class was used as the outcome. The backward linear regression method systematically eliminates variables that are the least significant in the model one-at-a-time until only the significant ones are left. Results from the backward regression model revealed that the individual implementation subscales that were significantly associated with student achievement were: congruence with explicit instruction (b = .082, p = .000), congruence with phonics instruction (b = -.069, p = .001), innovation with systematic instruction (b = -.045, p = .032), innovation with phonics instruction (b = .093, p = .002), and innovation with vocabulary instruction (b = -.053, p = .029). A summary of this analysis is provided in Table 14.

Table 14.

Results of the Backward Regression Model with Individual Implementation Variables Predicting Average Student Achievement in Reading by Class

Variables	*Coefficient*	*se*	*p Value*
Congruence with SBRI			
90 minutes of instruction	-.006	.034	.861
Assessment	.025	.019	.211
Differentiation	-.039	.026	.151
Systematic instruction	.015	.025	.568
Explicit instruction	.082	.020	.000*
Phonics	-.069	.018	.001*
Phonemic awareness	.011	.026	.973
Fluency	-.014	.024	.557
Vocabulary	.005	.032	.871
Comprehension	-.035	.023	.147
Innovation of SBRI			
Differentiation	-.029	.033	.387
Systematic instruction	-.045	.020	.032*
Explicit instruction	.042	.059	.486
Phonics	.093	.028	.002*
Phonemic awareness	-.019	.023	.417
Fluency	.026	.018	.169
Vocabulary	-.053	.023	.029*
Comprehension	-.009	.052	.858

Note. A backward linear regression procedure was used to determine which combination of variables was most parsimonious and most likely to produce significant results in the HLM model. The significance levels for each of the non-significant subscales listed above represent the p value immediately prior to being deleted from the model. * $p < .05$.

The next step was to take the variables that were significant in the backward linear regression model and assess their significance in the multilevel model. All 5 of the implementation subscales that were found to be significant were added to the HLM model together, along with the control variables. Results from the multilevel model revealed that there were 4 individual implementation subscales that were significantly associated with student achievement. Congruence with explicit instruction was significant ($b = .081$, $p = .001$). For every 1 standard deviation (.95) increase in teachers modeling

and scaffolding during reading instruction, student achievement increased by 8 percentage points. Congruence with phonics instruction was also significant, although this was a negative association (b = -.067, p = .001). For every 1 standard deviation (.87) increase in teachers teaching phonics, student achievement decreased by 6 percentage points. 2 of the instruction subscales were also significant. Innovation with systematic instruction was negatively associated with student achievement (b = -.049, p = .025). For every 1 standard deviation (.91) increase in teachers trying different things with their planning and sequencing, student achievement decreased by 4 percentage points. Last, innovation with phonics instruction was significant (b = .095, p = .008). For every 1 standard deviation (.84) increase in teachers trying different things with their phonics instruction, student achievement increased by 8 percentage points. The complete results from this multilevel model are presented in Table 15. These results imply that some individual components of implementation of SBRI have a direct impact on student achievement in reading, although some have positive impacts and some have negative impacts. The positive or negative slope does not appear to be related to the category of implementation (either congruence / innovation or content / instructional components).

Table 15.

Results of the HLM Model with Individual Implementation Variables Predicting Student Achievement in Reading

Fixed Effect	*Coefficient*	*se*	*p Value*	*Effect size*
Intercept, γ_{00}	.693	.068	.000	
Kindergarten, γ_{01}	-.038	.032	.907	
1st grade, γ_{02}	.041	.032	.207	
Congruence with SBRI				
Explicit instruction, γ_{03}	.081	.021	.001*	.08
Phonics, γ_{04}	-.067	.018	.001*	.06
Innovation of SBRI				
Systematic instruction, γ_{05}	-.049	.021	.025*	.04
Phonics, γ_{06}	.095	.033	.008*	.08
Vocabulary, γ_{07}	-.057	.029	.056	
Effect of BOY, γ_{10}				

Note. Results from the backward analysis were used to determine which combination of variables was most parsimonious and most likely to produce significant results in this HLM model. Only the variables that showed a significant relationship to student achievement in the regression model were used in the HLM model, Effect size was computed by multiplying the coefficient by the standard deviation, effect sizes represent percentiles, * $p < .05$.

Model 3

This model tested the predicted association between innovation of SBRI and student achievement in reading. I expected that this relationship would be moderated by the quality of the innovations that teachers used. In order for the moderator hypothesis to be supported the interaction of innovation of SBRI and quality of innovation must be significantly associated with student achievement in reading (Baron & Kenny, 1986). To test the moderator hypothesis, innovation and quality of innovation were tested in the model, along with an interaction term for both. As with the previous analyses, the 2 implementation variables were divided into 2 sub-categories: content and instruction, resulting in 4 implementation variables. Model 3 tested the main effect for each

implementation variable as well as an interaction term for each. As with previous models, a limited number of variables could be included in the model at any one time to maintain sufficient power for the analysis. Therefore, each subscale was tested separately, using 4 different models. First, the main effects and interaction for innovation of content and quality of innovation of content was assessed, along with the control variables. Results revealed that the main effects were not significant but the interaction was (b = .037, p = .046). This result indicates the presence of a moderator effect. When the strength of this moderating effect was examined, the impact of innovation on student achievement was 1 point when the quality was low but 4 points when the quality was high. Therefore, innovation has a stronger effect on student achievement when the quality of those innovations is high. The moderator hypothesis was supported with these variables. It appears that the quality of innovations of content affects the strength of the relationship between innovations of content and student achievement in reading. Results are summarized in Table 16.

Table 16.

Results of the Model with Innovation of Content and Quality of Innovation of Content Predicting Student Achievement in Reading

Fixed Effect	*Coefficient*	*se*	*p Value*
Intercept, γ_{00}	1.065	.223	.000
Kindergarten, γ_{01}	.019	.035	.594
1st grade, γ_{02}	.036	.035	.306
Innovation Content, γ_{03}	-.016	.111	.153
Quality of Innovation of Content, γ_{04}	-.081	.078	.308
Interaction term, γ_{05}	.037	.018	.046*
Effect of BOY, γ_{10}	.325	.033	.000

Note. * p < .05.

Next, the main effects and interaction for innovation of instruction and quality of innovation of content was assessed, along with the control variables. Results revealed that neither the main effects nor the interaction were significantly associated with student achievement in reading. The moderator hypothesis was not supported with these variables. Results are summarized in Table 17.

Table 17.

Results of the Model with Innovation of Instruction and Quality of Innovation of Content Predicting Student Achievement in Reading

Fixed Effect	*Coefficient*	*se*	*p Value*
Intercept, γ_{00}	.893	.226	.001
Kindergarten, γ_{01}	.025	.033	.450
1st grade, γ_{02}	.035	.036	.348
Innovation of Instruction, γ_{03}	-.077	.067	.262
Quality of Innovation of Content, γ_{04}	-.067	.077	.393
Interaction term, γ_{05}	.024	.019	.214
Effect of BOY, γ_{10}	.327	.033	.000

Note. * $p < .05$.

Next, the main effects and interaction for innovation of content and quality of innovation of instruction was assessed, along with the control variables. Results revealed that the main effect of innovation of content was significant ($b = .201$, $p = .008$) and the interaction term was significant as well ($b = .046$, $p = .009$). A moderator effect was found. When the strength of this effect was examined, the impact of innovation on student achievement was 1 point when the quality was low but 12 points when the quality was high. The hypothesis was confirmed: innovation has a stronger impact on student

achievement when the quality of those innovations is high. The moderator hypothesis was supported with these variables. It appears that the quality of innovation of instruction affects the strength of the association between innovation of content and student achievement in reading. Results are summarized in Table 18.

Table 18.

Results of the Model with Innovation of Content and Quality of Innovation of Instruction Predicting Student Achievement in Reading

Fixed Effect	*Coefficient*	*se*	*p Value*
Intercept, γ_{00}	1.166	.209	.000
Kindergarten, γ_{01}	.006	.029	.842
1st grade, γ_{02}	.035	.031	.273
Innovation of Content, γ_{03}	.201	.070	.008*
Quality of Innovation of Instruction, γ_{04}	.100	.057	.087
Interaction term, γ_{05}	.046	.016	.009*
Effect of BOY, γ_{10}	.325	.032	.000

Note. * $p < .05$.

Next, the main effects and interaction for innovation of instruction and quality of innovation of instruction was assessed, along with the control variables. Results revealed that the main effect of innovation of instruction was significant (b = -.125, p = .037) but the interaction term was not significant. The moderator hypothesis was not supported with these variables. Results are summarized in Table 19.

Table 19.

Results of the Model with Innovation of Instruction and Quality of Innovation of Instruction Predicting Student Achievement in Reading

Fixed Effect	*Coefficient*	*se*	*p Value*
Intercept, γ_{00}	.841	.159	.000
Kindergarten, γ_{01}	.024	.030	.435
1st grade, γ_{02}	.045	.039	.189
Innovation of Instruction, γ_{03}	-.125	.057	.037*
Quality of Innovation of Instruction, γ_{04}	-.010	.055	.859
Interaction term, γ_{05}	.024	.014	.107
Effect of BOY, γ_{10}	.328	.032	.000

Note. * $p < .05$.

Next, the moderator hypothesis was tested for each of the individual subscales of innovation and quality of innovation of SBRI. Based on the likelihood of significance, and in the interest of parsimony, interaction terms for each variable were confined to innovation and quality of innovation for the same variable. For example, when considering differentiation, the interaction of innovation and quality of innovation was tested but the interaction of differentiation with explicit instruction was not. There were 8 individual variables tested, including their main effects and interaction terms. As before, these tests were conducted individually to preserve power in the model. However, the results for each model are reported together in Table 20. Results indicate that the only interaction for the individual components of innovation that was found to be significant was fluency ($b = .034$, $p = .007$). A moderator effect was found for fluency. When the strength of this effect was examined, the impact of innovation in fluency instruction on student achievement was 5 points when the quality was low but 6 points when the quality was high. The hypothesis was supported. Innovation has a stronger impact on student

achievement when the quality of innovations is high. It appears that the quality of innovations of fluency instruction affect the strength of the association between innovation with fluency instruction and student achievement in reading.

Table 20.

Results of the Model with Individual subscales of Innovation and Quality of Innovation Predicting Student Achievement in Reading

Fixed Effect	*Coefficient*	*se*	*p Value*
Differentiation			
Innovation	-.087	.039	.036*
Quality of Innovation	-.021	.036	.561
Interaction term	.020	.010	.054
Systematic instruction			
Innovation	-.058	.061	.352
Quality of Innovation	.034	.059	.566
Interaction term	.006	.016	.729
Explicit instruction			
Innovation	-.101	.064	.122
Quality of Innovation	-.028	.052	.590
Interaction term	.024	.013	.068
Phonemic Awareness			
Innovation	.013	.065	.844
Quality of Innovation	-.030	.058	.606
Interaction term	.004	.015	.790
Phonics			
Innovation	-.100	.076	.196
Quality of Innovation	-.073	.065	.270
Interaction term	.026	.015	.109
Fluency			
Innovation	.144	.060	.023*
Quality of Innovation	.059	.036	.111
Interaction term	.034	.012	.007*
Vocabulary			
Innovation	-.121	.080	.137
Quality of Innovation	-.044	.065	.504
Interaction term	.025	.016	.133
Comprehension			
Innovation	-.044	.083	.601
Quality of Innovation	-.043	.075	.568
Interaction term	.016	.016	.333

Note. * $p < .05$.

Summary of Analyses

Model 1

There was not a significant association between any of the teacher characteristic variables and their congruence with SBRI content. The only teacher characteristic variable that was significantly associated with their congruence with instruction was perceived autonomy support (b = .352, p = .004). When the association of teacher characteristics with their innovation of SBRI content was tested, as before, none of the teacher characteristic variables were significantly associated with the content subscale. Similar to the previous model, the results for the instruction category of innovation revealed that teachers' perceived autonomy support was significantly associated with their innovation with instruction (b = .369, p = .004). In addition, teachers' flexible thinking was significant as well (b = .486, p = .030). In addition, teachers' perceived autonomy support was found to be significantly positively associated with the quality of their innovations with SBRI content (b = .253, p = .049). Findings revealed that teachers' perceived autonomy support was significantly associated with their innovation with instruction as well (b = .362, p = .007).

Model 2

When testing the conditions for mediation, this analysis revealed that none of the teacher characteristic variables were significantly associated with student achievement, after controlling for BOY and grade level. Therefore, because at least 1 of the conditions for mediation was not met, the mediation hypothesis was not supported.

A subsequent analysis revealed that, when the direct association of each of the implementation variables was assessed, along with the control variables, congruence with SBRI content was statistically negatively associated with student achievement (b = -.082, p = .003) and congruence with SBRI instruction was significantly positively associated with student achievement (b = .073, p = .040). Innovation of SBRI content was also found to be positively significantly associated with student achievement (b = .064, p = .042) but innovation of SBRI instruction was not found to be significantly associated with student achievement. When the individual subscales for the implementation variables were tested, congruence with explicit instruction (b = .081, p = .001), congruence with phonics instruction (b = -.067, p = .001), innovation with systematic instruction (b = -.049, p = .025), and innovation with phonics instruction (b = .095, p = .008) were all found to be statistically significant.

Model 3

The moderator hypothesis was tested for the quality of innovations with content first. The interaction between innovation of SBRI content and quality of innovation of SBRI content was found to be significant (b = .037, p = .046). When the interaction for innovation of SBRI instruction and quality of innovation of SBRI content was assessed, it was not significant and the moderator hypothesis was not supported. Next, the moderator hypothesis for quality of innovations with instruction was assessed. When the interaction for innovation of SBRI content and quality of innovation of SBRI instruction was assessed, it was found to be significant (b = .046, p = .009). When the interaction for innovation of SBRI instruction and quality of innovation of SBRI instruction was assessed, results revealed that it was not significant. The moderator hypothesis was not

supported for these variables. When the moderator hypothesis was tested for the individual implementation variables, the only one that was found to be significant was fluency (b = .034, p = .007). The moderator hypothesis was supported with this individual variable.

Discussion

If student achievement is the common goal of education, then teachers are key to improving student achievement through their instructional practices (Klinger, 2004; Van der Sijde, 1989). In order to increase student outcomes, teachers must improve their teaching (Datnow & Castellano, 2000). This improvement in teaching can be achieved through teacher training that focuses on updating and refining instructional practices (Dyer, 1999; Hargreaves & Evans, 1997; Klinger, 2004; Scileppi, 1988). However, if the content of such training is not transferred by teachers and used in real life teaching it does not seem reasonable to conclude that it will have much effect on student achievement. Therefore, implementation of training is an essential part of any effort to create change in instructional practices. Without implementation of new methods or strategies in everyday classrooms, the status quo will remain intact. Therefore, the purpose of this dissertation was to examine the implementation of teacher training and its effects on student achievement. Specifically, I investigated the general hypothesis that different approaches to the implementation of training (heuristic and algorithmic) would impact student achievement differently (Datnow, 1998; Drach-Zahavy, 2004).

Although the intention of this dissertation was to examine the implementation of training, this construct was necessarily studied within the context of a specific training

initiative (Reading First). Thus, it is possible that there were influences based on the program itself that could not be entirely separated from the implementation of training. That is, this study was concerned with implementation but *what* was being implemented no doubt affected the implementation process. For instance, the results raise some interesting questions about the nature of reading instruction in general and Reading First in particular. The results do suggest some best practices for reading instruction and these findings will be noted as appropriate. However, the majority of this discussion will center on the nature of implementation and its affects on student achievement with the eventual goal of identifying generalizable factors that impact these constructs.

To aid in interpretation of the following discussion section, a review of the conceptual model for the study is provided in Figure 6. The analyses included a significance test for each of the predicted associations in the conceptual model and each of the research questions was addressed accordingly. In this chapter I will present and discuss the key findings from those analyses (organized by research question).

Figure 6.

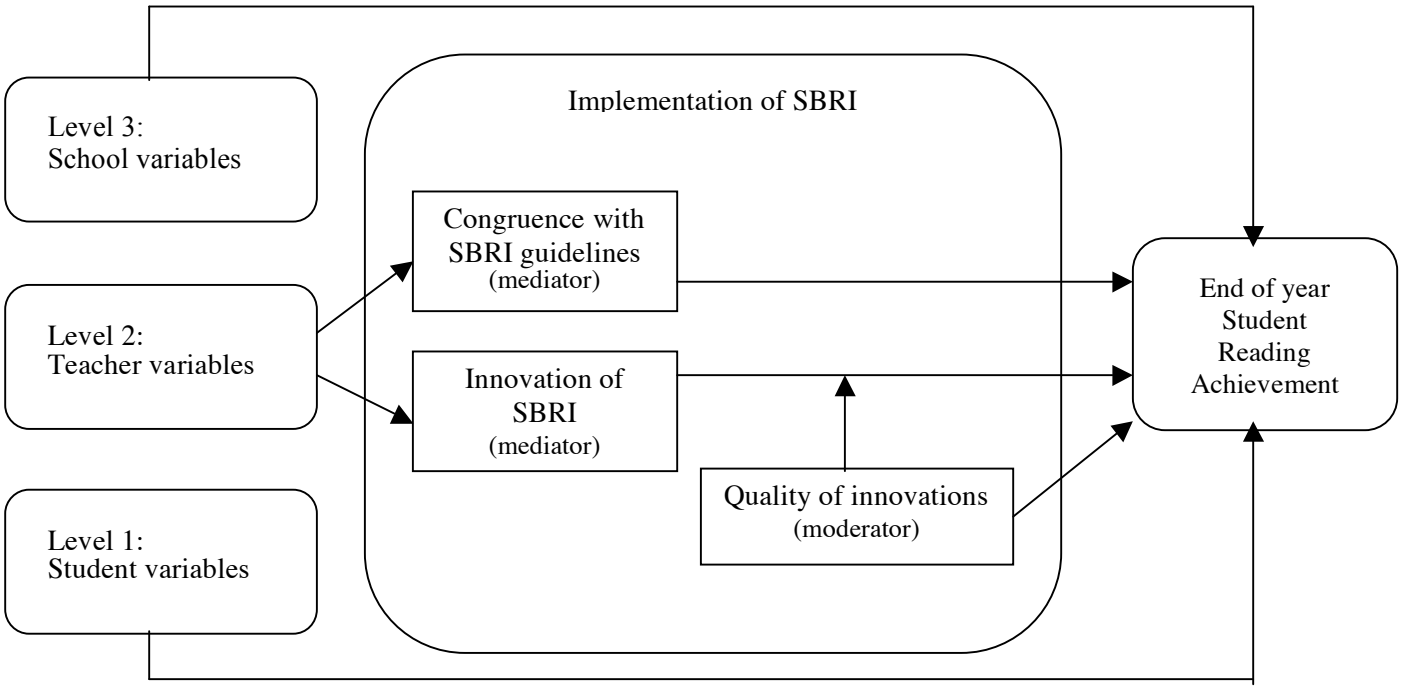


Figure 6: The conceptual for the studies.

The following three research questions were the focus of the analyses:

1. To what extent do teacher characteristics (flexible thinking, perceived autonomy support, attitude toward SBRI, and perceived competence with SBRI) predict their implementation of SBRI (congruence with SBRI, innovation of SBRI and the quality of innovations)?

2. To what extent do congruence with SBRI and innovation of SBRI mediate the relationship between teacher characteristics (flexible thinking, perceived

autonomy support, attitude toward SBRI, and perceived competence with SBRI) and students' achievement in reading?

3. To what extent does the quality of teachers' innovations of SBRI moderate the relationship between innovation of SBRI and students' achievement in reading?

Summary of Findings

Research Question 1*:* To what extent do teacher individual characteristics (flexible thinking, perceived autonomy support, attitude toward SBRI, and perceived competence with SBRI) predict their implementation of SBRI (congruence with SBRI, innovation of SBRI, and quality of innovation of SBRI)?

Results indicate that, to some extent, teacher characteristics do predict their implementation of SBRI. The hypothesis that their individual characteristics could predict a more heuristic approach to implementation was partially supported, as more than one of the characteristics was found to be positively associated with innovation outcomes. These results are summarized in Table 21. The following sections discuss the results for each of the teacher characteristics variables separately.

Table 21.

Summary of Findings for Research Question 1

Teacher Characteristics	*Implementation Subscales*	
	Content	*Instruction*
Flexible Thinking		
Congruence with SBRI		
Innovation of SBRI		X
Quality of innovations		
Autonomy Support		
Congruence with SBRI		X
Innovation of SBRI		X
Quality of innovations	X	X
Attitude toward SBRI		
Congruence with SBRI		
Innovation of SBRI		
Quality of innovations		
Perceived Competence with SBRI		
Congruence with SBRI		
Innovation of SBRI		
Quality of innovations		

Note. "X" represents a statistically significant association.

When analyzing Research Question 1, an interesting trend emerged from the data. Teachers' individual characteristics appear to influence their implementation differently for the two subscales of implementation (content and instruction). Individual characteristics influence teacher's implementation of the instructional components more often than they influence their implementation of content. This finding may be explained by considering the nature of the two implementation subscales. The content subscale is

made up of the five elements of SBRI (phonics, phonemic awareness, fluency, vocabulary, and comprehension) and the instruction subscale is made up of the features of effective reading instruction (differentiation, systematic, and explicit instruction). If differences exist in the implementation subscales, then differences in the impact of individual characteristics on those subscales would be expected to some extent. The fact that teachers' individual characteristics were more associated with the instructional components of SBRI may indicate that it is easier to see the effects of individual differences in their instruction than in the content that they teach. In other words, teachers use the instructional components of SBRI to teach SBRI content. Therefore, it seems reasonable that as teachers use the instructional strategies and methods of SBRI, this is where their individual differences may be revealed and therefore more easily measured.

Flexible Thinking

As expected, teachers who had higher levels of flexible thinking tended to implement SBRI in a more heuristic manner, although not consistently. Teachers who had a tendency toward flexible thinking were more heuristic in their approach to using the instructional components of SBRI. That is, flexible thinkers were more innovative in their approach to using SBRI instructional strategies and methods.

Flexible thinking has been shown to influence the decisions that people make, particularly in the face of change (Stanovich & West, 1997). In fact, flexible thinkers have been characterized as feeling the confidence, the ability, and the willingness to change (Martin & Anderson, 1998). As such, it has been likened to receptivity to change (Stanovich & West, 1997). As implementation of training necessarily involves changing one's behavior, a recent study of implementation of a new reading program established a

preliminary connection between teachers' flexible thinking and the quantity and quality of their implementation (Kallestad & Olweus, 2003). The results of this study provide support for this connection, further establishing the link between teachers' flexible thinking and their implementation of training.

Indeed, the present study expands on previous findings by examining the connection between flexible thinking and different approaches to implementation. Recall that a more heuristic approach to implementation represents a more changeful approach (more innovative) and a more algorithmic approach represents a less changeful approach (less innovative). Therefore, the results of this study extend previous research in this area by applying this theory not only to receptivity to change itself but the nature of those changes. That is, flexible thinking has been shown to be related to change overall in previous literature but this study shows that it is also related to how teachers approach those changes as well. Results from this study indicate that teachers' flexible thinking is associated with *the way* that they implement changes. In other words, flexible thinkers tend to be more heuristic in their implementation, or more likely to voluntarily change their instructional strategies and methods *during* the implementation process, not simply adopting something new and then using it in a formulaic way. This study also contributes to the body of understanding about flexible thinking by extending its implications toward the nature of the changes that teachers make. However, this research is a preliminary step. More research is needed to investigate further the nature of these associations. Future research might ask, "Is it possible to train teachers to be more flexible in their thinking?" or "Is it possible to design and deliver teacher training that encourages flexibility in implementation?"

Even so, flexible thinkers were not heuristic in their approach to all of the components of implementation in this study. Contrary to expectations, flexible thinking was not associated with teachers' implementation of the content areas of SBRI. As mentioned, this may be due to the differences in the categories of implementation. That is, teachers may be more likely to exhibit their heuristic tendencies in their instructional behaviors, which may carry over to *how* they implement the content. If this were the case, implementation of the content areas would not discriminate the nature of implementation (heuristic or algorithmic) as much as the instructional components themselves.

Also contrary to my hypothesis, flexible thinking was not associated with the quality of teachers' innovations. This result may be due to the fact that the quality of innovations was found to moderate the relationship between innovation and student achievement in this study, at least to some extent. It is possible that the impact of teachers' individual characteristics on the quality of their innovations may be indirect, through their innovations. Therefore, teachers' individual differences may impact the quality of their innovations in a way that was not measured in this study, with innovation acting as mediator.

Autonomy Support

In line with expectations, the environmental support that teachers perceived did predict their implementation. I also hypothesized that higher levels of autonomy support would result in a more heuristic (innovative) approach to implementation. This hypothesis was supported. Teachers who felt that they had support to act autonomously were more likely to implement SBRI in an innovative manner, including innovation and quality of innovation.

Cognitive Evaluation Theory suggests that when we engage in a behavior (in this case implementation), the context plays a role in the initiation and regulation of that behavior (Deci & Ryan, 2002). Autonomy support is based on contextual factors that impact the freedom and ability of individuals to act independently in a given environment (Deci & Ryan, 2002). However, it is the perceptions of those contextual factors that impact behavioral choices. Context does not determine the choices, but it can certainly impact the perceptions, which in turn have been shown to impact the choices that individuals make (Deci & Ryan, 1987). The results of this study, that autonomy support can predict teachers' implementation of SBRI, are consistent with previous research that explored the connection between perceptions of environmental support and behavioral choices (Deci & Ryan, 2002; Gange, 2003; Williams et al., 1996). This study builds on previous findings by applying Cognitive Evaluation Theory to the nature of implementation of teacher training. Autonomy support appears to be predictive of a more heuristic approach to implementation.

Interestingly, perceived autonomy support was also associated with congruence with SBRI. This may be explained by looking at implementation from the point of view of the teacher. Teachers are essentially independent actors, simply by virtue of their work environments, where they are free to do what they want once their classroom doors are closed. They work in relative isolation, performing as independents more often than many other professions (Hargreaves, 1992; Kirby et al., 1992). This freedom to act on their own, and the relative support that they feel in doing so, may influence their overall implementation choices. In other words, these findings seem to indicate that teachers are more likely to implement, in general, when they feel supported to act on their own.

Hence, whether teachers are implementing more heuristically or more algorithmically, it appears that the very act itself is determined in part by their perceived autonomy support. If teachers feel supported to act autonomously, they may implement more overall. This finding has important implications for the development of teacher training, as well as for school administrators. It seems likely, based on these findings, that moving toward the goal of improving classroom instruction (and thereby student achievement) may involve more than simply training teachers to change their instruction. It appears to also require creating school environments that support such actions.

Attitude Toward SBRI

Contrary to expectations, teachers' attitude toward SBRI was not predictive of their implementation. None of the implementation variables was associated with teachers' attitudes toward SBRI. This may be due to several factors. Lack of significant findings may be attributed to either the presence of an association that was not measured in this study or no association between these variables. First, it is possible that teachers' attitude toward SBRI does have an impact on their implementation but that impact may not be direct. For example, if a teacher did not have a positive attitude toward SBRI, then she may chose not to pay attention during the training sessions. This may then lead to a reduced proficiency with the components of SBRI and a limited knowledge of how to implement it appropriately. In this case, it would be the teacher's knowledge of SBRI (and therefore perhaps her confidence and/or ability) that was directly impacting her implementation, not her attitude. This is one example of many possible ways that teachers' attitudes toward SBRI may indirectly impact their implementation. It is possible that teachers' feelings toward the program that they are implementing could have an

indirect effect on their implementation and this indirect effect was not measured in this study.

Second, it is also possible that a direct effect of attitude on implementation is present but was not adequately measured by the survey instrument. The attitude toward SBRI scale was created for this study and it is possible that it does not validly measure the construct for which it was created. Many factors could contribute to a lack of validity, including a limited number of test items, in this case four. In addition, it is possible that this construct is made up of other subscales (for example agreement, endorsement, or consent) that were not considered when creating the items.

Third, it is possible that teachers' attitude toward SBRI does not predict their implementation. Based on previous research, it was expected that attitude toward the program that teachers were implementing would affect their implementation. Research has repeatedly shown that attitudes do have an effect on behavioral choices (Corrigan, 2001; Fullan, 2000; Hargreaves, 1992). However, it is possible that in this case they do not. Perhaps something about this particular program is different than those studied previously. If the results are accurate then this study appears to provide evidence that is divergent. This finding is contrary to the majority of research in this area and as such is a potentially important result. This construct should be studied further to verify these findings and examine whether or not attitude does impact implementation.

Perceived Competence with SBRI

Also, contrary to expectations, teachers' perceived competence was not predictive of their implementation. None of the implementation variables was associated with teachers' perceptions of their competence with SBRI. As with the attitude variable, this

could be due to the same factors. That is, it may be that there is an association that was not measured in this study (an indirect association or scale validity problems) or it may be that there is not an association between these variables and the findings are accurate.

Perceived competence can be likened to situated self-efficacy (Bandura, 1986). In light of previous research that has firmly established the connection between self-efficacy and behavioral outcomes (Pajares, 1996; Tschannen-Moran & Woolfolk-Hoy, 2001), it seems likely that there is an association between these variables that was not measured in this study. For instance, it is possible that teachers' general sense of self-efficacy has a greater impact than their situated efficacy in this case. In other words, perhaps teachers' perceptions of their own competence as teachers *overall* impact their implementation over and above their feelings of competence with SBRI. General self-efficacy was not measured in this study. However, as before, if the findings are accurate then it is a potentially important result. Either way, these results should be verified with further research.

All of the non-significant associations found for the teacher characteristics variables may have occurred because the characteristics included in this study failed to capture the most important teacher variables that contribute to implementation. In light of the overall results, it seems likely that there are other teacher characteristics that impact their implementation that may have stronger effects then some of those included in this study. Many research studies have established that teachers and their individual characteristics impact their instructional choices (Pajares, 1996; Tschannen-Moran & Woolfolk-Hoy, 2001). It also seems likely that a combination of multiple factors contribute to instructional choices and this construct may be difficult to capture in its

entirety. As mentioned, this study represents one step toward a better understanding of the connections between teachers as individuals and the nature of their implementation of training. More research is needed to further understand these associations.

Research Question 2: To what extent do congruence with SBRI and innovation of SBRI mediate the relationship between teacher characteristics (flexible thinking, perceived autonomy support, attitude toward SBRI, and perceived competence with SBRI) and students' achievement in reading?

The results indicate that neither of the implementation variables mediates the relationship between teacher characteristics and student achievement. Therefore, the mediation hypothesis was not supported. It appears that implementation of SBRI does not account for the relationship between teacher characteristics and student achievement in this study. This result, although unexpected, may be explained in two different ways.

First, this determination was made based on the lack of a main effect between teacher characteristics and student achievement. The hypothesis assumes this main effect as a condition for mediation. Considering the results from Research Question 1, as mentioned previously, it is possible that the teacher variables included in this study were not the most important variables that contribute to implementation. If the link between teachers as individuals and their instructional choices was not clearly established in this study (by not including some important contributing variables) then it is not surprising that the teacher characteristic variables were not found to be predictive of student achievement either. It is possible that the teacher characteristic variables included in this

study may not represent enough of the key predictors for either implementation or student achievement.

However, a few of the teacher variables did predict their implementation of SBRI (flexible thinking and autonomy support) but were still not predictive of student achievement. This result can be explained by considering the literature. The hypothesis was based on a combination of two different established findings. First, teachers as individuals have been shown to have an impact on their students' achievement (Woolfolk-Hoy, 2001). Second, that instruction has an impact on student achievement as well (Datnow & Castellano, 2000). However, the results from this model are consistent with the most recent research, which states that teachers' instructional choices determine student outcomes more than their individual characteristics (Datnow & Castellano, 2000). In this case, it seems that the direct link of instruction to student achievement is more relevant than the direct link of teachers' individual differences to their students' achievement. This finding is encouraging for teacher trainers. It indicates that instruction may have the primary impact on students, not teachers as individuals. Therefore, a goal to improve student achievement may focus efforts on teacher training as a means to changing instruction, far more easily achieved than changing teachers' individual characteristics.

In light of the importance of instruction to student achievement, a post-hoc addendum to Research Question 2 tested the direct association of the implementation variables to achievement in reading. Implementation of SBRI was found to be predictive of student achievement. These results are in line with research that found that teachers'

instruction was predictive of their students' achievement over and above their personal characteristics (Datnow & Castellano, 2000). These findings are summarized in Table 22.

Table 22.

Summary of Findings for Research Question 2, Addendum

Implementation Variables	*Student Achievement*
Congruence with SBRI	
Content	X x
Instructional components	X x
Innovation of SBRI	
Content	X x
Instructional components	x

Note. "X" represents a statistically significant association for the subscale variables and "x" represents a statistically significant association for individual variables within subscales.

Congruence with SBRI (both content and instruction) did predict student achievement. However, the two subscales had different effects. Congruence with SBRI content overall had a negative impact on achievement. That is, when teachers taught all five components of SBRI (phonics, phonemic awareness, fluency, vocabulary, and comprehension) their students performed at lower levels.

This may be explained by taking into consideration that there were three different grade levels included in this study (Kindergarten, first, and second grade). Research on reading instruction has shown that all five of the content areas are necessary for effective reading instruction and appropriate for all grade levels, if adapted to be at a higher or lower level (Snow, Burns & Griffin, 1998). For example, letter-sound correspondence (phonics) can be taught through alphabet activities for Kindergarteners or through spelling activities for second graders. Therefore, Reading First contends that all five of

the content areas should be taught at every early elementary grade level, although different grade levels should be teaching the content in different ways in order to meet the needs of their students. It is possible that this differentiation in instruction across grade levels did not occur in this study. That is, perhaps the negative impact of teaching all five content areas is due to a poor quality of implementation of content.

Research has also shown that level-appropriate, high quality instruction positively impacts student learning (Datnow & Castellano, 2000). For reading in particular, high quality, effective reading instruction includes adapting the content to meet the needs of different ability levels across grades (Snow, Burns & Griffin, 1998). It is possible that teachers who were teaching all five content areas were not teaching in an effective manner and that negatively impacted student achievement. For instance, a kindergarten teacher may have been teaching spelling, which would not have been ability-appropriate for most of her students. Or perhaps a second grade teacher was teaching spelling but was scaffolding poorly so her students did not understand. Adjusting content and instructional strategies to meet the needs of individual students would be in line with the features of effective reading instruction (Snow, Burns & Griffin, 1998). The results from the innovation subscale in this study indicate that this may be the case. Innovation (adaptation and modification) of instructional strategies predicted higher student achievement. It appears that adapting and modifying instructional strategies (such as modeling and scaffolding) enhances student learning. Therefore, the negative impact of teaching all five content areas may be related to poor quality instruction that did not adapt appropriately for different ability levels. The quality of instruction was not measured in this study but these results indicate that it should be considered in future research.

An additional explanation may be found in an examination of the individual content areas. When the individual content areas were tested, phonics instruction had a negative impact in student achievement. It is possible that the teachers in this study who did teach all five of the content areas spent time on content that was unnecessary, thereby negatively impacting achievement. Although previous research has indicated that all early elementary students need instruction in all five content areas (National Reading Panel Report, 1999), it is possible that the students in this study did not need such instruction. In particular, they may not have needed phonics instruction. For example, very high achieving students generally are focusing on fluency and comprehension and do not need to focus on letter-sound correspondence and/or spelling as much. This result is not consistent with previous research and as such has potentially important implications for reading instruction across grade levels. These findings warrant further investigation.

Converse to the congruence with content results, congruence with the instructional components of SBRI positively predicted student achievement. In other words, when teachers used all of the features of effective instruction (differentiation, systematic instruction, explicit instruction) their students achieved at higher levels. This may be explained by considering that the features of effective instruction were derived from multiple research studies that identified the key instructional elements of effective reading instruction (National Reading Panel Report, 1999). In particular, the individual subscale that was found to predict student achievement was explicit instruction. In line with expectations, when teachers model and scaffold their reading instruction their students achieve at higher rates. These results are consistent with research in this area.

This study confirms that the use of effective instructional strategies and methods seem to be related to increases in student achievement.

Innovation also predicted student achievement. Teachers who were innovative in their implementation of SBRI content had students who achieved at higher rates. In other words, teachers who adapted and modified the content frequently had students who were more successful. This result supports my hypothesis that a more heuristic approach to implementation (more innovative), as opposed to a more algorithmic approach (less innovative), would positively impact student achievement. Although preliminary, there is some support for this hypothesis in the literature. Recent research has begun to establish a link between different approaches to implementation and effects on job performance. One study linked a heuristic-type of approach to implementation of training with increased job effectiveness (Drach-Zahavy et al., 2004). Another linked adaptations in instruction with increased student performance (Supovitz & May, 2004). The results of this dissertation study reinforce such findings, supporting the relationship between different approaches to implementation and increased performance. These findings also extend previous research by applying these theories in an educational setting and empirically linking a heuristic approach to implementation with increased student outcomes.

In particular, the individual subscale that was predictive of student achievement was phonics instruction. These results show that teaching phonics instruction in a more heuristic manner may positively impact student achievement. This is in line with the findings in this study concerning congruence with SBRI content, which showed that simply teaching phonics negatively impacted student achievement. It appears that phonics instruction that is more heuristic may be better for student learning. For example,

as mentioned earlier, phonics instruction may require adaptations for the varying levels of students within a classroom. It appears that teaching phonics in an adaptive way, altering the instruction to meet the needs of students, is more effective than simply teaching phonics at all. This further supports the hypothesis that heuristic instruction, over algorithmic instruction, is effective for students.

There were mixed results for the innovation of SBRI instructional components. Contrary to expectations, overall innovation of SBRI instructional strategies was not predictive of student achievement. It appears that an overall heuristic approach is beneficial to students if the content is modified and adapted, but not necessarily the instructional components. This may be due to the differing grade levels mentioned earlier. It is possible that teachers *need* to adapt the content to meet their student's needs more than they need to adapt their instructional strategies. For example, perhaps the overall instructional strategies do not need to be adapted, but if you are simply using all of the features of effective instruction it will benefit students. This is supported by the results from the congruence variable, which showed that the combination of differentiating, modeling and scaffolding is positively related to increases in student achievement, as well as modeling and scaffolding being beneficial when used in isolation. Results indicate that a more heuristic approach to teaching content is beneficial for students but innovation in the instructional strategies of SBRI overall is not.

However, one of the innovation subscales, systematic instruction, was found to predict higher student achievement. It appears that innovation in the overall instructional strategies of SBRI is not beneficial for students, but innovation in systematic instruction may be beneficial. Teachers who modified and adapted their planning and sequencing of

instruction had students who achieve at higher rates. Although limited, this result offers further support for the hypothesis that a more heuristic implementation approach is better for student achievement. These results should be considered tentative as none of the other innovation of instruction variables was found to be beneficial for student achievement. However, it does represent a starting point that may indicate that innovation of instructional strategies can impact student achievement in reading.

Taken as a whole, these results seem to indicate that there may be an optimal combination of congruence and innovation that would benefit student achievement. Overall, it appears that in order to impact student achievement, it is best to be congruent with the instructional components of SBRI (differentiate, model, scaffold) *as well as* take a heuristic approach to teaching SBRI content and systematic instruction. These results support my hypothesis that it may be the combination of congruence and a heuristic approach to implementation that is best for student achievement. That is, if teachers are using what they learned in training and also adapting it to fit the needs of their students, this might be optimal for students. Congruence coupled with innovation appears to benefit student achievement. Of course, these results are a first step and need to be further studied and confirmed.

Unfortunately, the question remains, what teacher variables are associated with these implementation variables? The results from the first model failed to answer this question. But in light of the confirmed connection between implementation and student achievement, future research should address this concern. It would be beneficial to understand further what teacher characteristics are related to these specific components of implementation so that they can be encouraged through purposeful teacher training.

Research Question 3: To what extent does the quality of teacher innovations of SBRI moderate the relationship between innovation of SBRI and students' achievement in reading?

The results indicate that some of the quality variables moderated the relationship between innovation and student achievement. Therefore, the moderation hypothesis was partially supported. The direction and strength of the relationship between innovation of SBRI content and student achievement depended on the quality of innovations. These results are summarized in Table 23.

Table 23.

Summary of Findings for Research Question 3: Interactions

Quality of Innovation Variables	*Innovation Variables*	
	Innovation of Content	Innovation of Instruction
Quality of innovation of content	X	
Quality of innovation of instruction	X	

Note. "X" represents a statistically significant association.

In this study, a more heuristic approach to teaching content appears to benefit student achievement depending on the quality of those innovations. In other words, the direction and strength of the relationship between innovation of SBRI content and student achievement depends on the quality of innovations. Interestingly, this appears to be true for both quality of innovations with content and with instruction. That is, when teachers are innovating, or teaching SBRI content in a more heuristic manner, the quality of their innovations in content *and* instruction are important. For example, in order for a teacher

who was adapting and modifying her instruction in the five content areas to increase student achievement, it would be beneficial for the teacher to have high quality adaptations in either content (adjusting phonics to an appropriate level), or instruction (scaffolding appropriately) or both. Perhaps, as mentioned earlier, if SBRI content needs more adaptation then it may be that the quality of those adaptations is more salient and relevant to student needs. This result is in line with research that has supported a connection between high quality instruction overall and increased student outcomes (Datnow & Castellano, 2000). This finding also extends understanding of the findings from Model 2 and may help to explain *when* a more heuristic approach to implementation can be beneficial to students. It appears that the impact of a more heuristic approach to implementation does depend to some extent on the quality of instructional innovations.

However, this holds true only for SBRI content. The quality of innovation of a more heuristic approach to using SBRI instructional strategies does not appear to benefit student achievement. Although unexpected, these results can be explained by considering the findings of the other models within this study. Recall that a more heuristic approach to teaching content was predictive of student achievement but a more heuristic approach to instruction was not. It seems reasonable that because a more heuristic approach to instructional strategies was not found to be predictive of achievement, the quality of those innovations would also not be important. That is, if teachers are heuristic in their instruction (for example, adapting their modeling) but the quality of those adaptations is poor, then it would not matter because the adaptations have already been shown to be unimportant for student achievement. Overall, the moderation results are mixed but

promising. In this study, for teachers who were more heuristic in their implementation, student achievement depended to some extent on the quality of their innovations.

The results of this study represent a first step in the effort to understand implementation of training and the effects of different approaches to implementation on student achievement. My findings provide support for the hypothesis that implementation is an important factor for student achievement in reading. In particular, this study revealed that teachers' approach to implementation, specifically a more heuristic approach, may be beneficial for student achievement, thus underscoring the need to not only assess implementation using student outcomes as the benchmark but also to consider the nature of teachers' approach to implementation as an important determining factor to its success.

Chapter 5

Bilingual Classrooms

Results

This chapter will present the results from the Bilingual classroom data portion of this study. First, I will discuss the sample and the demographic make-up of the participants. Then I will discuss the analyses of the data, including model building to answer the 3 research questions and the additional models that were tested during the analyses.

Participants

Response Rate

For both studies together, a total of 109 teachers were surveyed from 9 elementary schools in 1 school district in a border town in West Texas. The response rate for coaches reporting on teacher implementation was 100% for all 109 teachers. Of the 109 teachers sampled, 82 teachers responded to the self-report survey and 27 teachers did not respond for an overall teacher response rate of 75%. There were 2 teachers who did respond but were subsequently dropped from the sample because it was determined that they taught third grade, which is outside the criteria for inclusion in this study (kindergarten, first, and second grade). In addition, 5 teachers were dropped from the sample because they did not complete all of the survey items. There were 4 teachers who were also dropped from the sample because their student achievement data was not available, a requirement for analysis. It is unknown why their class achievement data was not reported to the district. This left 71 teachers who had complete data. Finally, the remaining sample was divided into 2 groups: English-only classrooms and Bilingual classrooms. The final

number of teacher participants for the Bilingual classrooms was 35. Broken down by grade level, there were 13 kindergarten, 11 first grade, and 11 second grade teacher participants. For student participation, achievement data was gathered through the district. Because this study used the end-of-year (EOY) reading achievement score as the outcome and the beginning-of-year (BOY) reading achievement score as a covariate, it was necessary that all students that were included in the sample have *both* the BOY and EOY data available. It is impossible to determine why either data point might be missing, but missing achievement data in public schools is usually attributed to movement in the student population. Approximately 10% of the student data was dropped because one of the data points was not present. This resulted in a total of 1,265 students participating, 517 of which were used for the Bilingual classroom portion of this study. Broken down by grade level, there were 185 kindergarten, 167 first grade, and 165 second grade student participants.

Demographics

All 9 elementary schools were represented in the Bilingual classroom sample. The number of teachers who responded from each school ranged from 1 to 8, with an average of 4 teachers per school. The average number of years of experience for teachers was quite high at approximately 9 years, with 78% of teachers having 4 years of experience or more. Approximately 94 % of teachers in the sample received their teaching certification through a university-based program, with only 2 teachers out of the sample receiving alternative certification. Student demographics for this sample were not made available by the district but it can be reasonably assumed that they match the demographics of the district overall, which reports student gender statistics (51% male and 49% female),

ethnicity (79% Hispanic, 15% White, 5% African American, and 2% Asian/Pacific Islander), and economic advantage status (67% disadvantaged).

It is important to note that upon inspection of the data, it was discovered that the second grade data was potentially problematic. Although unknown at the time of data collection, a new requirement of the district was that all second grade students be taught reading and tested for reading achievement in English for the entire school year. Therefore, their instruction and assessments were different than the rest of the Bilingual classroom data. This change in language of instruction and assessment very likely impacted their reading achievement scores. It, therefore, appeared likely that inclusion of the second grade data would confound the results. This was confirmed when the initial analyses were run. Unlike the models for the English-only classrooms, grade level was found to be highly and significantly associated with reading achievement in every model. For the complete results of these analyses, please refer to Appendix 35.

Based on these results, the decision was made to continue with the analyses without the second grade data. This reduced the sample size substantially (by one third). This smaller sample size made it more difficult to make reliable inferences based on the results, as the models had less power. Thus, the results I present will represent a very preliminary step toward testing the hypotheses with Bilingual classrooms. The results of the analyses that include only the kindergarten and first grade data may be best used to reinforce, confirm, or extend the findings of the English-only classroom models. After the second grade data was removed, the number of teachers was 25 and the number of students was 354. The remainder of this section will report results for the Bilingual classroom data set that included only kindergarten and first grade data.

Descriptive Statistics for Variables

There are many variables included in these analyses, 8 of which were measured using survey instruments that were created expressly for this study. For the sake of brevity, a summary of the descriptive statistics for each is provided in Table 24, including the mean, standard deviation, and reliability statistics if applicable.

Table 24.

Descriptive Statistics for Variables in these Analyses

Variable		*Mean*	*Standard Deviation*	*Cronbach's Alpha*
Teacher Characteristics	Flexible Thinking	3.98	.51	.65
	Autonomy Support	3.32	1.13	.96
	Perceived Competence	3.91	.79	.50
	Attitude toward SBRI	3.80	.80	.57
Congruence with SBRI	Overall Content	3.98	.86	.89
	Overall Instruction	4.06	.79	.91
	90 minutes of instruction	4.51	.92	
	Assessments	3.99	.87	
	Differentiation	3.66	.968	
	Systematic Instruction	4.17	.92	
	Explicit Instruction	3.97	.93	
	Phonemic Awareness	4.14	1.14	
	Phonics	4.26	.92	
	Fluency	3.40	1.19	
	Vocabulary	4.00	.94	
	Comprehension	4.09	.92	
Innovation of SBRI	Overall Content	3.44	.96	.94
	Overall Instruction	3.55	.97	.96
	Differentiation	3.55	1.03	.97
	Systematic Instruction	3.62	1.03	.95
	Explicit Instruction	3.49	.96	.96
	Phonemic Awareness	3.64	1.14	.95
	Phonics	3.65	.99	.94
	Fluency	3.16	1.16	.98
	Vocabulary	3.39	.96	.96
	Comprehension	3.38	1.03	.97
Quality of Innovations	Overall Content	3.59	.98	.94

	Overall Instruction	3.62	1.03	.95
	Differentiation	3.63	1.12	.98
	Systematic Instruction	3.64	1.09	.98
	Explicit Instruction	3.59	1.02	.97
	Phonemic Awareness	3.74	1.18	.98
	Phonics	3.81	1.04	.98
	Fluency	3.21	1.11	.99
	Vocabulary	3.59	1.04	.98
	Comprehension	3.57	1.09	.98
Student Achievement	Beginning of year	.36	.26	
	End of year	.75	.33	

Note: Additional control variables were used in this study (grade level and school location). Because these variables were categorical, they were dummy-coded.

The congruence with SBRI scale was measured using 1 item, so reliability is only reported for the aggregate scales of congruence with overall content and instruction. However, the other implementation variables were measured using multiple items (3 for innovation and 2 for quality) so the reliability for those scales is reported. When interpreting the means for each variable, there are several considerations. The student achievement variables were converted from raw scores to percentages, so appropriate interpretation of these means requires that they be multiplied by 100. For example, the end of year (EOY) mean student achievement score is .84, which should be interpreted as 84% of required skills mastered. In addition, the teacher characteristic variables and implementation variables were measured using a 5-point Likert-type scale. Therefore, interpretation of these means should take into consideration that it represents an average out of 5 points.

Analyses

The purpose of this study was to examine the relationships among teachers' individual characteristics, their instructional approach to the implementation of SBRI after training, and the reading achievement of their students. Each of the associations predicted by the conceptual model was tested during the analyses, resulting in 3 different analytical models. The following sections review the model building process and the results from each of the 3 models separately.

Model 1

Model 1 tested the predicted association between the teacher's individual characteristic variables (flexible thinking, perceived autonomy support, perceived competence with SBRI, and attitude toward SBRI) and their implementation of SBRI (congruence with SBRI, innovation with SBRI, and quality of innovations of SBRI). The level of significance for the association between each of the teacher characteristic variables with each of the implementation variables will indicate the extent to which that particular teacher variable predicts that type of implementation of SBRI. I hypothesized each of the teacher characteristic variables would positively predict a more heuristic approach to implementation of SBRI (positive associations with innovation and quality of innovation) and that they would negatively predict a more algorithmic approach to implementation of SBRI (negative associations with innovation and quality of innovation). Linear regression was used for this analysis.

There is more than 1 outcome variable for Model 1. As with the English-only classroom portion of this study, the outcomes are all parts of the overall implementation of SBRI. These implementation variables can be broken down into either content or

instructional components. That is, implementation of SBRI involves teaching certain content (phonemic awareness, phonics, fluency, vocabulary, and comprehension) and using certain instructional strategies (differentiation, systematic instruction, and explicit instruction). Therefore, all of the implementation variables can be broken down into 2 subscales: content and instruction. These classifications are summarized in Table 25.

Table 25.

Classification of 2 subscales of Implementation Variables

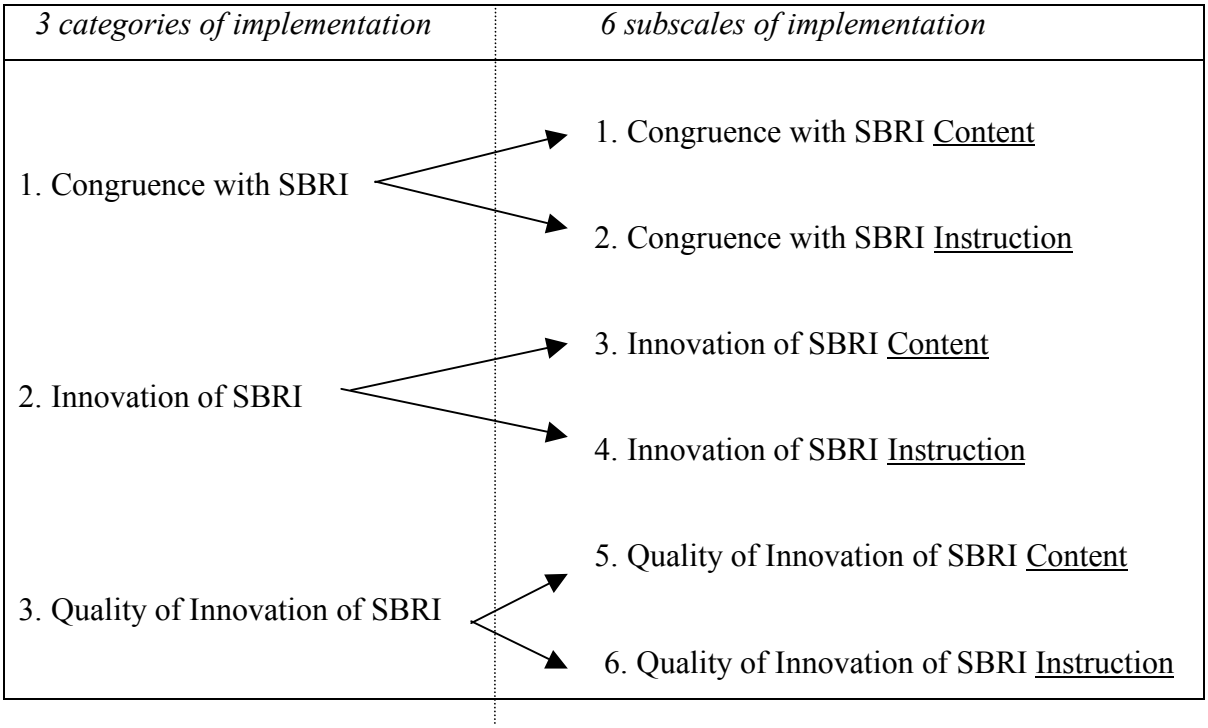
Classification	*Subscales*
Content	Phonemic Awareness
	Phonics
	Fluency
	Vocabulary
	Comprehension
Instruction	Differentiation of instruction
	Systematic instruction
	Explicit instruction

These 2 classifications (content and instruction) can be used to identify particular aspects of each of the 3 implementation variables (congruence with SBRI, innovation of SBRI, and quality of innovations). For instance, congruence with SBRI can be broken down into congruence with SBRI content and congruence with SBRI instructional components. For the remainder of these analyses, all 3 of the implementation variables will be broken down into 2 subscales: content and instructional components. By classifying implementation in this way, results can be interpreted as either relevant to the content of SBRI or relevant to SBRI instructional strategies and methods, thus increasing interpretability and applicability. This classification resulted in a total of 6 subscales of

the implementation variables. A summary of the division of the 3 implementation variables into the 6 subscales is presented in Table 26.

Table 26.

Division of Implementation Variables into 6 Subscales for Analyses



To simplify the language in this section, for the remainder of these analyses, the implementation variables will be referred to as either content or instruction. For example, when congruence with SBRI is discussed, the subscales will be referred to as congruence with content or congruence with instruction.

The first step of the analysis was to assess the direct affect of the control variables on the outcome by regressing grade level and school location on each of the 6 implementation of SBRI outcomes. I found that grade level was significantly associated

with some of the implementation outcomes but not all of them. I also found that school location was not significantly predictive of any of the implementation outcomes. Because these tables are lengthy, results are summarized in Appendix H. Based on these results, and because the limited sample size jeopardized the stability of the model, the decision was made to include grade level as a control variable in subsequent analyses but drop school location as a control variable in order to reduce the total number of variables in the model to help preserve stability.

In the next step, I added all of the teacher characteristic variables to the model to test the association of teachers' individual characteristics with their implementation of SBRI (each of the 6 subscales was tested separately). I began by testing all of the teacher characteristic variables with the 2 congruence subscales. Results showed that there was not a significant association between any of the teacher characteristic variables and their congruence with content (see Table 27). Neither was there a significant association between any of the teacher characteristic variables and their congruence with instruction (see Table 28). Overall, these teacher characteristics do not seem to impact their congruence with SBRI.

Table 27.

Results of the Model with Teacher Characteristic Variables Predicting Congruence with SBRI Content

Variables	*Coefficient*	*se*	*p Value*
Grade Level			
Kindergarten	-.489	.336	.163
Teacher characteristics			
Flexible Thinking	-.041	.372	.914
Autonomy Support	-.091	.159	.574
Attitude toward SBRI	.306	.323	.357
Perceived competence with SBRI	-.107	.239	.661

Note. * $p < .05$.

Table 28.

Results of the Model with Teacher Characteristic Variables Predicting Congruence with SBRI Instructional Components

Variables	*Coefficient*	*se*	*p Value*
Grade Level			
Kindergarten	-.667	.315	.048*
Teacher characteristics			
Flexible Thinking	-.517	.348	.155
Autonomy Support	-.031	.149	.837
Attitude toward SBRI	.624	.303	.054
Perceived competence with SBRI	-.061	.224	.790

Note. * $p < .05$.

Next, the teacher characteristics were tested with the innovations outcomes. When the association of teacher characteristics with their innovation of content was tested, as before, none of the teacher characteristic variables were significantly associated with the content subscale (see Table 29). Also the same, the results for the instruction subscale of innovation revealed no significant association (see Table 30). It appears that these teacher characteristics do not predict their innovation of SBRI.

Table 29.

Results of the Model with Teacher Characteristic Variables Predicting Innovation with SBRI Content

Variables	*Coefficient*	*se*	*p Value*
Grade Level			
Kindergarten	-.689	.415	.114
Teacher characteristics			
Flexible Thinking	-.458	.459	.332
Autonomy Support	.030	.196	.879
Attitude toward SBRI	.696	.399	.098
Perceived competence with SBRI	-.341	.296	.264

Note. * $p < .05$.

Table 30.

Results of the Model with Teacher Characteristic Variables Predicting Innovation with SBRI Instructional Components

Variables	*Coefficient*	*se*	*p Value*
Grade Level			
Kindergarten	-.910	.452	.059
Teacher characteristics			
Flexible Thinking	-.728	.500	.163
Autonomy Support	.113	.214	.605
Attitude toward SBRI	.729	.434	.111
Perceived competence with SBRI	-.108	.322	.742

Note. * $p < .05$.

Last, the association of teacher characteristics with the quality of their innovation of content was tested. The model that tested the quality of innovations with content found that attitude toward SBRI was significant ($b = .777$, $p = .049$). These results are summarized in Table 31. In addition, attitude toward SBRI was also found to be significantly associated with quality of innovations of instruction ($b = .833$, $p = .048$). Grade level was also found to be significant ($b = -.890$, $p = .043$). Please see Table 32 for

complete results from this model. It appears that attitude toward SBRI is predictive of the quality of teachers' innovations with SBRI overall.

Table 31.

Results of the Model with Teacher Characteristic Variables Predicting Quality of Innovations with SBRI Content

Variables	*Coefficient*	*se*	*p Value*
Grade Level			
Kindergarten	-.776	.383	.058
Teacher characteristics			
Flexible Thinking	-.675	.424	.128
Autonomy Support	.015	.181	.935
Attitude toward SBRI	.777	.368	.049*
Perceived competence with SBRI	-.265	.273	.345

Note. * $p < .05$.

Table 32.

Results of the Model with Teacher Characteristic Variables Predicting Quality of Innovations with SBRI Instructional Components

Variables	*Coefficient*	*se*	*p Value*
Grade Level			
Kindergarten	-.890	.409	.043*
Teacher characteristics			
Flexible Thinking	-.770	.452	.106
Autonomy Support	.036	.193	.856
Attitude toward SBRI	.833	.392	.048*
Perceived competence with SBRI	-.126	.291	.670

Note. * $p < .05$.

These results suggest that teachers' instructional choices when it comes to implementing SBRI are partially predicted by the teacher variables that were included in this study. The hypotheses that these teacher variables would predict their heuristic

implementation (positive association with innovation and quality of innovation) found partial support, as attitude toward SBRI was found to positively predict quality of innovations. The hypothesis that teacher characteristics would predict their algorithmic implementation (negative association with innovation and quality of innovation) was not supported.

Model 2

Model 2 tested the predicted association between the teacher characteristic variables (flexible thinking, perceived autonomy support, perceived competence with SBRI, and attitude toward SBRI) and student achievement in reading. Specifically, I expected that this association would be mediated by 2 of the implementation variables, congruence with SBRI and innovation with SBRI. The following conditions must be met in order for mediation to occur: (1) the direct association between teacher characteristics and the 2 implementation of SBRI variables is statistically significant, (2) the association between teacher characteristics and student achievement is statistically significant, (3) the total association between the implementation variables and student achievement is statistically significant, and (4) the association between teacher characteristics and student achievement shrinks upon the addition of the implementation variables to the model.

To test for mediation, these 4 conditions were tested in order. Multilevel modeling (2-level HLM) was used for this analysis, as discussed in Chapter 3. The first condition was already tested in Model 1 and attitude toward SBRI was found to predict quality of innovations of SBRI (see Tables 31 and 32). To check condition #2, the main effect of each of the teacher characteristic variables with student achievement was tested. First, a

null model was tested, with only student achievement in reading included as the outcome. The null model represents the multilevel model without any predictor variables. This model provides a baseline for all of the other models by providing initial variance estimates for levels 1 and 2. Results are summarized in Table 33.

Table 33.

Results of the Null Model with EOY Reading Achievement as the Dependent Variable

Fixed Effect		*Coefficient*	*se*	*p Value*
Average class mean, γ_{00}		.916	.014	.000
Random Effect	*Variance*	*df*	χ^2	*p Value*
Class mean, u_{0j}	.004	23	85.067	.000
Level-1 effect, r_{1j}	.020			

Next, the predictor variables were added to the model. All of the teacher characteristic variables were added at Level-2 along with the control variables, which were BOY (at Level-1) and grade level (at Level-2). This analysis revealed that none of the teacher characteristic variables were significantly associated with student achievement, controlling for BOY and grade level (see Table 34). Because this condition for mediation was not met, the mediation hypothesis was not supported.

Table 34.

Results of the Model with Teacher Characteristic Variables Predicting Student Achievement in Reading

Fixed Effect	*Coefficient*	*se*	*p Value*
Intercept, γ_{00}	.889	.106	.000
Kindergarten, γ_{01}	.034	.029	.246
Flexible Thinking, γ_{02}	-.026	.032	.431
Autonomy Support, γ_{03}	-.006	.013	.662
Attitude toward SBRI, γ_{04}	-.005	.027	.856
Perceived Competence with SBRI, γ_{05}	.010	.020	.646
Effect of BOY, γ_{10}	.266	.028	.000

Note. * $p < .05$.

However, like in the English study analysis, I wondered if the implementation of variables might have a direct impact on student achievement, as would have been tested by condition #3 in the mediation model. The following section describes how this association was tested post-hoc.

First, the null model was tested. As this model is the same as the null for the previous model, please refer to Table 33 for results. Next, as before, the 2 implementation variables (congruence with SBRI and innovation with SBRI) were each broken down into 2 subscales (content and instruction), for a total of 4 implementation variables. When the main effect of each of these variables was assessed, along with the control variables, the results revealed that congruence with instruction was predictive of student achievement ($b = .113$, $p = .023$). Table 35 has the complete results from this model. In terms of effect size, for every 1 standard deviation (.84) increase in teachers using SBRI instructional strategies, student achievement increased by 9 percentage points. None of the other implementation variables were found to predict student achievement. These results

suggest that implementation of SBRI may have some impact on student achievement in reading.

Table 35.

Results of the Model with Implementation Variables Predicting Student Achievement in Reading

Fixed Effect	*Coefficient*	*se*	*p Value*	*Effect size*
Intercept, γ_{00}	.596	.086	.000	
Kindergarten, γ_{01}	.046	.025	.083	
Congruence with SBRI				
Content, γ_{02}	-.038	.040	.362	
Instruction, γ_{03}	.113	.046	.023*	.09
Innovation of SBRI				
Content, γ_{04}	.001	.049	.981	
Instruction, γ_{05}	-.038	.047	.420	
Effect of BOY, γ_{10}	.262	.028	.000	

Note. Effect size was computed by multiplying the coefficient by the standard deviation, effect sizes represent percentiles, * $p < .05$.

The association of each of the individual subscales of implementation of SBRI with student achievement was also assessed. For this analysis, a large set of variables would need to be present in the model to test for significance (18 variables total). However, because of the limited sample size, the number of variables in the HLM model should be kept to a minimum in order to preserve power and decrease the chances of a Type 1 error. An analysis that can determine which combination of variables is optimal to assess significance and yet is most parsimonious is appropriate for this analysis. Therefore, before using HLM to test this model, a backward linear regression model was used for a preliminary determination of which of the 18 variables was significantly related to student achievement. Because linear regression can only analyze single-level

data, average student achievement per class was used as the outcome. The backward linear regression method systematically eliminates variables that are the least significant in the model one-at-a-time until only the significant ones are left. Results from the backward regression model revealed that all of the congruence subscales were significant and a large number of the innovation subscales were as well. The individual implementation subscales that were significantly associated with student achievement were: Congruence with differentiation (b = -.230, p = .002), congruence with systematic instruction (b = .247, p = .000), congruence with explicit instruction (b = -.131, p = .016), congruence with phonics (b = .251, p = .000), congruence with phonemic awareness (b = -.087, p = .001), congruence with fluency (b = -.100, p = .000), congruence with vocabulary (b = -.137, p = .003), congruence with comprehension (b = -.137, p = .001), innovation with differentiation (b = .093, p = .020), innovation with systematic instruction (b = .180, p = .002), innovation with phonics (b = -.343, p = .000), innovation with fluency (b = .114, p = .001), and innovation with vocabulary (b = .167, p = .001). A summary of this analysis is provided in Table 36.

Table 36.

Results of the Backward Regression Model with Individual Implementation Variables Predicting Average Student Achievement in Reading by Class

Variables	*Coefficient*	*se*	*p Value*
Congruence with SBRI			
90 minutes of instruction	-.004	.014	.786
Assessment	-.037	.017	.081
Differentiation	-.230	.046	.002*
Systematic instruction	.247	.029	.000*
Explicit instruction	-.131	.039	.016*
Phonics	.251	.029	.000*
Phonemic awareness	-.087	.015	.001*
Fluency	-.100	.011	.000*
Vocabulary	-.137	.028	.003*
Comprehension	-.137	.021	.001*
Innovation of SBRI			
Differentiation	.093	.029	.020*
Systematic instruction	.180	.034	.002*
Explicit instruction	.149	.062	.053
Phonics	-.343	.042	.000*
Phonemic awareness	-.015	.013	.295
Fluency	.114	.017	.001*
Vocabulary	.167	.028	.001*
Comprehension	-.038	.019	.109

Note. A backward linear regression procedure was used to determine which combination of variables was most parsimonious and most likely to produce significant results in the HLM model. The significance levels for each of the non-significant subscales listed above represent the p value immediately prior to being deleted from the model. * $p < .05$.

The next step was to take the variables that were significant in the backward linear regression model and assess their significance in the multilevel model. The intent of the backward regression analysis was to discern the variables most likely to not be significant so that a limited number of variables could be added to the multilevel model. Too many variables in the multilevel model can potentially reduce the power. However, there were too many variables (13) that were found to be significant in the backward regression than could be added at one time to the multilevel model. Therefore, these

variables were tested in the multilevel model in groups with the intention of combining the significant variables from each group into a final model that included all of the significant variables. The congruence variables were tested first, by subscale. That is, the congruence with content subscales were tested and then the congruence with instruction subscales were tested. This limited the number of variables in the model to no more than 6. Results from the congruence with content model revealed that none of the content subscales were predictive of student achievement (see Table 37). Similarly, results from the congruence with instruction model revealed that none of the instruction subscales were significantly predictive of student achievement. These results are summarized in Table 38. It appears that congruence with the individual components of SBRI does not predict student achievement in reading.

Table 37.

Results of the HLM Model with Individual Congruence with Content Variables Predicting Student Achievement in Reading

Fixed Effect	*Coefficient*	*se*	*p Value*
Intercept, γ_{00}	.719	.100	.000
Kindergarten, γ_{01}	.038	.038	.323
Congruence with Content			
Phonics, γ_{02}	.008	.038	.845
Phonemic Awareness, γ_{03}	-.004	.039	.927
Fluency, γ_{04}	-.009	.014	.551
Vocabulary, γ_{05}	.032	.038	.407
Comprehension, γ_{06}	-.014	.038	.718
Effect of BOY, γ_{10}	.269	.028	.000

Note. Results from the backward analysis were used to determine which combination of variables was most parsimonious and most likely to produce significant results in this HLM model. Only the variables that showed a significant relationship to student achievement in the regression model were used in the HLM model. * $p < .05$.

Table 38.

Results of the HLM Model with Individual Congruence with Instruction Variables Predicting Student Achievement in Reading

Fixed Effect	*Coefficient*	*se*	*p Value*
Intercept, γ_{00}	.590	.082	.000
Kindergarten, γ_{01}	.053	.025	.051
Congruence with Instruction			
90 minutes of reading instruction, γ_{02}	.036	.021	.108
Assessment, γ_{03}	-.033	.028	.259
Differentiation, γ_{04}	.011	.026	.688
Systematic instruction, γ_{05}	-.006	.023	.814
Explicit instruction, γ_{06}	.033	.025	.209
Effect of BOY, γ_{10}	.264	.028	.000

Note. Results from the backward analysis were used to determine which combination of variables was most parsimonious and most likely to produce significant results in this HLM model. Only the variables that showed a significant relationship to student achievement in the regression model were used in the HLM model. * $p < .05$.

Next, the innovation with SBRI variables were tested. When the content subscales were tested, results revealed that none of the content subscales were predictive of student achievement. Table 39 summarizes the findings. Likewise, when the instruction subscales were tested, results revealed that none of the instructional subscales were predictive of student achievement in reading. Please see Table 40 for complete results. It appears that innovation of the individual components of SBRI does not predict student achievement in reading.

Table 39.

Results of the HLM Model with Individual Innovation with Content Variables Predicting Student Achievement in Reading

Fixed Effect	*Coefficient*	*se*	*p Value*
Intercept, γ_{00}	.737	.066	.000
Kindergarten, γ_{01}	.047	.030	.139
Innovation of Content			
Phonics, γ_{02}	-.062	.038	.121
Phonemic Awareness, γ_{03}	.026	.027	.347
Fluency, γ_{04}	.014	.023	.566
Vocabulary, γ_{05}	.027	.036	.467
Comprehension, γ_{06}	.010	.029	.742
Effect of BOY, γ_{10}	.267	.028	.000

Note. Results from the backward analysis were used to determine which combination of variables was most parsimonious and most likely to produce significant results in this HLM model. Only the variables that showed a significant relationship to student achievement in the regression model were used in the HLM model. * $p < .05$.

Table 40.

Results of the HLM Model with Individual Innovation with Instruction Variables Predicting Student Achievement in Reading

Fixed Effect	*Coefficient*	*se*	*p Value*
Intercept, γ_{00}	.728	.058	.000
Kindergarten, γ_{01}	.040	.031	.214
Innovation of Instruction			
Differentiation, γ_{02}	-.016	.028	.582
Systematic instruction, γ_{03}	.020	.038	.594
Explicit instruction, γ_{04}	.010	.040	.813
Effect of BOY, γ_{10}	.268	.028	.000

Note. Results from the backward analysis were used to determine which combination of variables was most parsimonious and most likely to produce significant results in this HLM model. Only the variables that showed a significant relationship to student achievement in the regression model were used in the HLM model. * $p < .05$.

Model 3

Model 3 tested the predicted association between innovation of SBRI and student achievement in reading. I expected that this relationship would be moderated by the quality of the innovations that teachers used. In order for the moderator hypothesis to be supported the interaction of innovation of SBRI and quality of innovation must be significantly associated with student achievement in reading (Baron & Kenny, 1986). To test the moderator hypothesis, innovation and quality of innovation were tested in the model, along with an interaction term for both. As with the previous analyses, the implementation variables were divided into 2 subscales (content and instruction), for a total of 4 implementation variables. Model 3 tested the main effect for each subscale as well as an interaction term for each. As with previous models, a limited number of variables could be included in the model at any one time to maintain sufficient power for the analysis. Therefore, each subscale was tested separately, using 4 different models. First, the main effects and interaction for innovation of content and quality of innovation of content was assessed, along with the control variables. Results revealed that neither the main effects nor the interaction were significant. It appears that the quality of innovations with content does not moderate the relationship between innovations of content and student achievement in reading. Results are summarized in Table 41. The moderator hypothesis was not supported for these variables.

Table 41.

Results of the Model with Innovation of Content and Quality of Innovation of Content Predicting Student Achievement in Reading

Fixed Effect	*Coefficient*	*se*	*p Value*
Intercept, γ_{00}	.963	.184	.000
Kindergarten, γ_{01}	.043	.027	.122
Innovation of Content, γ_{02}	-.071	.072	.331
Quality of Innovation of Content, γ_{03}	-.056	.067	.412
Interaction term, γ_{04}	.020	.015	.195
Effect of BOY, γ_{10}	.270	.028	.000

Note. * $p < .05$.

Next, the main effects and interaction for innovation of instruction and quality of innovation of content was assessed, along with the control variables. Results revealed that the main effect of quality of innovation of content was significant ($b = .153$, $p = .046$) and the interaction term was significantly associated with student achievement ($b = .029$, $p = .035$). A moderator effect was found for these variables. When the strength of this effect was examined, the impact of innovation of instruction on student achievement was 6 points when the quality was low but 17 points when the quality was high. The hypothesis was supported. Innovation has a stronger impact on student achievement when the quality of innovations is high. It appears that the quality of innovation of content affects the strength of the association between innovation of instruction and student achievement in reading. Results are summarized in Table 42.

Table 42.

Results of the Model with Innovation of Instruction and Quality of Innovation of Content Predicting Student Achievement in Reading

Fixed Effect	*Coefficient*	*se*	*p Value*
Intercept, γ_{00}	1.078	.162	.000
Kindergarten, γ_{01}	.050	.025	.054
Innovation of Instruction, γ_{02}	.043	.044	.340
Quality of Innovation of Content, γ_{03}	.153	.072	.046*
Interaction term, γ_{04}	.029	.013	.035*
Effect of BOY, γ_{10}	.268	.028	.000

Note. * $p < .05$.

Next, the main effects and interaction for innovation of content and quality of innovation of instruction was assessed, along with the control variables. Results revealed that neither the main effects nor the interaction term was significant. The moderator hypothesis was not supported with these variables. It appears that the quality of innovations of instruction does not moderate the association between innovation of content and student achievement in reading. Results are summarized in Table 43.

Table 43.

Results of the Model with Innovation of Content and Quality of Innovation of Instruction Predicting Student Achievement in Reading

Fixed Effect	*Coefficient*	*se*	*p Value*
Intercept, γ_{00}	1.003	.164	.000
Kindergarten, γ_{01}	.051	.025	.053
Innovation of Content, γ_{02}	-.140	.068	.052
Quality of Innovation of Instruction, γ_{03}	-.025	.049	.609
Interaction term, γ_{04}	.026	.014	.073
Effect of BOY, γ_{10}	.271	.028	.000

Note. * $p < .05$.

Next, the main effects and interaction for innovation of instruction and quality of innovation of instruction was assessed, along with the control variables. Results revealed that neither the main effect nor the interaction term was significant. The moderator hypothesis was not supported with these variables. Results are summarized in Table 44.

Table 44.

Results of the Model with Innovation of Instruction and Quality of Innovation of Instruction Predicting Student Achievement in Reading

Fixed Effect	*Coefficient*	*se*	*p Value*
Intercept, γ_{00}	.888	.133	.000
Kindergarten, γ_{01}	.048	.026	.076
Innovation of Instruction, γ_{02}	-.071	.052	.189
Quality of Innovation of Instruction, γ_{03}	-.029	.066	.666
Interaction term, γ_{04}	.017	.011	.138
Effect of BOY, γ_{10}	.271	.028	.000

Note. * $p < .10$, ** $p < .05$.

Next, the moderator hypothesis was tested for each of the individual subscales of innovation and quality of innovation of SBRI. Based on the likelihood of significance, and in the interest of parsimony, interaction terms for each variable were confined to innovation and quality of innovation for the same variable. For example, when considering differentiation, the interaction of innovation and quality of innovation was tested but the interaction of differentiation with explicit instruction was not. There were 8 individual variables tested, including their main effects and interaction terms. As before, these tests were conducted individually to preserve power in the model. However, the results for each model are reported together in Table 45. Results indicate that the only interaction for the individual components of innovation that was found to be significant

was vocabulary (b = .031, p = .037). A moderator effect was found for vocabulary. When the strength of this effect was examined, the impact of innovation in vocabulary instruction on student achievement was 3 points when the quality was low but 8 points when the quality was high. The hypothesis was supported. Innovation has a stronger impact on student achievement when the quality of innovations is high. It appears that the quality of innovation of vocabulary instruction affects the strength of the association between innovation with vocabulary instruction and student achievement in reading.

Table 45.

Results of the Model with Individual subscales of Innovation and Quality of Innovation Predicting Student Achievement in Reading

Fixed Effect	*Coefficient*	*se*	*p Value*
Differentiation			
Innovation	-.049	.048	.325
Quality of Innovation	.004	.043	.922
Interaction term	.008	.009	.404
Systematic instruction			
Innovation	-.069	.038	.085
Quality of Innovation	-.073	.058	.220
Interaction term	.024	.011	.053
Explicit instruction			
Innovation	-.050	.053	.354
Quality of Innovation	-.079	.060	.207
Interaction term	.022	.011	.068
Phonemic Awareness			
Innovation	-.041	.073	.583
Quality of Innovation	-.026	.071	.721
Interaction term	.011	.014	.448
Phonics			
Innovation	-.034	.072	.642
Quality of Innovation	-.042	.062	.503
Interaction term	.011	.015	.463
Fluency			
Innovation	-.048	.043	.282
Quality of Innovation	-.013	.031	.677
Interaction term	.011	.009	.228

Vocabulary			
Innovation	.124	.059	.047*
Quality of Innovation	.079	.054	.162
Interaction term	.031	.014	.037*
Comprehension			
Innovation	-.013	.044	.764
Quality of Innovation	-.050	.041	.236
Interaction term	.011	.010	.302

Note. * $p < .05$.

Summary of Analyses

Model 1

There was not a significant association between any of the teacher characteristic variables and their congruence with SBRI. In addition, there was not a significant association between any of the teacher characteristic variables and their innovations of SBRI. When the quality of innovations was tested as the outcome, attitude toward SBRI was significantly associated with both the quality of innovations with content ($b = .777$, $p = .049$) and the quality of innovations of instruction ($b = .833$, $p = .048$).

Model 2

When testing the conditions for mediation, this analysis revealed that none of the teacher characteristic variables were significantly associated with student achievement, after controlling for BOY and grade level. Therefore, because at least 1 of the conditions for mediation was not met, the mediation hypothesis was not supported.

A post-hoc analysis revealed that when the direct association of each of the implementation variables was assessed, along with the control variables, only congruence with SBRI instruction was significantly positively associated with student achievement (*b*

= .113, p = .023). When each of the individual implementation of SBRI variables was tested, none of them were found to predict student achievement.

Model 3

When the moderator hypotheses were tested, results revealed that the only interaction that was significant was quality of innovation of content. The quality of innovations of content did moderate the association between innovation of instruction and student achievement (*b* = -.153, p = .046). When the individual implementation variables were tested, the only interaction that was significant was vocabulary (*b* = .031, p = .037). It appears that the quality of innovations with vocabulary instruction moderates the association between innovations of vocabulary instruction and student achievement in reading. The moderator hypothesis was partially supported.

Discussion

Teachers are key to improving student achievement through their instructional practices (Klinger, 2004; Van der Sijde, 1989). In order to increase student outcomes, teachers must improve their teaching (Datnow & Castellano, 2000). Improvement in teaching can be achieved through teacher training that focuses on updating and refining instructional practices (Dyer, 1999; Hargreaves & Evans, 1997; Klinger, 2004; Scileppi, 1988). However, if the content of such training is not transferred by teachers and used in real life classrooms in order to impact student achievement, it does not seem reasonable to conclude that it will have much effect. Therefore, implementation of training is an essential part of any effort to create change in instructional practices. Without implementation of new methods or strategies in everyday classrooms, the status quo will

remain intact. Therefore, the purpose of this dissertation was to examine the implementation of teacher training and its effects on student achievement. Specifically, I examined the general hypothesis that different approaches to the implementation of training (heuristic and algorithmic) would impact student achievement differently (Datnow, 1998; Drach-Zahavy, 2004).

Although the intention of this dissertation was to examine the implementation of training, this construct was necessarily studied within the context of a specific training initiative (Reading First). Thus, it is possible that there were influences based on the program itself that could not be entirely separated from the implementation of training. That is, this study was concerned with implementation but *what* was being implemented no doubt affected the implementation process. For instance, the results raise some interesting questions about the nature of reading instruction in general and Reading First in particular. The results do suggest some best practices for reading instruction and these findings will be noted as appropriate. However, the majority of this discussion will center on the nature of implementation and its affects on student achievement with the eventual goal of identifying generalizable factors that impact these constructs.

To aid in interpretation of the following discussion section, a review of the conceptual model for the study is provided in Figure 7. The analyses included a significance test for each of the predicted associations in the conceptual model and each of the research questions was addressed accordingly. In this chapter I will present and discuss the key findings from those analyses, organized by research question.

Figure 7.

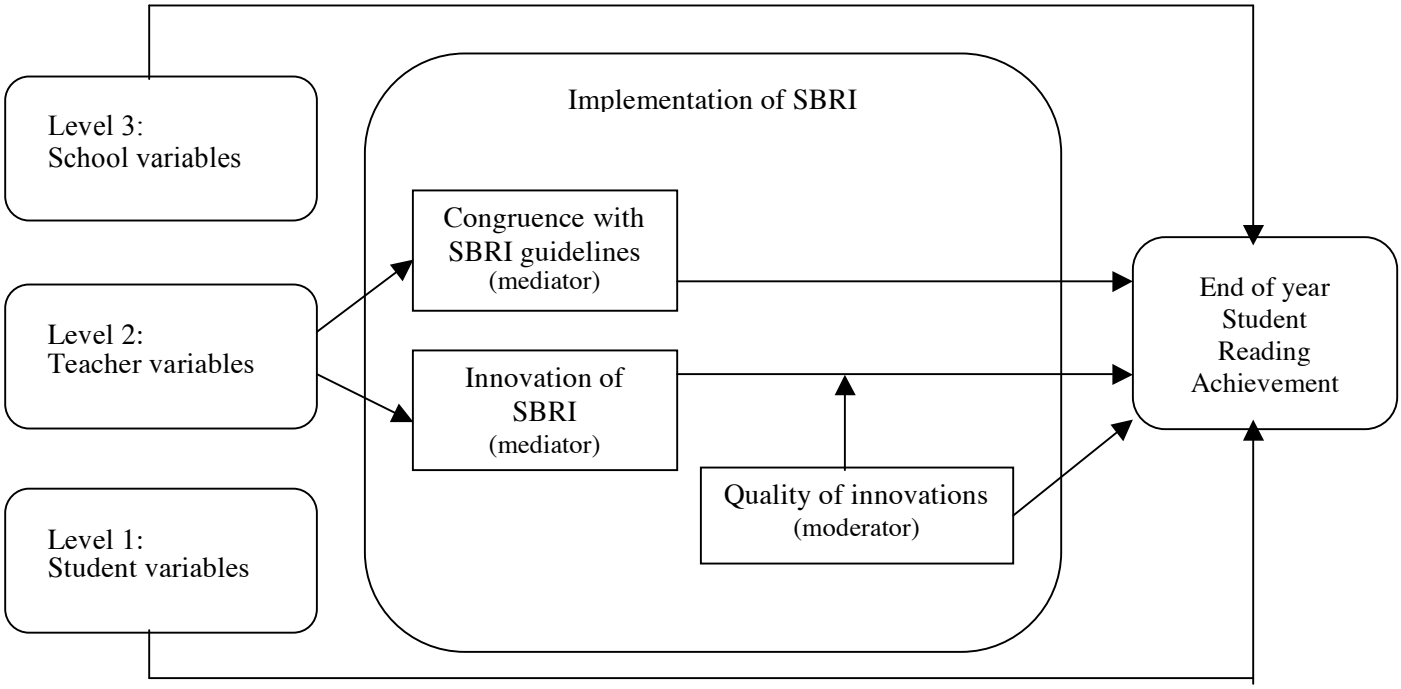


Figure 7: The conceptual for the studies.

The following three research questions were the focus of the analyses:

1. To what extent do teacher characteristics (flexible thinking, perceived autonomy support, attitude toward SBRI, and perceived competence with SBRI) predict their implementation of SBRI (congruence with SBRI, innovation of SBRI and the quality of innovations)?

2. To what extent do congruence with SBRI and innovation of SBRI mediate the relationship between teacher characteristics (flexible thinking, perceived autonomy support, attitude toward SBRI, and perceived competence with SBRI) and student achievement in reading?

3. To what extent does the quality of teachers' innovations of SBRI moderate the relationship between innovation of SBRI and student achievement in reading?

Summary of Findings

Research Question 1: To what extent do teacher individual characteristics (flexible thinking, perceived autonomy support, attitude toward SBRI, and perceived competence with SBRI) predict their implementation of SBRI (congruence with SBRI, innovation of SBRI, and quality of innovation of SBRI)?

Results indicate that, to some extent, these teacher characteristics do predict their implementation of SBRI for the Bilingual classrooms. However, only one of the characteristics, attitude toward SBRI, was found to be associated with the implementation outcomes. The hypothesis that these individual characteristics would predict a more heuristic approach to implementation was partially supported, as teachers' attitude toward SBRI was found to be positively associated with the quality of innovation outcome. These results are summarized in Table 46. The following sections discuss the results for each of the teacher characteristics variables separately and tie these results to research in each area specifically.

Table 46.

Summary of Findings for Research Question 1

Teacher Characteristics	*Implementation Subscales*	
	Content	*Instruction*
Flexible Thinking		
Congruence with SBRI		
Innovation of SBRI		
Quality of innovations		
Autonomy Support		
Congruence with SBRI		
Innovation of SBRI		
Quality of innovations		
Attitude toward SBRI		
Congruence with SBRI		
Innovation of SBRI		
Quality of innovations	X	X
Perceived Competence with SBRI		
Congruence with SBRI		
Innovation of SBRI		
Quality of innovations		

Note. "X" represents a statistically significant association.

Flexible Thinking

Contrary to my hypothesis, flexible thinking was not shown to be associated with teachers' implementation of SBRI. It appears that a tendency toward flexible thinking does not effect implementation of training for the Bilingual classroom teachers. Flexible thinking has been shown to influence the decisions that people make, particularly in the face of change (Stanovich & West, 1997). Flexible thinkers have even been characterized as feeling the confidence, ability, and willingness to change (Martin & Anderson, 1998).

As such, it has been likened to receptivity to change (Stanovich & West, 1997). As implementation of training necessarily involves changing one's behavior, teachers' flexible thinking has recently been empirically linked with the quantity and quality of their implementation of training (Kallestad & Olweus, 2003). The hypothesis for this research question was based on such previous research, which indicated that it was likely that flexible thinking would impact teachers' implementation of training. However, the results of this study deviate from previous findings.

This may be due to several factors. Lack of significant findings may be attributed to either the presence of an association that was not measured in this study or no association between these variables. First, it is possible that flexible thinking does have an impact on implementation of SBRI but that impact may not be direct. For example, a lack of flexibility in thinking has been likened to a lack of receptivity to change (Stanovich & West, 1997). If teachers were not receptive to change, they may have entered into the training sessions with resistance to implementing SBRI. This resistance to change may have resulted in non-attendance at training sessions or reduced focus at trainings. This may then lead to a reduced proficiency with the components of SBRI and a limited knowledge of how to implement it appropriately. In this case, it would be the teacher's knowledge of SBRI (and therefore perhaps confidence and/or ability) that was directly impacting implementation, not flexible thinking. This is just one example of many possible ways that teachers' flexible thinking may have indirectly impacted their implementation. It may be that teachers' tendency toward flexible thinking has an indirect effect on their implementation and this indirect effect was not measured in this study.

Second, it is also possible that flexible thinking does predict implementation but was not adequately measured by the survey instrument. The flexible thinking survey that was used was developed to measure Active Open-minded Thinking, also called Flexible Thinking (Stanovich & West, 1997). This instrument displayed adequate but not exemplary reliability at its inception (Cronbach's Alpha = .77) but lower reliability in this study (Cronbach's Alpha = .65). This relatively low reliability indicates that if this study were repeated with different samples of teachers, the results may be different. In addition, the relatively small sample size (24 teachers) may have also reduced the chances that these are generalizable results. In other words, the sample may have been too small to provide enough variation to detect the predicted associations. Thus, it is possible that the results from this study may not be accurate, based on potentially unreliable measurement.

It is also possible that flexible thinking was not validly measured for teachers from the Bilingual classrooms specifically. Though the ethnic background of the teacher participants was not collected, it is probable that a larger percentage of the Bilingual classroom teachers were of Hispanic-descent than the English-only classroom teachers. If this is the case, these potential sociocultural differences may have impacted the validity of the instrument with the Bilingual classroom sample.

Research has shown that there are different sociocultural influences for people from who's native language is not the majority language, and it is possible that teachers from the Bilingual classrooms were at least partially influenced by these sociocultural factors (Duran, 1983). Sociocultural influences have been defined in terms of a broad social context of influences that may create differences in many ways, including values, beliefs and attitudes (Goldenberg, Rueda & August, 2006). These potential differences

may have contributed to different perceptions of the constructs being measured by the survey items or different interpretations of the meaning of the survey items. To date, this instrument has not been evaluated for sociocultural factors that may impact its validity. Therefore, it is unknown whether or not this instrument provides a valid measure of flexible thinking for people from language-minorities. But research has suggested that assessments developed for a dominant group in a society may pose issues of cultural bias for those from other sociocultural backgrounds (Garcia & Person, 1994; Mercer, 1979). It is possible that the flexible thinking instrument that was used was biased toward the dominant culture and was not a valid instrument to assess the flexible thinking of at least some of the Bilingual classroom teachers. Therefore, it may be that teachers' flexible thinking impacts their implementation of SBRI but it was not reliably or validly measured by the flexible thinking instrument.

Last, it is possible that teachers' flexible thinking does not predict their implementation. Based on previous research, it was hypothesized that flexible thinking would influence receptivity to change and behavioral choices, reflected in implementation of training (Stanovich & West, 1997). However, in this case it may not. It may be that the instrument was reliable and valid but, for Bilingual classroom teachers, their flexible thinking simply did not influence their instruction. Sociocultural influences have also been identified as influencing individual characteristics and behaviors (Goldenberg, Rueda & August, 2006). It is possible that, for teachers from language-minority backgrounds, flexible thinking does not impact their implementation of SBRI. If this is the case, this study appears to provide evidence that is divergent from previous findings concerning flexible thinking. As such, this is a potentially important result. This

construct should be studied further to verify these findings and examine whether or not a tendency toward flexible thinking does impact implementation. More research is also needed that examines flexible thinking with second-language learners specifically.

Perceived Autonomy Support

The hypothesis that perceived autonomy support would to be associated with teachers' implementation of SBRI was not supported. For Bilingual classroom teachers, perceptions of the environmental support to act autonomously did not influence their instructional choices during implementation. Cognitive Evaluation Theory suggests that when we engage in a behavior, in this case implementation, the context plays a role in the initiation and regulation of that behavior (Deci & Ryan, 2002). Autonomy support is based on contextual factors that impact the freedom and ability of individuals to act independently in a given environment (Deci & Ryan, 2002). However, it is the perceptions of those contextual factors that impact behavioral choices. Context does not determine the choices, but it can certainly impact the perceptions, which in turn have been shown to impact the choices that individuals make (Deci & Ryan, 1997). The results of this study, that perceived autonomy support does not predict teachers' implementation of SBRI, are inconsistent with previous research that explored the connection between perceptions of environmental support and behavioral choices (Deci & Ryan, 2002; Gange, 2003; Williams et al., 1996).

This result may be due to several factors. As stated, a lack of significant findings may be attributed to either the presence of an association that was not measured in this study or no association between these variables. First, there may be an association present that was not measured. Like the flexible thinking variable, it is possible that perceived

autonomy support does predict implementation but was not adequately measured by the survey instrument. The survey that was used was developed specifically to measure perceived autonomy support (Deci & Ryan, 2000), although the original instrument had twelve items and this study used the published condensed version with six items. But it is possible that the instrument did not measure perceived autonomy support accurately in this study. One explanation could be that the relatively small sample size (24 teachers) was too small to provide enough variation to detect the predicted associations. If this is the case, it would have reduced the generalizability of the results.

It is also possible that perceived autonomy support was not validly measured for teachers from the Bilingual classrooms specifically. As mentioned, the ethnic background of the teacher participants was not collected, but it is probable that a larger percentage of the Bilingual classroom teachers were of Hispanic-descent than the English-only classroom teachers. If this is the case, these potential sociocultural differences may have impacted the validity of the instrument with the Bilingual classroom sample (Duran, 1983). Sociocultural influences have been linked to differences in values, beliefs and attitudes (Goldenberg, Rueda & August, 2006). The underlying construct with a self-report instrument is that it is based on participants' *perceptions*. If these perceptions were different for some of the teachers in the Bilingual classrooms sample, then it may have affected the validity of the instrument. That is, they may have interpreted the items differently according to their perceptions, and this may have affected the outcomes. The Perceived Autonomy Support scale has not been evaluated specifically for sociocultural factors that may impact its validity. Therefore, it is unknown whether or not this instrument is a valid measure for people from language-minorities. It is possible that the

instrument that was used was biased toward the dominant culture and was not a valid instrument to assess perceived autonomy support for at least some of the Bilingual classroom teachers. Therefore, it may be that teachers' perceived autonomy support does impact their implementation of SBRI but was not reliably or validly measured by the survey instrument that was used in this study.

Last, it is possible that teachers' perceived autonomy support does not predict their implementation. It was hypothesized that perceived autonomy support would influence whether teachers implemented SBRI as well as how they implemented it, based on previous research that suggested a link between perceptions of freedom to act as an individual and behavioral choices (Deci & Ryan, 2000). However, in this case perceived autonomy support may not predict teachers' actions. It is possible that something about this study is different than previous research. Or perhaps perceived autonomy support in Bilingual classroom teachers particularly does not predict implementation. If the results are accurate then this study appears to provide evidence that is different from previous findings. Therefore, this is a potentially important result. This construct should be studied further to verify these findings and examine whether or not perceived autonomy support does impact implementation. More research is also needed that investigates perceived autonomy support with second-language learners specifically.

Attitude Toward SBRI

As hypothesized, teachers' attitude toward SBRI was associated with their implementation. Attitude toward SBRI predicted the quality of teachers' innovation for both the content and instruction subscales of SBRI. The hypothesis that this variable would predict a more heuristic approach to implementation was supported. It appears that

when Bilingual classroom teachers have a positive attitude toward SBRI, the quality of their innovations is higher.

General attitude has also been shown to overlap with other constructs, such as beliefs and values (Wyer, 2005). As such, research has suggested that attitude is an important factor in predicting behavioral choices (Glasman & Albarracin, 2006). For this study, situated attitude was measured, or teachers' attitude toward the training content in particular. Research has also suggested a connection between situated attitude and behavior (Glasman & Albarracin, 2006; Wyer, 2005). The results from this study provide further evidence for this hypothesized association. These results also extend previous findings by applying such constructs to the implementation of training, to SBRI specifically, and to Bilingual classroom teachers in particular.

Indeed, this study expands on previous findings by examining the connection between situated attitude and different approaches to implementation. It appears that attitude not only influences whether of not teachers implement in general, but also the *nature* of those implementation choices. That is, situated attitude has been suggested to be related to behavioral choices overall in previous literature but this study shows that it is also related to *how* teachers approach those choices as well. Attitude toward SBRI was predictive of a more heuristic approach to implementation. It appears that a positive attitude toward using a required program can lead to more voluntarily modifying and adapting the content and instructional strategies and methods of the program. However, this research is a preliminary step. More research is needed to investigate further the nature of these associations. Future research might ask, "Is it possible to teach teachers to

be have a positive attitude?" or "Is it possible to design and deliver teacher training that encourages more heuristic implementation?"

Even so, attitude toward SBRI was not predictive of all of the components of implementation of SBRI. Bilingual classroom teachers' situated attitude did not influence their congruence with SBRI or their innovations of SBRI. There could be several reasons for these non-significant results. As before, perhaps there was an association that was not detected in this study (an indirect association or scale validity problems related to the prospective sociocultural background of the sample). In particular, the reliability of the instrument is a potential issue. The reliability was relatively low (Cronbach's Alpha = .57), which means that if this study was repeated with the same measure but a different sample of teachers, then the results might have been different. Potential reliability issues may have contributed to the results. It is possible that there was an association present but the survey did not accurately measure Bilingual classroom teachers' attitude toward SBRI. Or it may be that there is not an association between these variables and the findings are accurate. Perhaps attitude toward SBRI does not effect implementation of SBRI for these teachers. If this is the case, then more research is warranted to examine these findings further.

Perceived Competence with SBRI

The hypothesis that perceived competence with SBRI would to be associated with teachers' implementation of SBRI was not supported. In this study, the sense of confidence that the Bilingual classroom teachers felt in implementing the guidelines of SBRI did not influence their instructional choices during implementation. As with the other non-significant variables, this could be due to the same factors. That is, it may be

that there is an association that was not detected in this study (an indirect association or scale validity problems related to the prospective sociocultural background of the sample) or it may be that there is not an association between these variables and the findings are accurate.

Perceived competence can be likened to situated self-efficacy (Bandura, 1986). In light of previous research that has established the connection between self-efficacy and behavioral outcomes (Pajares, 1996; Tschannen-Moran & Woolfolk-Hoy, 2001), it seems likely that there is an association between these variables that was not measured in this study. For instance, it is possible that teachers' general sense of self-efficacy has a greater impact than their situated efficacy in this case. In other words, perhaps teachers' perceptions of their own competence as teachers *overall* impact their implementation over and above their feelings of competence with SBRI. General self-efficacy was not measured in this study. However, as before, if the findings are accurate then it is a potentially important result. Either way, these results should be verified with further research.

All of the non-significant associations found for the teacher characteristics variables may have occurred because the characteristics included in this study failed to capture the most important teacher variables that contribute to implementation. In light of the overall results, it seems likely that there are other teacher characteristics that impact Bilingual classroom teachers' implementation that may have stronger effects then some of those included in this study. Indeed, many research studies have suggested that teachers and their individual characteristics impact their instructional choices (Pajares, 1996; Tschannen-Moran & Woolfolk-Hoy, 2001). It also seems likely that a combination

of multiple factors contribute to instructional choices and this construct may be difficult to capture in its entirety.

In particular, predictor variables should be chosen based on which are the most likely to influence outcomes, considering the targeted population. The Bilingual classroom portion of this study was developed after data collection was complete. If this study had been designed with this particular population in mind, it is probable that other variables that have been shown to impact Bilingual classroom teachers' instructional choices would have been included, including the great diversity and sometimes inconsistency of instruction within Bilingual education (Goldenberg, Rueda & August, 2006). As mentioned, this study represents one step toward a better understanding of the connections between teachers as individuals and the nature of their implementation of training. More research is needed to further understand these associations.

Research Question 2: To what extent do congruence with SBRI and innovation of SBRI mediate the relationship between teacher characteristics (flexible thinking, perceived autonomy support, attitude toward SBRI, and perceived competence with SBRI) and students' achievement in reading?

Neither of the implementation variables was found to mediate the relationship between teacher characteristics and student achievement. Therefore, the mediation hypothesis was not supported. For Bilingual classroom teachers, implementation of SBRI did not account for the relationship between teacher characteristics and student achievement. This result, although unexpected, may be explained by considering the teacher variables.

This determination was made based on the lack of a main effect between teacher characteristics and student achievement. The hypothesis assumes this main effect as a condition for mediation. Considering the results from Research Question 1, as mentioned previously, it is possible that the teacher variables included in this study were not the most important variables that contribute to implementation. If the link between teachers as individuals and their instructional choices was not clearly established in this study (by not including some important contributing variables) then it is not surprising that the teacher characteristic variables were not found to be predictive of student achievement either. It is possible that the teacher characteristic variables included in this study may not represent enough of the key predictors for either implementation or student achievement.

However, one of the teacher variables did predict implementation of SBRI (attitude toward SBRI) but was still not predictive of student achievement. This result can be explained by considering the literature. The hypothesis was based on a combination of two different established findings. First, teachers as individuals have been suggested to have an impact on their students' achievement (Woolfolk-Hoy, 2001). Second, instruction will likely have an impact on student achievement as well (Datnow & Castellano, 2000). However, the results from this model are consistent with the most recent research, which states that teachers' instructional choices determine student outcomes more than their individual characteristics (Datnow & Castellano, 2000). In this case, it seems that the direct link of instruction to student achievement may be more relevant than the direct link of teachers' individual differences to their students' achievement. This finding is encouraging for teacher trainers. It indicates that instruction may have the primary impact on students, not teachers as individuals. Therefore, a goal to

improve student achievement may focus efforts on teacher training as a means to changing instruction, far more easily achieved than changing teachers' individual characteristics.

In light of the importance of instruction to student achievement, a post-hoc analysis was done that tested the direct association of the implementation variables to achievement in reading. Implementation of SBRI was found to be predictive of student achievement, although to a limited extent. These results are in line with research that found that teachers' instruction was predictive of their students' achievement over and above their personal characteristics (Datnow & Castellano, 2000). These findings are summarized in Table 47.

Table 47.

Summary of Findings for Research Question 2, Addendum

Implementation Variables	*Student Achievement*
Congruence with SBRI	
Content	
Instructional components	X
Innovation of SBRI	
Content	
Instructional components	

Note. "X" represents a statistically significant association.

As hypothesized, congruence with the instructional components of SBRI positively predicted student achievement. In other words, when Bilingual classroom teachers used all of the features of effective instruction (differentiation, systematic instruction, explicit instruction) their students achieved at higher levels. This may be

explained by considering that the features of effective instruction were derived from multiple research studies that identified the key instructional elements of effective reading instruction across languages (National Reading Panel Report, 1999). This report suggested that the positive effects on student learning from following the guidelines of SBRI are transferable between languages of instruction. In addition, research has shown that these instructional strategies, especially differentiation and multiple opportunities to practice skills, which are provided in the SBRI model, are effective for second-language learners specifically (Larson, 1996; Shanahan & Beck, 2006). Indeed, this study found that when Bilingual classroom teachers plan appropriately, sequence, model, and scaffold their reading instruction their students achieve at higher rates. These results are consistent with previous research in this area. This study reinforces that the use of SBRI instructional strategies and methods seem to be related to increases in student achievement. This study contributes to this area of research by providing further evidence of the connection between effective instructional strategies and student achievement in the context of Bilingual classrooms.

However, the other implementation variables were not predictive of student achievement. Congruence with content did not influence student achievement in reading, as well as neither of the innovation variables. Therefore, the hypothesis that a more heuristic approach to implementation would have a positive impact on student learning was not supported. These results may be explained by the previously mentioned factors (scale reliability and validity, sample size) or by considering the nature of the sample used for this study. As mentioned, the Bilingual classroom portion of this study was not planned from the beginning, and the variables and measures were not chosen with

second-language learners in mind. Yet research has shown that there are differences in student learning, instruction, and contextual expectations for second language learners (Goldenberg, Rueda & August, 2006). Therefore, it is possible that the potential differences in the Bilingual classroom sample were sufficient to change the results of this study. These potential differences may have been at the student, instructional, or contextual level.

First, students included in this study may have needed different types of instruction in order to be successful readers. Sociocultural factors have been linked to differences among second-language learners' literacy outcomes through their cognitions, motivational attributes, values, beliefs, and assumptions that influence the learning process and subsequently learning outcomes (Goldenberg, Rueda & August, 2006). It may be that the student participants in this study did not respond to SBRI instruction based on their instructional needs as second-language learners. There have been studies that have linked other instructional components to achievement in reading for second-language learners, such as building the home-literacy connection and cooperative learning strategies (Calderon et al, 1998; Goldenberg et al, 1992). Therefore, it is possible that the students in this sample needed other forms of instruction divergent from or supplemental to SBRI and that is why their achievement was not impacted by the implementation of SBRI.

Second, the instruction that the Bilingual classroom students received may have influenced the outcomes. For example, there could have been inconsistencies in the language of instruction. Reading First requires by the terms of the grant that reading instruction be taught and tested in one language. Therefore, a Bilingual model for reading

instruction would be outside of the conventions of SBRI. Further, the school district used for sampling required that these students be taught in their native language, primarily Spanish. However, it is impossible to know how much of the reading instruction that the students received was only in Spanish. This construct was not measured but we know from previous research that wide variation in second-language learner education exists and that implementation of Bilingual programs also has wide variation (August & Shanahan, 2006; Johnson, 1992). I also received feedback from one of the Coaches that teachers on her campus were not always following the single-language requirement during reading instruction. Such potential differences in the instruction that students received could have effected their literacy acquisition and potentially impacted the effects of the implementation of SBRI.

Research has shown that teaching reading using a Bilingual model is effective but that it may delay the mastery of skills (Fitzgerald & Noblit, 2000; Neufeld & Fitzgerald, 2001). That is, teaching reading in Spanish and English at the same time might affect the rate of acquisition of literacy. Moreover, research has shown specifically that Bilingual children instructed in Spanish mastered reading skills faster (Kuball & Peck, 1997). It is unknown whether or not all of the students in this sample received instruction in Spanish only. It is possible that if inconsistencies in language of instruction existed it may have impacted the results of this study.

Third, environmental and/or contextual factors may have influenced the results of this study. When I contacted the district regarding their Bilingual education program, I was informed that they teach second-language learners using a Bilingual model (instruction in Spanish and English). They also said that there was latitude given to the

campus principals and therefore variation may exist from school to school, depending upon the campus principal's values and expectations for Bilingual education. When pressed for more information about what the district-level instructional expectations were for the Bilingual model, there did not seem to be one clear directive for how to teach second-language learners. It seems likely that without a clear instructional plan, there may have been variation in Bilingual classroom instruction for this study. It may be that this lack of clear instructional directives from the district resulted in inconsistencies in the implementation of SBRI. In addition, it is possible that inconsistencies in the expectations for instruction from campus principal's of the schools included in this sample influenced the instruction that the Bilingual classroom students received. These potential inconsistencies may have contributed to the results of this study as well. For example, if one campus principal expected that the teachers adhere to the Bilingual model without exception, then perhaps reading instruction was taught in both Spanish and English. Or if another campus principal valued a Dual-Language model (wherein all students learn multiple languages) and included English-only students in the Bilingual classrooms for reading instruction, this may have confounded the implementation of SBRI and perhaps the achievement results as well.

Lastly, as only one out of four implementation variables was found to be predictive of student achievement in reading, it seems probable that there are other variables that impact Bilingual classroom reading instruction and achievement that were not included in this study. In the future, it could be valuable to examine the implementation of SBRI with a study designed to address Bilingual classrooms specifically.

Research Question 3: To what extent does the quality of teachers' innovations of SBRI moderate the relationship between innovation of SBRI and students' achievement in reading?

The results indicate that one of the quality variables moderates the relationship between innovation and student achievement. Therefore, the moderation hypothesis was partially supported. For Bilingual classroom teachers, quality did determine the strength and direction, to some extent, of the relationship between innovation and student achievement. These results are summarized in Table 48.

Table 48.

Summary of Findings for Research Question 3: Interactions

Quality of Innovation Variables	*Innovation Variables*	
	Innovation of Content	Innovation of Instruction
Quality of innovation of content	x	X
Quality of innovation of instruction		

Note. "X" represents a statistically significant association for the subscale variables and "x" represents a statistically significant association for individual variables within subscales.

This study found that the quality of innovations with SBRI content determined the strength and direction of the relationship between a more heuristic approach to instructional strategies and student achievement. That is, for example, for Bilingual classroom teachers who modify and adapt their scaffolding strategies, student achievement increases when there are high quality modifications and adaptations of SBRI

content (phonics, phonemic awareness, fluency, vocabulary, and comprehension). Interestingly, the effects of innovations in one area (instruction) seem to be impacted by the quality of innovations in another area (content). Thus, for example, the impact of modifications of scaffolding depends on quality modifications of phonics.

This result may be explained by considering the results from Research Question 2. It was revealed that congruence with instruction impacted student achievement. Given this finding, it appears that simply implementing SBRI instructional strategies is beneficial for student achievement in reading, but in order for a heuristic approach to implementing SBRI instruction to be good for student achievement it needs to be coupled with high quality innovations in content. That is, scaffolding *alone* may be beneficial but scaffolding in new and different ways needs to be tempered by high quality innovations of content in order to be beneficial. Thus, if teachers are trying new and different ways of scaffolding, this will improve student learning if they also are effective in the new and different ways they teach phonics. It appears that a heuristic approach alone may not be beneficial for Bilingual students, as evidenced by the results from Research Question 2, but high quality heuristic approaches may be beneficial. This result is in line with research that has suggested a connection between high quality instruction overall and increased student outcomes (Datnow & Castellano, 2000). This finding also extends our understanding of innovation and may help to explain *how* a more heuristic approach to implementation can be beneficial to students. It appears that the impact of a more heuristic approach to implementation does depend to some extent on the quality of instructional innovations.

However, the moderation hypothesis was only supported for the innovation of instruction variable. Quality was not found to determine the strength or direction of the relationship between either of the innovation of content variables and student achievement. This result is also in line with results from Research Question 2, which found that neither of the content subscales (congruence or innovation) was predictive of student achievement. Interestingly, the only time SBRI content appears to be important for student achievement is when it tempers innovations. This may be explained by considering the content itself. Research on reading instruction has shown that all five of the content areas are necessary for effective reading instruction and appropriate for all grade levels, if adapted to be at a higher or lower level (Snow, Burns & Griffin, 1998). For example, letter-sound correspondence (phonics) can be taught through alphabet activities for Kindergarteners or through spelling activities for second graders. Therefore, Reading First contends that all five of the content areas should be taught at every early elementary grade level.

Nevertheless, it is possible that the instructional needs of the Bilingual classroom students were different than those in previous studies. As mentioned, it is possible that there was variation in the instruction needed as well as the instruction received by the students in the Bilingual classrooms and this impacted the results of this study. It is possible that the teachers in this study who did teach all five of the content areas spent time on content that did not contribute to their students' literacy acquisition. Although previous research has indicated that all early elementary students need instruction in all five content areas (National Reading Panel report, 1999), it is possible that the students in this study did not need such instruction. This result is not consistent with previous

research and as such has potentially important implications for the content of reading instruction. These findings warrant further investigation. It may be that the implementation of all five of the components of SBRI content was not appropriate for the needs of this sample and therefore was not predictive of their achievement in reading.

Even so, one of the individual content areas, vocabulary, did support the moderation hypothesis. The quality of innovations may determine the strength and direction of the relationship between innovation of vocabulary instruction and student achievement in reading. This result suggests that, although overall congruence with content was not found to be an important contributor to student achievement, this particular component of SBRI content may be important for these students' literacy acquisition. Several research studies have found that for second-language learners, vocabulary knowledge is related to student achievement in early literacy acquisition (Carlo et al, 2004; Perez, 1981). However, none of the SBRI content variables were found to impact student achievement directly. In addition, none of the innovation variables were found to directly impact student achievement. Hence, the results of the moderation models indicate that a more heuristic approach to teaching vocabulary does impact student achievement *under certain conditions*. That is, if a teacher is trying different things when she is teaching vocabulary, it is beneficial to students if those different things that she is trying are relevant and effective for students. Therefore, it appears that a more heuristic approach to implementation may be beneficial for student achievement with students from Bilingual classrooms but only when the quality is high.

Overall, the moderation results are mixed but promising. In this study, student achievement depended to some extent on the quality of teachers' innovations. The results

of this dissertation study represent a first step in the effort to understand implementation of training and the effects of different approaches to implementation on student achievement. In addition, the results from the Bilingual classrooms represent a preliminary step toward applying these constructs to second-language learners. My findings provide support for the hypothesis that implementation is an important factor for student achievement in reading, thus underscoring the need to assess implementation using student outcomes as the benchmark for success.

Chapter 6

Synthesis of Results

Overall, the results from the English-language and Spanish-language studies were quite different. This is consistent with research that has shown that dominant-language and minority-language reading instruction and achievement are different, as are the individual characteristics of teachers and students from different sociocultural backgrounds (Goldenberg, Rueda & August, 2006). The similarities and differences between the two studies may offer potential insight into the nature of implementation of training with different languages of instruction. The subsequent sections will compare and contrast the results for each of the research questions individually, followed by the limitations of both studies and directions for future research.

Results by Research Question

Research Question 1: To what extent do teacher characteristics (flexible thinking, perceived autonomy support, attitude toward SBRI, and perceived competence with SBRI) predict their implementation of SBRI (congruence with SBRI, innovation of SBRI and the quality of innovations)?

Table 49.

Summary of Findings for Research Question 1

Implementation Variables	*Teacher Characteristics*			
	Flexible Thinking	*Perceived Autonomy Support*	*Attitude toward SBRI*	*Perceived Competence with SBRI*
Congruence with SBRI				
Content				
Instruction		.004		
Innovation of SBRI				
Content				
Instruction	.030	.004		
Quality of Innovation of SBRI				
Content		.049	*.049*	
Instruction		.007	*.048*	

Note. Significant results for English-only classrooms are in regular type and Bilingual classrooms are in italics.

For each of the teacher characteristics variables, the literature has not addressed differences in language of instruction specifically. Therefore, it was unknown whether these variables would hold the same predictive potential for implementation for both sets of teachers, those from English-only classrooms and those from Bilingual classrooms. While at least some of the teacher characteristics did predict teacher implementation for both studies, the results suggest that the individual characteristics of the teachers impact their implementation of training very differently. It appears that English-only classroom teachers' instructional choices may be determined more by their tendency toward flexible thinking and their perceptions of autonomy support. On the other hand, Bilingual

teachers' instructional choices may be more determined by their attitude toward the program that they are implementing.

These results may be explained by considering potential disparity in the teachers as individuals and their instruction. It may be that the there were individual differences among the teachers in the two studies, along sociocultural lines, and these differences impacted their implementation. As mentioned, sociocultural differences have been shown to impact teachers' attitudes, perceptions, and behaviors (Goldenberg, Rueda & August, 2006). Therefore, perhaps English-only classroom teachers and Bilingual classroom teachers implement training differently based on possible differences in their sociocultural backgrounds. Or perhaps the language of instruction determines the individual characteristics that influence implementation. For example, it is possible that Spanish-language teachers teach differently and therefore have different determining factors for their implementation. In either case, the results from these two studies support previous research that has suggested that the choices that teachers make are related to their individual characteristics, identities of themselves, and their perceptions of the world around them (Corrigan, 2001; Fullan, 2000; Hargreaves, 1992). This research extends previous findings by applying such constructs in the context of implementation of teacher training and by considering implementation with teachers who teach using different languages of instruction. These studies represents a first step toward better understanding not only determinants of implementation of training but how they may differ according to the language of instruction.

Research Question 2: To what extent do congruence with SBRI and innovation of SBRI mediate the relationship between teacher characteristics (flexible thinking, perceived autonomy support, attitude toward SBRI, and perceived competence with SBRI) and student achievement in reading?

Table 50.

Summary of Findings for Research Question 2

Implementation Variables	*Student Achievement*	
	Standard Error	*p value*
Congruence with SBRI		
Content	-.082	.003
Instruction	.073	.040
	.046	*.023*
Innovation of SBRI		
Content	.064	.042
Instruction		

Note. Significant results for English-only classrooms are in regular type and Bilingual classrooms are in italics.

The results from Research Question 2 represent the only overlap in the findings between the two studies. To some extent, implementation did predict student achievement for both studies. It appears that, for both English-only classrooms and Bilingual classrooms, teaching reading using the features of effective instruction is beneficial for student achievement in reading. That is, when teachers from either study differentiated, modeled, and scaffolded their instruction, students performed better. This result supports research that has suggested that these instructional strategies can benefit both English-only and Bilingual student achievement (Shanahan & Beck, 2006). This

study seems to confirm the link between the features of effective instruction for reading and student achievement.

However, there were differences in the results from the two studies. The Spanish-language study did not find any additional implementation variables to be associated with student achievement. For the English-only classrooms, teaching all five of the content areas was detrimental for student achievement while a more heuristic approach to implementation of the five content areas was beneficial for students. This lack of correspondence between the components that impact reading achievement for different languages of instruction is contrary to research in this area. Previous research shows that although students who receive reading instruction in different languages may progress at different rates, their progression through literacy acquisition follows similar paths (Fitzgerald & Noblit, 2000; Neufeld & Fitzgerald, 2001). In other words, effective reading instruction should look similar no matter the language. In fact, the instructional components that make up the guidelines of SBRI have been shown to transfer between languages of instruction (Shanahan & Beck, 2006; Snow, Burns & Griffin, 1998). However, the results of this study suggest that this may not be the case. In this research there appear to be differences in the determinants of reading achievement according to language of instruction, particularly with the five content areas. As such, this is a potentially important result. These associations should be studied further to clarify the effects of instruction on reading achievement for different languages of instruction.

Research Question 3: To what extent does the quality of teachers' innovations of SBRI moderate the relationship between innovation of SBRI and student achievement in reading?

Table 51.

Summary of Findings for Research Question 3

Interaction Variables	*Student Achievement*
Innovation of content X Quality of content	.046
Innovation of content X Quality of instruction	.009
Innovation of instruction X Quality of content	*.035*
Innovation of instruction X Quality of instruction	

Note. Significant results for English-only classrooms are in regular type and Bilingual classrooms are in italics.

The results from Research Question 3 were quite different for the two studies. The moderation hypothesis was partially supported for both but for different components of implementation. For the English-only classrooms, the impact of a more heuristic approach to implementation of content was found to depend upon the quality of innovations for both content and instruction. Conversely, for the Bilingual classrooms, the impact of a more heuristic approach to implementation of instruction depended upon the quality of innovations of content. These results suggest that there may be differences in the effect of SBRI on students from English-only classrooms and Bilingual classrooms, which implies that there may be differences in the instruction these students need in order to be successful readers. Indeed, previous research has indicated that there are potential differences in instruction that best serve the needs of minority-language students (Lesaux & Geva, 2006). The results of these studies seem to confirm this needed

differentiation in instruction. However, taken as a whole, these results do suggest that the quality of instruction does impact student achievement. Although high quality instruction may be defined differently for language-dominant and language-minority students, high quality instruction does seem to play an important role in acquiring early literacy.

Limitations

The following limitations should be considered when interpreting the results from this study.

Sampling

There are several potential limitations with the sample used for this study. First, and most importantly, the sample size was very limited. As reported, 36 teachers were surveyed for the English-only classroom study but only 24 teachers for the Bilingual classrooms study. Although this was not intentional, it is possible that it impacted the results of this study. After the data was collected it was discovered that the second grade data that was collected for the Bilingual classrooms could not be used in this study. The district had changed its policy and required all second grade Bilingual classrooms to be taught and tested in English. Therefore, because these students did not receive consistent instruction in one language, a term of the Reading First grant, they were dropped from the study.

The bilingual sample data may also have impacted the results due to several unknown factors. Because the inclusion of a Bilingual portion was not the original intention the data collected from the Bilingual sample, in retrospect, was not sufficient to assume certain factors. That is, if the Bilingual study had been planned from the onset,

certain pertinent data would have been collected but this data was not able to be collected after the fact. For example, the proficiency of the Local Camps Coaches in both Spanish and the tenets of Bilingual instruction remains unknown. It is possible that when the coaches observed the bilingual teachers (and subsequently rated them on their implementation) they did not have sufficient proficiency to accurately observe and rate the Bilingual instruction. This may have impacted the results of this study. In addition, the consistency of Bilingual instruction across teachers and schools is another unknown factor. As noted, the school district was unable to provide a clear expectation for Bilingual education, potentially resulting in differences in reading instruction and implementation of Reading First in the Bilingual classrooms. If this was the case, it may have impacted the results for this study as well.

In order to have sufficient power, particularly for a multi-level analysis, sufficient sample size is very important (Raudenbush & Bryk, 2002; Snijders & Bosker, 1999). A general standard for sufficient sample size in multi-level analyses is 10 subjects per variable at the corresponding level in the model (Snijders & Bosker, 1999). With roughly 35 teachers, optimal model estimations recommend there should have been no more than 4 variables in any model at one time. Although every effort was made to limit the number of variables in the model, there were occasions where the violation of this standard was unavoidable. For instance, when testing the individual sub-scales, although regression was used to initially identify significant variables and weed out insignificant ones, there were still five variables that were significant and needed to be added to the model together to test for significance. If these variables had been added to the model independently, the results would not have been as accurate because then the effects of

each variable on the outcome would be isolated and no control variables could account for shared variance. It is difficult to tell the real impact of the included variable if other variables cannot be included as controls. This may lead to an over-estimation of the included variable's importance to the outcome. The limited number of variables able to be added to the statistical model at any one time is a second potential limitation of this study. However, every effort was made to find a reasonable balance between sufficient power and adequate controls in the model.

Third, because of the relatively small size, participating teachers may not be representative of the entire population of teachers in the participating district or the state. Therefore, generalizability is limited. The sample was chosen based on its representative qualities, but fewer teachers responded than expected and this may have led to a restriction of range in the sample. It is difficult to tell if this is the case, but a larger sample normally provides more variation among participants. It is possible that another sample of teachers would not produce the same results found in this study.

Regarding participants, although multiple steps were taken to ensure confidentiality, and the measures were explained to teachers, it is possible that some teachers may not have responded to the online survey for fear of being identified. In addition, there are a few common concerns when administering self-report surveys that may have impacted the results of this study. First, it is possible that the teachers who did respond tended to share some characteristic, and therefore tended to respond to the surveys in the same way. This may have led to a restricted range of participant responses. As there was a high response rate (75%) this seems unlikely but it is possible. Second, an online administration of a self-report instrument is open to interpretation and it is possible

that teachers did not fully understand or attend to the meaning behind the questions being asked. Every effort was made to ensure the validity of the instrument and its results, including conducting a pilot study, but it is possible that some respondents answered questions in a way that was inaccurate.

Reliability

The reliability for several of the scales used in this study was relatively low. It is possible that this potential issue with the replicability of the measures may have impacted the results. In particular, there were differences in the reliabilities for some of the teacher individual characteristics scales between the two studies. For example, the reliability for the Perceived Competence scale was high for the English-only classroom study (Cronbach's Alpha = .92) but noticeably lower for the Bilingual classroom study (Cronbach's Alpha = .50). In addition, the attitude toward SBRI scale had lower reliability levels for the Bilingual classroom study (Cronbach's Alpha = .57) than for the English-only classroom study (Cronbach's Alpha = .70). These levels of reliability with the Bilingual classroom study suggests that if this study was repeated with the same instrument but a different sample of teachers, then the results might not be replicated. This presents a potential limitation in the reliability of the results of this study.

Validity

It is difficult to determine with absolute certainty that any instrument is completely valid. The survey instruments used in this study were chosen based on their theoretical constructs used to develop them as well as their established records of use. It is worth noting that two of the scales that were used for this study that were taken from other authors (Deci & Ryan, 2000; Stanovich & West, 1999) and did show significant

relationships with other variables. However, one of the teacher characteristics survey instruments that was created for this study (perceived competence with SBRI) did not reveal any significant results. It seems reasonable, based on previous research, that this teacher variable would be significant. Therefore, as mentioned earlier, this lack of results may indicate that the instrumentation was flawed. The survey may not have measured what it was intended to measure.

In addition, using these surveys to measure constructs with Bilingual classrooms may have added to the potential validity issues. None of these instruments has been expressly tested for possible variations by sociocultural affiliation or language of instruction and therefore may not be a valid measure for all participants.

Research Design

There are several factors related to the research design that may limit this study. First, as mentioned, there may be other factors that contributed to the outcomes that were not included as variables in this study. It seems likely in light of the limited results from the teacher characteristics model that there are other more important individual characteristics that contribute to teacher implementation that were not included here. This will be discussed further when considering future research directions. In addition, It seems likely that there are factors that contribute to student achievement in reading that were not included in this study. It was my intention to include more student-level predictors that have been shown to influence reading achievement (SES, ethnicity, struggling-reader status) but this data was not provided by the district and could not be analyzed. It is also reasonable to assume that there are additional student-level factors that influence their achievement that were not included, such as home environment and

education level of the parents (Goldenberg, Rueda & August, 2006). Unfortunately, this information was also not available to analyze.

Second, it was discovered after the data collection had begun that the schools that participated in this study had not had an equal opportunity to implement Reading First throughout the school year. The participating school district did not authorize the hiring of Reading First Campus Coaches (a requirement of the grant) to help with implementation until late November. The coaches are responsible for overseeing the implementation of the Reading First guidelines as well as providing professional development and feedback for teachers. The lack of a coach on each campus for part of the year is likely to have inhibited the implementation process. Therefore, the assumption cannot be made that the students received Reading First instruction for an entire school year. It seems reasonable to assume that they did receive Reading First instruction for the spring semester. Therefore, it is entirely possible that if this study were replicated with schools that had implemented the Reading First guidelines throughout the entire school year, the results may be different.

Last, a primary limitation of this study is the inability to make causal inferences. Linear regression and Hierarchical Linear Modeling only provide information concerning the strength of associations between variables. Therefore, this study can only infer that there is an association between these variables, but cannot describe or explain cause and effect. In addition, the use of only quantitative data may have limited the interpretation of results as well. These results make it difficult to answer the next question, "Why do these associations exist?"

Implications for Future Research

More research is necessary to understand how implementation of teacher training impacts student achievement, what teacher characteristics may be related to their instructional choices during implementation of training and how these may differ according to language of instruction. The results from this study suggest an association between the nature of teachers' implementation and student achievement in both English-only classrooms and Bilingual classrooms. The next step in this investigation might be to look at these associations over time. A longitudinal approach could add valuable insight into the implementation process. Future research might ask, "Does the implementation process change over time or is it static?" and "What can be done to help teachers implement effectively over time?" In addition, a longitudinal perspective might offer insight into how teachers as individuals impact their students and their own implementation of training. Future research might ask, "What teacher characteristics affect student achievement" and "Can these individual characteristics be impacted through training?"

Next, future research may focus on identifying additional variables that contribute to teachers' implementation of training, particularly for Bilingual classrooms. This study included only a few of the possible variables that may contribute to teachers' instructional choices. Other variables that might be included are general self-efficacy, knowledge of SBRI, and epistemological beliefs. Also, future research might look at additional student variables that could not be included in this study. Examples of student variables that have been shown to impact student achievement are SES, ethnicity, struggling-reader status, and home literacy background. A subsequent study might look at

the same outcomes but include a larger sample size and more student variables as controls in order to confirm the associations suggested here.

Last, more research is needed that identifies causal relationships between teacher variables and their implementation of training. Change is difficult and teachers tend to be resistant (Little, 1998). Yet the most feasible and most common way to impact student achievement is through ongoing teacher training designed to improve classroom instruction (Darling-Hammond, 2000). Research that helps provide a better understanding of what factors encourage effective implementation could be valuable for reform efforts. A qualitative approach could help to achieve this goal. Future research might ask, "How can we encourage teachers to update their instructional practices?" and "What factors contribute to effective implementation?"

Conclusion

This dissertation contributed to the base of understanding about implementation of training and its' possible effects on student achievement. I found that there are teacher characteristics that predict their implementation of training content for both English-only classrooms and Bilingual classrooms. Teachers' tendency toward flexible thinking and feeling of environmental support for acting autonomously were both associated with English-only classroom implementation. For Bilingual classrooms, teachers' attitude toward the program affected their implementation choices. I also found that the nature of teachers' implementation could predict student achievement in reading. For both studies, using the features of effective instruction had a positive impact on student achievement in reading. For the English-language study, implementing SBRI content in a heuristic

manner was associated with higher student achievement. In addition, teaching SBRI content was found to negatively impact student achievement. I also found that the quality of innovations impacts student achievement in reading. For the English-language study, I found that for teachers who were heuristic in their approach to teaching SBRI content, increases in student achievement depended on the quality of those innovations. For the Spanish-language study, the impact of a more heuristic approach to implementation on student achievement depended on the quality of teachers' innovations with content. In both cases, high quality innovations resulted in higher student achievement.

These findings extend previous research and offer some insight into methods for raising student achievement through examining factors that lead to more effective implementation of training. It appears that an examination of the nature of implementation may be fruitful for identifying factors that might contribute to increases in student achievement, regardless of the language of instruction. This study represents a departure from traditional studies of implementation in two ways. First, it investigated the implementation process rather than simply the product. By examining the nature of teachers' instructional choices, heuristic or algorithmic, we can better understand how teachers use what they learn in training and thereby improve teacher training itself. Second, it investigated effective implementation by using student achievement as the benchmark for success. This line of research may offer insight into providing the highest quality of education for our students, one of the great challenges of our time.

Appendix A: SBRI Guidelines

The purpose of Reading First is to ensure that all children in America learn to read well by the end of third grade so they are well prepared to achieve their full academic potential (Leading for Reading Success: An Introduction for Reading First Coaches, 2005). Reading First involves the implementation of Scientifically Based Reading Instruction (SBRI) through strategic, systematic professional development.

SBRI Guidelines:

- Include 90 minutes per day of uninterrupted time for literacy instruction
- Use assessment data to monitor student learning and inform instruction
- Provide differentiated instruction to meet students' needs
- Provide systematic and explicit instruction
    - Systematic: instruction is planned and sequenced
    - Explicit: instruction is modeled
- Include the 5 essential components of effective reading instruction
    6. Phonics
    7. Phonemic Awareness
    8. Fluency
    9. Vocabulary
    10. Comprehension

Appendix B: Teacher correspondence

Initial contact letter (via mail)

March 29, 2006

Judy Teacher
Any School
1818 West Elementary Street
Somewhere, Texas 55555

Dear (Teacher Name),

You have been selected to participate in an important survey of teachers. The purpose of this study is to learn more about teachers and their instructional choices. The enclosed dollar bill is a small token of our gratitude for taking the time to participate.

The topic of this study is possible relationships between teacher characteristics and the process of implementing new curricula. We will be gathering information about what teachers tend to do when faced with using a new program. This survey will be administered online and will only take about 20 minutes to complete. For your convenience, you will be receiving an e-mail notification in one week providing the Internet link for this survey. If you choose to complete the survey in advance, you may visit the web address below at any time.

Web address: **http://www.surveymonkey.com**

This survey is being conducted from the Department of Educational Psychology at the University of Texas at Austin as part of my dissertation study. Your participation will be helpful for gathering practical knowledge about teachers and the change process and our findings will be applied to design better quality teacher training. Because you are part of a select group of teachers chosen especially for this study, your participation is important and greatly appreciated.

This study is completely confidential. All information gathered will be done using only a pre-assigned identification number. The information from this survey will be used for academic purposes only. Please see the enclosed letter for more information about your rights as a participant and the confidential nature of this study.

Please look for an e-mail in the coming week with the subject heading "Teacher Survey" to participate in this study. Thank you very much for your time and cooperation!

Sincerely,

Candice Knight
University of Texas

Questions or comments: Contact Candice at (512) 913-6147 or candiceknight@mail.utexas.edu

Second contact (via e-mail)

Subject: Teaching Survey

Dear Valued Teacher,

As you were notified earlier by mail, you have been selected to participate in a survey of teachers about their teaching practices. The purpose of this study is to learn more about what teachers are doing in their classrooms when they are using a new program. This survey will only take 20 minutes to complete.

This survey is being conducted from the Department of Educational Psychology at the University of Texas at Austin as part of a dissertation study. Your participation will be helpful not only to this study but also for gathering practical knowledge about how we can better help teachers through training. Your participation is important and greatly appreciated. Simply click on the link below and you will be brought directly to the survey.

This study is completely confidential. After accessing the website included below, you will only be identified by a numerical code. Feel free to be completely honest in your responses. The information from this survey will be used for academic purposes only and your individual answers will not be shared with your administrators.

Please click on this link to access the survey: **http://www.surveymonkey.com**

Thank you very much for your time and participation in this study!

Sincerely,

Candice Knight
University of Texas

Questions: Contact Candice at (512) 913-6147 or candiceknight@mail.utexas.edu

Last contact (via e-mail)

Subject: Don't forget: Teaching Survey

Dear Valued Teacher,

We noticed that you have not yet responded to the teaching survey. We know how busy teachers can be! As a friendly reminder, you were chosen among a select group to participate in a survey of teachers about their teaching practices. It will only take 20 minutes to complete. Please take a moment to complete the survey at the website listed below.

This survey is being conducted from the Department of Educational Psychology at the University of Texas at Austin as part of a dissertation study. It is designed to learn more about if teachers and their teaching. Your participation will be very helpful in gathering practical knowledge about how we can improve teacher training.

This study is completely confidential. All information gathered will be done using an identification number only. Thank you so much for your time and cooperation in this study! We appreciate your help.

Please click on this link to access the survey: **http://www.teachersurvey.com**

Sincerely,

Candice Knight
University of Texas

Questions: Contact Candice at (512) 913-6147 or candiceknight@mail.utexas.edu

Appendix C: Teacher Survey items

Teacher Demographics: 7 items

1. Please enter your total number of years teaching at a public school _____.
   (include the current academic year as part of this total)

2. Please enter your total number of years teaching at your current school _____.
   (*include the current academic year as part of this total*)

3. Please indicate which grade level you currently teach.
   ( ) Kindergarten
   ( ) First grade
   ( ) Second grade

4. Which of the following methods did you use to receive your teaching certification?
   ( ) Four or five year university-based teacher certification program
   ( ) Received bachelors degree and then returned to college for teacher certification
   ( ) Alternative certification program
   ( ) I have not received my teaching certificate at this time

5. How many Reading First training sessions have you attended <u>in the past year</u>?
   (include all professional development delivered by RTA's or Local Campus Coaches)
   ( ) 0
   ( ) 1-2
   ( ) 3-5
   ( ) 6-8
   ( ) 9-11
   ( ) 12 or more

6. How often did your Local Campus Coach visit your classroom <u>in the past month</u>?
   (include walk-throughs, observations, modeling of lessons, and evaluations)
   ( ) 0 visits
   ( ) 1 visit
   ( ) 2 visits
   ( ) 3 visits
   ( ) 4 visits
   ( ) 5 or more visits

7. How often did your Local Campus Coach observe your classroom teaching <u>in the past month</u>? *(only include observations of 20 minutes or more)*

   ( ) 0 observations
   ( ) 1 observation
   ( ) 2 observations

( ) 3 observations
( ) 4 observations
( ) 5 or more observations

Attitude toward SBRI Scale: 4 items

Teachers*: Please indicate how true each of the following statements is for you currently.*

1	2	3	4	5
Not at all true of me		Somewhat true of me		Very much true of me

1. I do not want to use SBRI in my language arts instruction.
2. I will implement the SBRI guidelines exactly as they are supposed to be implemented.
3. To be effective for my students, the SBRI guidelines need to be altered.
4. I endorse the philosophy behind SBRI.

Autonomy Scale: 6 items

(General Causality Orientations scale)

Teachers: The following item describes a situation and lists three ways of responding to it. Please read each item, imagine yourself in that situation, and then consider each of the possible responses. Select how typical each response would be for you according to how accurately it describes you.

1	2	3	4	5
Not at all Typical of me		Somewhat typical of me		Very much typical of me

1. A student teacher who has been working with you had generally done an adequate job. However, for the past two weeks, her work has not been up to par and she appears to be less actively interested in her work. Select how typical or not typical each of these approaches would be for you.

    a. I would tell her that her work is below what is expected and that she should start working harder.
    b. I would ask her about the problem and let her know I was available to help her work it out.
    c. It would be hard to know what to do to get her straightened out.

2. You had a job interview several weeks ago. In the mail, you received a form letter, which states that the position has been filled. Select how typical or not typical each of these reactions would be for you.

a. The position has been filled, not based on what a person knows but whom they know.
b. I'm probably not good enough for the job.
c. Somehow, they didn't see my qualifications as matching their needs.

3. You have just received the results of a test you took, and you discovered that you did very poorly. Select how typical or not typical each statement would be <u>for you</u>.

    a. I would have sad feelings such as "I can't do anything right."
    b. I would have disappointed feelings such as "I wonder what areas I did not understand."
    c. I would have angry feelings such as "That stupid test doesn't show anything."

4. You and your friend are making plans for Saturday evening. Select how typical or not typical each of these approaches would be <u>for you</u>.

    a. I would usually leave it up to my friend; he/she probably wouldn't want to do what I suggest.
    b. Each of us would make suggestions and then decide together on something that we both feel like doing.
    c. I would usually talk my friend into doing what I want to do.

5. Recently, a position opened up at your school that could have meant a promotion for you. However, another teacher was offered the position rather than you. Select how typical or not typical each of these thoughts would be <u>for you</u>.

    a. I wouldn't really have expected the job; I frequently get passed over.
    b. The other teacher probably "did the right things" politically to get the job.
    c. I would have probably looked at factors in my own performance that led me to be passed over.

6. Your friend has a habit that annoys you to the point of making you angry. Select how typical or not typical each approach would be <u>for you</u>.

    a. I would point it out each time I noticed it; that way maybe he/she will stop doing it.
    b. I would try to ignore the habit because talking about it won't do any good anyway.
    c. I would try to understand why my friend does it and why it is so upsetting for me.

Perceived Competence Scale: 4 items

Teachers*: Please indicate how true each of the following statements is for you <u>currently.</u>*

1	2	3	4	5
Not at all true of me		Somewhat true of me		Very much true of me

1. I can successfully implement SBRI in my language arts instruction.
2. I do not feel prepared to use SBRI in my language arts instruction.
3. The training I have received in SBRI has prepared me to implement the essential components of SBRI in my language arts instruction.
4. I feel confident that I can …
    a. Teach reading for 90 uninterrupted minutes each day.
    b. Use assessment data to inform my reading instruction.

c. Provide differentiated (individualized) language arts instruction for my students.
d. Provide systematic (planned and sequenced) language arts instruction for my students.
e. Provide explicit (clear, modeled with practice) language arts instruction for my students.
f. Teach phonics in my language arts instruction.
g. Teach phonemic awareness in my language arts instruction.
h. Teach fluency in my language arts instruction.
i. Teach vocabulary in my language arts instruction.
j. Teach comprehension in my language arts instruction.

Flexible Thinking Scale: 13 items

Teachers: Select how accurately the following statements describe you by rating each statement by how true it is for you.

1	2	3	4	5
Not at all true of me		Somewhat true of me		Very much true of me

Flexible Thinking Scale

1. Changing your mind is a sign of weakness. ®
2. A person should always consider new possibilities.
3. If I think longer about a problem I will be more likely to solve it.
4. Basically, I know everything I need to know about the important things in life. ®
5. Considering too many different opinions often leads to bad decisions. ®

6. People should always take into consideration evidence that goes against their beliefs.
7. Difficulties can usually be overcome by thinking about the problem, rather than waiting for good fortune.
8. There is nothing wrong with being undecided about many issues.
9. Coming to decisions quickly is a sign of wisdom. ®
10. Intuition is the best guide in making decisions. ®

Categorical Thinking

11. There are basically two kinds of people in this world, good and bad.
12. I think there are many wrong ways, but only one right way, to almost anything.
13. I tend to classify people as either for me or against me.

<u>Deleted</u> Attitude toward Change Scale: 5 items

Teachers: Select how accurately the following statements <u>describe you</u> by rating each statement by how true it is for you.

1	2	3	4	5
Not at all true of me		Somewhat true of me		Very much true of me

1. If what teachers are supposed to do may not work, they should not do it.
2. Teachers should take a trial and error approach to their teaching.
3. Good teachers don't need to change lessons in the moment. ®
4. Teachers should always stick to their lesson plans. ®
5. Good teachers are always experimenting with different ways of teaching.

Appendix D: Coach correspondence

Initial contact letter (via e-mail)

March 22, 2006

Margaret Coach
Any School
1818 West Elementary Street
Somewhere, Texas 55555

Dear (Name of Coach),

You have been selected to participate in an important survey of about teachers. The purpose of this study is to learn more about the instructional choices that teachers make when implementing a new program.

The topic of this study is possible relationships between teacher characteristics and the process of change. You will be asked to evaluate the teachers on your campus and report your observations via an online survey. If you choose to participate, please reply to this e-mail with your consent. For your convenience, upon receiving your reply e-mail of consent, you will be receiving a packet with more information in a few days.

This survey is being conducted from the Department of Educational Psychology at the University of Texas at Austin as part of a dissertation study. Your participation will be helpful for gathering practical knowledge about teachers and the change process and our findings will be applied to design better quality teacher training. Because you are part of a select group of Coaches chosen especially for this study, your participation is important and greatly appreciated.

This study is completely confidential. All information gathered will be done using a pre-assigned identification number. The information from this survey will be used for academic purposes only.

Don't forget, if you choose to participate in this important study, you must reply to this e-mail. Thank you very much for your time and cooperation!

Sincerely,

Candice Knight
University of Texas

Questions or comments: Contact Candice at (512) 913-6147 or candiceknight@mail.utexas.edu

Appendix E: Coach information packet

Dear Coaches, March 24, 2006

Thank you for participating in this study! As a quick reminder, the purpose of this study is to examine teachers and their instructional choices when faced with implementing a new program. To that end, you will be reporting the implementation of Scientifically Based Reading Instruction (SBRI) for the teachers on your campus based on your observations of their reading instruction over the last semester. You will fill out an online survey for each teacher on your campus, rating them on their SBRI and any innovations they use in their reading instruction. To assist in this process, several tools have been included in this packet. Enclosed please find:

1. What am I observing and why?
2. Guidelines for SBRR
3. Observation Checklists
4. Answering Guide

This research is being conducted from the University of Texas at Austin as part of a dissertation study. Any questions or feedback would be welcomed and encouraged. Please do not hesitate to contact me by e-mail at candiceknight@mail.utexas.edu or at (512) 913-6147 if I can assist you in any way. My sincerest thanks for you help with this project. You are

Sincerely,

Candice Knight
Educational Psychology
University of Texas

What am I observing and why?

Implementation of SBRI

Implementation of SBRI is one of the central concerns of this study. The first question on the observation checklist, and also on the survey, is about congruence with SBRI. Simply, are teachers following the guidelines of SBRI? If so, then they are consistent with Reading First expectations. However, teachers may implement some aspects of SBRI but not others, so each of the guidelines will be assessed separately.

Innovation of SBRI

This study is also interested in the new or different things that teachers may try in their reading instruction, referred to as innovations. It is very important to note that trying new or different things may not necessarily fall outside of the guidelines of SBRI. Therefore, it is not to be considered a negative if teachers are experimenting with different things. For example, a teacher could be teaching phonemic awareness, which would mean they are following the guidelines of SBRI, but also be trying new or different ways of teaching phonics. Or a teacher may be trying all kinds of things but not following SBRI. For this reason, implementation of SBRI and innovations in reading instruction will be measured separately. The relationship between these two constructs and how they work together is another central theme of this research.

In addition, the appropriateness of any innovations that are observed will be measured. Some teachers may not try new things at all, some teachers may try new things but they are not done well, and other teachers may try new things that work wonderfully. However, appropriateness will not be measured in terms of SBRI. The appropriateness of teachers' innovations will be assessed through their: (a) relevance to student needs and (b) effectiveness for students.

Guidelines for SBRI

The purpose of Reading First is to ensure that all children in America learn to read by the end of third grade so they are well prepared to achieve their full academic potential. Central to the goal of Reading First is the implementation of Scientifically Based Reading Instruction (SBRI), which includes the following guidelines for effective reading instruction. Each of these guidelines will be assessed in this study.

- Include 90 minutes per day of uninterrupted time for reading instruction
- Use assessment data to monitor student learning and inform instruction
- Provide differentiated instruction to meet students' needs
- Provide systematic and explicit instruction
- Include the 5 essential components of effective reading instruction

    1. Phonics
    2. Phonemic Awareness
    3. Fluency
    4. Vocabulary
    5. Comprehension

Observation Checklist for the SBRI study

The observation checklist is a tool to assist you in tracking the SBRR instruction of the teachers on your campus for this study. Using the observation checklist during the one-month observation period will help you remember what teachers did throughout the entire month. At the end of the observation period when you are rating the teachers in the online surveys, you will have a summary of each teachers' instruction related to SBRR and be able to respond to the questions quickly and accurately.

Also enclosed is an example observation checklist as a model of what a completed checklist may look like after a month of observations. In this example, the Local Campus Coach observed Mrs. Davis' first grade reading instruction 4 times throughout the month and kept track of her implementation of SBRI in terms of her compliance with each of the guidelines and her efforts to try different things with her reading instruction. Before beginning to rate the teachers on your campus, it will be helpful to gain insight into just what the survey items will be asking you. Upon receipt of this package, please use this example observation checklist to respond to an online practice survey about Mrs. Davis. Using this example to practice will help prepare you to rate your own teachers faster and more precisely because you will be more familiar with the survey items as well as how best to respond to each of them. This practice should be brief and informative, and is required for participation in this study. The link to access the practice survey has been e-mailed to you but you can also access it by going to:

Link: http:/www.surveymonkey.com

Answering Guide: How to best answer survey items

For your assistance, a cheat sheet for help in using the observation checklist and answering the survey items has been included. This tool is intended to assist you throughout this study, during the one-month observation period and while taking the online surveys. In addition, you are encouraged to use it to assist you when taking the practice survey. You can keep the hardcopy nearby as you answer each of the items on your computer. If you get to a survey item that you find hard to answer or it is difficult to know what is being asked, you may refer to the cheat sheet to assist you in interpreting the items. The cheat sheet will help guide you toward the best answer.

Appendix F: Coach Survey items

Coach Survey Items: 64 items (depending)

For ease in reporting, the Coach survey items will by categorized by each of the SBRI guidelines. In addition, the questions for each guideline must be administered in order, as the questions build on each other. Subsequent items may not need to be administered if the first items are answered negatively. Items for each of the 6 SBRI guidelines will include a measure of congruence and some will include measures of innovation and the appropriateness of those innovations, where appropriate. The three types of measures are listed below, along with the format for each:

1. **Congruence with SBRI**
    a. (Name of teacher) teaches _____ during language arts instruction.
2. **Innovations within that guideline**
    a. (Name of teacher) has tried different ways of _____during language arts instruction.
    b. (Name of teacher) generates their own ideas for _____during language arts instruction.
    c. (Name of teacher) continues to try new things when _____during language arts instruction.
3. **Appropriateness of those innovations**
    a. (Name of teacher)'s efforts to try new things when _____ are relevant to students' needs.
    b. (Name of teacher)'s efforts to try new things when _____ are effective for students.

As the Coach answers the items online, reminders will pop up that reinforce the separate nature of the scales. For instance, Coaches will be reminded that innovations in instruction should be rated only on their frequency first - the quality of those innovations will be rated separately. In addition, for each innovation item, Coaches will be reminded for each innovation item exactly what it is asking. For example the "trying new things" items are not distinguishing between trying someone else's ideas (even SBRI ideas) or trying your own ideas (that will be measured separately), just whether or not the teacher is generally trying things.

Coaches: Please rate the following statements by how true they are of (name of teacher) as a language arts teacher, based on your observations and interactions with them in the past month.

1	2	3	4	5	6	7
Never true of this teacher			Sometimes true of this teacher			Always true of this teacher

1. **Reading First guideline #1: 90 minutes of uninterrupted language arts instruction every day.**
    a. (Name of teacher) teaches language arts for at least 90 uninterrupted minutes every day.
    STOP: If the teacher is not doing this at all then the following items will not be administered. THE SAME IS TRUE OF EACH SECTION.
    b. (Name of teacher) has tried different ways of teaching language arts for 90 minutes.
    c. (Name of teacher) generates their own ideas for teaching language arts for 90 minutes.
    d. (Name of teacher) continues to try new things when teaching language arts for 90 minutes.

e. (Name of teacher)'s efforts to try new things when teaching language arts for 90 minutes are relevant to students' needs.
f. (Name of teacher)'s efforts to try new things when teaching language arts for 90 minutes.

2. **Reading First guideline #2: Use assessment data to monitor student learning and inform instruction.**
   a. (Name of teacher) uses assessment data to monitor student learning. *(include progress monitoring, benchmarks, formal assessments)*
   b. (Name of teacher) has tried different ways of monitoring student learning.
   c. (Name of teacher) generates their own ideas for monitoring student learning.
   d. (Name of teacher) continues to try new things when monitoring student learning.
   e. (Name of teacher)'s efforts to try new things when monitoring student learning.
   f. (Name of teacher)'s efforts to try new things when monitoring student learning.

   g. (Name of teacher) uses assessment data to inform instruction. *(include progress monitoring, benchmarks, formal assessments)*
   h. (Name of teacher) has tried different ways of using data to inform instruction.
   i. (Name of teacher) generates their own ideas for using data to inform instruction.
   j. (Name of teacher) continues to try new things when using data to inform instruction.
   k. (Name of teacher)'s efforts to try new things when using data to inform instruction.
   l. (Name of teacher)'s efforts to try new things when using data to inform instruction.

3. **Reading First guideline #3: Provide differentiated instruction in order to meets all students' needs.**
   SURVEY HEADER: for the following questions on differentiation, please take into account any and all differentiations in instructional content, instructional activities, delivery of instruction, and/or materials.
   a. (Name of teacher) differentiates their language arts instruction. *STOP RULE IN SURVEY: If the teacher has not been differentiating at all then the rater will be forwarded to the next section. THE SAME IS TRUE OF EACH SECTION.*
   b. (Name of teacher) has tried different ways of differentiating their language arts instruction.

c. (Name of teacher) generates their own ideas for differentiating their language arts instruction.
d. (Name of teacher) continues to try new things when differentiating their language arts instruction.
STOP: If the teacher is not innovating at all then the following items will not be administered. THE SAME IS TRUE OF EACH SECTION.
e. (Name of teacher)'s efforts to try new things when differentiating are relevant to students' needs.
f. (Name of teacher)'s efforts to try new things when differentiating are effective for students.

4. Reading First guideline #4: Provide systematic (planned and scaffolded) language arts instruction.

HEADER: for the following questions on planned instruction, please take into account any and all planning for instructional content, instructional activities, delivery of instruction, and/or materials.

a. (Name of teacher) provides planned language arts instruction.
b. (Name of teacher) has tried different ways of planning their language arts instruction.
c. (Name of teacher) generates their own ideas for planning their language arts instruction.
d. (Name of teacher) continues to try new things when planning their language arts instruction.
e. (Name of teacher)'s efforts to try new things when planning are relevant to student needs.
f. (Name of teacher)'s efforts to try new things when planning are effective for students.

HEADER: for the following questions on scaffolded instruction, please take into account any and all scaffolding of instructional content, instructional activities, delivery of instruction, and/or materials.

g. Name of teacher) provides scaffolding language arts instruction.
h. (Name of teacher) has tried different ways of scaffolding their language arts instruction.
i. (Name of teacher) generates their own ideas for scaffolding their language arts instruction.
j. (Name of teacher) continues to try new things when scaffolding their language arts instruction.
k. (Name of teacher)'s efforts to try new things when scaffolding are relevant to student needs.
l. (Name of teacher)'s efforts to try new things when scaffolding are effective for students.

5. **Reading First guideline #5: Provide explicit (modeled) language arts instruction.**

   HEADER: for the following questions on modeling during instruction, please take into account any and all modeling of instructional content, instructional activities, delivery of instruction, and/or materials.

   a. (Name of teacher) provides modeling during their language arts instruction.
   b. (Name of teacher) has tried different ways of modeling during language arts instruction.
   c. (Name of teacher) generates their own ideas for modeling during language arts instruction.
   d. (Name of teacher) continues to try new things when modeling during language arts instruction.
   e. (Name of teacher)'s efforts to try new things when modeling are relevant to student needs.
   f. (Name of teacher)'s efforts to try new things when modeling are effective for students.

6. **Reading First guideline #6: Include the 5 essential components of effective reading instruction (phonics, phonemic awareness, fluency, vocabulary, comprehension)**

   HEADER: for the following questions on phonics instruction, please take into account any and all phonics-related instruction, including instructional content, instructional activities, delivery of instruction, and/or materials.

   a. (Name of teacher) teaches phonics during their language arts instruction.
   b. (Name of teacher) has tried different ways of teaching phonics during their language arts instruction.
   c. (Name of teacher) generates their own ideas for teaching phonics during language arts instruction.
   d. (Name of teacher) continues to try new things when teaching phonics during their language arts instruction.
   e. (Name of teacher)'s efforts to try new things when teaching phonics are relevant to student needs.
   f. (Name of teacher)'s efforts to try new things when teaching phonics are effective for students.

   HEADER: for the following questions on phonemic awareness instruction, please take into account any and all phonemic awareness-related instruction, including instructional content, instructional activities, delivery of instruction, and/or materials.

   g. (Name of teacher) teaches phonemic awareness during their language arts instruction.
   h. (Name of teacher) has tried different ways of teaching phonemic awareness during their language arts instruction.

i. (Name of teacher) generates their own ideas for teaching phonemic awareness during language arts instruction.
j. (Name of teacher) continues to try new things when teaching phonemic awareness during their language arts instruction.
k. (Name of teacher)'s efforts to try new things when teaching phonemic awareness are relevant to student needs.
l. (Name of teacher)'s efforts to try new things when teaching phonemic awareness are effective for students.

HEADER: for the following questions on fluency instruction, please take into account any and all fluency-related instruction, including instructional content, instructional activities, delivery of instruction, and/or materials.
m. (Name of teacher) teaches fluency during their language arts instruction.
n. (Name of teacher) has tried different ways of teaching fluency during their language arts instruction.
o. (Name of teacher) generates their own ideas for teaching fluency during language arts instruction.
p. (Name of teacher) continues to try new things when teaching fluency during their language arts instruction.
q. (Name of teacher)'s efforts to try new things when teaching fluency are relevant to student needs.
r. (Name of teacher)'s efforts to try new things when teaching fluency are effective for students.

HEADER: for the following questions on vocabulary instruction, please take into account any and all vocabulary-related instruction, including instructional content, instructional activities, delivery of instruction, and/or materials.
s. (Name of teacher) teaches vocabulary during their language arts instruction.
t. (Name of teacher) has tried different ways of teaching vocabulary during their language arts instruction.
u. (Name of teacher) generates their own ideas for teaching vocabulary during language arts instruction.
v. (Name of teacher) continues to try new things when teaching vocabulary during their language arts instruction.
w. (Name of teacher)'s efforts to try new things when teaching vocabulary are relevant to student needs.
x. (Name of teacher)'s efforts to try new things when teaching vocabulary are effective for students.

HEADER: for the following questions on comprehension instruction, please include any and all comprehension-related instruction, including instructional content, instructional activities, delivery of instruction, and/or materials.

y. (Name of teacher) teaches comprehension during their language arts instruction.
z. (Name of teacher) has tried different ways of teaching comprehension during their language arts instruction.
aa. (Name of teacher) generates their own ideas for teaching comprehension during language arts instruction.
bb. (Name of teacher) continues to try new things when teaching comprehension during their language arts instruction.
cc. (Name of teacher)'s efforts to try new things when teaching comprehension are relevant to student needs.

(Name of teacher)'s efforts to try new things when teaching comprehension are effective for students.

Appendix G: Multilevel Models

This appendix will provide the multilevel models needed to test each hypothesis or this study. First, a one aspect of the following models warrants more detailed consideration. In order to test hypotheses for this study, a random intercept multilevel model will be used. As previously discussed, the nature of this study, as well as constraints on the feasibility of data collection, call for a relatively small sample size at Level-3 (schools). However, a small sample size may interfere with the accuracy of the estimates of standard errors if a traditional fully conditional HLM model were employed (with varying intercepts and slopes). Therefore, to produce a more valid analysis, a model will be used wherein the slopes will not be allowed to vary at Level-3. A common linear effect across Level-3 units will be assumed. This should not affect hypothesis testing for this study as the research questions address the effects of teacher variables on their students' performance.

Model 1

Model 1 will assess the association between teacher-level variables and implementation of SBRI. The following models will be specified for both of the implementation outcomes separately (congruence with SBRI and innovation of SBRI). To illustrate, congruence with SBRI will be used as the outcome in the example models. This section will provide the multilevel models designed to examine these predicted associations, with teachers' representing level-1 and schools representing level-2.

The Fully Unconditional Model

The first step in the analysis is to fit a fully unconditional model. This unconditional model is a multilevel model that does not include any explanatory variables at level-1 (within school) or level-2 (between school). The purpose of beginning with this model is to compute an intraclass correlation, the proportion of total variance between schools. First, the unconditional within-school model will be specified as:

$$Y_{ij} = \beta_{0j} + r_{ij}$$

where Y_{ij} represents the congruence with SBRI score for teacher i in school j; β_{0j} represents the within-school intercept; and r_{ij}, the within-school residual, represents the difference between a teachers' congruence with SBRI score (Y_{ij}) and the average score for that given teacher's school (β_{0j}).

The unconditional between-school model will be specified as:

$$\beta_{0j} = \gamma_{00} + \mu_{0j}$$

where β_{0j} is permitted to vary around the overall intercept, γ_{00}, and $\mu 0j$, the between-school residual, represents the difference between a given school's average congruence with SBRI score (β_{0j}) and the overall congruence with SBRI score average, or grand mean (γ_{00}).

Model Estimating the Total Effect of Teachers on Implementation

The second step in the analysis is to fit a fully conditional model (which includes explanatory variables in the within-school and between-school models) for each of the teacher variables of interest (flexible thinking, autonomy, and perceived competence) along with the control variables. The purpose of this fully conditional model is to

estimate and test the effect of the teacher variables, accounting for the level-1 and level-2 control variables. The conditional within-school model represents the congruence with SBRI score as a function of the teacher variables of interest, the level-1 control variables, and error. Note that student-level control variables will not be used in this model, but their aggregates will be used as additional teacher-level (level-1) control variables. All of the variables will be represented using X_{ij1} through X_{ij10}:

$$Y_{ij} = \beta_{0j} + \beta_{1j}X_{ij10} + \ldots + \beta_{10j}X_{ij10} + r_{ij}$$

The conditional between-school model represents the average congruence with SBRI score varying as a function of the level-2 control variables (represented by W_{j1}) and error (for intercepts):

$$\beta_{0j} = \gamma_{00} + \gamma_{01}W_{j1} + \mu_{0j}$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}W_{j1}$$

Model 2

Model 2 will assess the mediator effect of implementation (including congruence with SBRI and innovation of SBRI) on the association between teacher variables and student reading achievement. This section will provide the multilevel models designed to examine these predicted mediational associations. To examine these associations, multilevel models with 3 levels will be used, with students at level-1, teachers at level-2, and schools at level-3.

Fully Unconditional Models

As before, the first step in the analysis is to fit a fully unconditional model. First, the unconditional student-level model will be specified as:

$$Y_{ijk} = \pi_{0jk} + e_{ijk}$$

where Y_{ijk} represents the end of year reading achievement score of student *i* in classroom *j* and school *k*; π_{0jk} represents the mean end of year reading achievement score of classroom j in school *k*; and e_{ijk} represents a random student effect , or the deviation of student *ijk*'s score from the class mean.

Next, the unconditional classroom-level model will be specified as:

$$\pi_{0jk} = \beta_{00k} + r_{0jk}$$

where β_{00k} represents the mean end of year reading score in school *k*; and r_{0jk} represents a random classroom effect, or the deviation of classroom *jk*'s mean end of year reading score from the school mean.

Last, the unconditional school-level model will be specified as:

$$B_{00k} = \gamma_{000}$$

where γ_{000} represents the grand mean, or overall average end of year reading score for all students in all classrooms in all schools.

Conditional Models

The second step in the analysis is to fit a fully conditional model, which includes explanatory variables at each of the three levels. The purpose of the fully conditional models is to estimate and test the effect of the teacher variables of interest and the control variables for each level. This conditional model will represent the end of year reading achievement score as a function of teacher variables of interest (flexible thinking, autonomy, and perceived competence), all of the student-level control variables

(represented by a_{1ijk} through a_{3ijk}), and error. The conditional student-level model will be specified as:

$$Y_{ijk} = \pi_{0jk} + \pi_{1jk}a_{1ijk} + \pi_{2jk}a_{2ijk} + \pi_{3jk}a_{3ijk} + e_{ijk}$$

where Y_{ijk} represents the end of year reading achievement score of student *i* in classroom *j* and school *k*; π_{0jk} represents the mean end of year reading achievement score for classroom j in school k; a_{pijk} represent student-level control variables; π_{pjk} represents the corresponding student-level coefficients that indicate the direction and strength of the association between student control variable, a_p, and the reading score of classroom *jk*; and e_{ijk} represents a student-level random effect , or the deviation of student *ijk*'s score from the predicted score based on the student-level model.

The conditional classroom-level model represents the mean end of year reading score for a class varying as a function of the teacher-level variables of interest, control variables, and error. The teacher-level variables will be represented by X_{1jk} though $X_{7jk.}$ This model will be specified as:

$$\pi_{pjk} = \beta_{p0k} + \sum \beta_{pqk}X_{1jk} + \ldots + \sum \beta_{pqk}X_{7jk} + r_{pjk}$$

where β_{p0k} is the mean end of year reading score for school *k* in modeling the classroom effect $\pi_{pjk;}$; X_{pjk} is a teacher variable used as a predictor of the classroom effect $\pi_{pjk;}$; β_{p0k} is the corresponding coefficient that represents the direction and strength of association between teacher variable x_{pjk} and π_{pjk}; and r_{pjk} represents a teacher-level random effect, or the deviation of classroom *jk*'s student-level coefficient, π_{pjk} , from its predicted value based on the classroom-level model.

The conditional school-level model represents the grand mean end of year reading score as a function of school-level control variables and error (for intercepts). The conditional school-level model will be specified as:

$$B_{pqk} = \gamma_{pq0} + \sum \gamma_{pqs} W_{1k} + u_{pqk}$$

$$B_{pqk} = \gamma_{pq0} + \sum \gamma_{pqs} W_{1k}$$

where γ_{pq0} is the intercept term in the school-level model for B_{pqk}; W_{sk} is a school control variable used as a predictor for the school effect B_{pqk}; and γ_{pq0} is the corresponding school-level coefficient that represents the direction and strength of the association between school characteristic W_{sk} and B_{pqk} .

Mediational Effects Model

The final step of the analysis for Model 2 is to fit a fully conditional model for each of the teacher variables (and all control variables) that adds both congruence with SBRI and innovations of SBRI to the classroom-level model. This model will only be specified for teacher variables that were statistically significant in the previous model. The purpose of this model is to estimate and test the mediating effect of both congruence with SBRI and innovation of SBRI. As before, congruence with SBRI will be used as the example in the following models but a separate model will be specified for innovation of SBRI. The student-level model represents the end of year reading achievement score as a function of the teacher variables of interest, all of the student-level control variables, and congruence with SBRI. The student-level model will be specified in the same way as the

previous conditional model. The classroom-level model will include the predicted mediator variable and will be specified as:

$$\pi_{pjk} = \beta_{p0k} + \sum \beta_{pqk} X_{1jk} \ldots + \sum \beta_{pqk} X_{8jk} + r_{pjk}$$

The school-level model will be specified the same way as the previous conditional model as well.

Model 3

Model 3 will assess the moderating effect of quality of innovation on the association between innovation of SBRI and student reading achievement. This section will provide the multilevel models designed to examine these predicted moderational associations.

Fully Unconditional Model

The first step of the analysis is the fit a fully unconditional model. First, the unconditional student-level model will be specified as:

$$Y_{ijk} = \pi_{0jk} + e_{ijk}$$

Next, the unconditional classroom-level model will be specified as:

$$\pi_{0jk} = \beta_{00k} + r_{0jk}$$

Last, the unconditional school-level model will be specified as:

$$B_{00k} = \gamma_{000}$$

Moderational Effects Model

The next step of the analysis of Model 3 will be to fit a conditional model. The purpose of this model is to estimate and test the moderating effect of quality of

innovation as well as the effect of innovation of SBRI and quality of innovation separately. To do this, an interaction term for innovation of SBRI and quality of innovation will be added to the teacher-level model. The conditional student-level model represents the end of year reading achievement score as a function of innovation of SBRI, quality of innovation, the interaction of innovation of SBRI and quality of innovation, all of the student-level control variables, represented by (represented by a_{1ijk} through a_{3ijk}), and error. The conditional student-level model will be specified as:

$$Y_{ijk} = \pi_{0jk} + \pi_{1jk}a_{1ijk} + \pi_{2jk}a_{2ijk} + \pi_{3jk}a_{3ijk} + e_{ijk}$$

The conditional teacher-level model represents the end of year reading achievement score as a function of innovation of SBRI, quality of innovation, the interaction of innovation of SBRI and quality of innovation, all of the teacher-level control variables, and error. The teacher-level variables will be represented by X_{1jk} though $X_{10jk.}$ This model will be specified as:

$$\pi_{pjk} = \beta_{p0k} + \sum \beta_{pqk}X_{1jk} + \ldots + \sum \beta_{pqk}X_{10jk} + r_{pjk}$$

The conditional school-level model represents the grand mean end of year reading score as a function of school-level control variables and error (for intercepts). The conditional school-level model will be specified as:

$$B_{pqk} = \gamma_{pq0} + \sum \gamma_{pqs}W_{1k} + u_{pqk}$$

$$B_{pqk} = \gamma_{pq0} + \sum \gamma_{pqs}W_{1k}$$

Appendix H: Results from the Bilingual Analyses Including Second Grade

The first step of the analysis was to assess the direct affect of the control variables on the outcome by regressing grade level and school location on each of the 6 implementation of SBRI outcomes. I found that grade level was significantly associated with some of the implementation subscale outcomes but not all of them. I also found that school location was not significantly predictive of any of the implementation outcomes. Because these tables are lengthy, results are summarized in Appendix J. Based on these results, and because the limited sample size jeopardized the stability of the model, the decision was made to include grade level as a control variable in subsequent analyses but drop school location as a control variable in order to reduce the total number of variables in the model to help preserve stability.

In the next step, I added all of the teacher characteristic variables to the model to test the association of teachers' individual characteristics with their implementation of SBRI (each of the 6 subscales was tested separately). I began by testing all of the teacher characteristic variables with the 2 congruence subscales. Results showed that there was not a significant association between any of the teacher characteristic variables and their congruence with content (see Table 1). Neither was there a significant association between any of the teacher characteristic variables and their congruence with instruction (see Table 2). Overall, these teacher characteristics do not seem to impact their congruence with SBRI.

Table 1. *Results of the Model with Teacher Characteristic Variables Predicting Congruence with SBRI Content*

Variables	*Coefficient*	*se*	*p Value*
Grade Level			
Kindergarten	-.008	.379	.984
1st grade	.495	.396	.222
Teacher characteristics			
Flexible Thinking	-.220	.327	.506
Autonomy Support	.027	.147	.858
Attitude toward SBRI	.164	.220	.461
Perceived competence with SBRI	.024	.216	.911

Note. * $p < .05$.

Table 2. *Results of the Model with Teacher Characteristic Variables Predicting Congruence with SBRI Instructional Components*

Variables	*Coefficient*	*se*	*p Value*
Grade Level			
Kindergarten	-.025	.330	.941
1st grade	.545	.345	.126
Teacher characteristics			
Flexible Thinking	-.460	.284	.117
Autonomy Support	.054	.128	.676
Attitude toward SBRI	.195	.191	.317
Perceived competence with SBRI	.064	.188	.735

Note. * $p < .05$.

When the association of teacher characteristics with their innovation of content was tested, as before, none of the teacher characteristic variables were significantly associated with the content subscale (see Table 3). Also the same, the results for the instruction subscale of innovation revealed no significant association (see Table 4). It appears that these teacher characteristics do not predict their innovation of SBRI.

Table 3. *Results of the Model with Teacher Characteristic Variables Predicting Innovation with SBRI Content*

Variables	*Coefficient*	*se*	*p Value*
Grade Level			
Kindergarten	-.049	.420	.907
1st grade	.471	.439	.292
Teacher characteristics			
Flexible Thinking	-.265	.362	.470
Autonomy Support	.093	.163	.574
Attitude toward SBRI	.082	.244	.739
Perceived competence with SBRI	-.096	.239	.692

Note. * $p < .05$.

Table 4. *Results of the Model with Teacher Characteristic Variables Predicting Innovation with SBRI Instructional Components*

Variables	*Coefficient*	*se*	*p Value*
Grade Level			
Kindergarten	-.274	.418	.517
1st grade	.442	.437	.320
Teacher characteristics			
Flexible Thinking	-.430	.360	.242
Autonomy Support	.110	.163	.506
Attitude toward SBRI	.127	.242	.604
Perceived competence with SBRI	.023	.238	.925

Note. * $p < .05$.

Last, the association of teacher characteristics with the quality of their innovation of content was tested. These models found the same results as the previous models. None of the teacher characteristic variables were predictive of the quality of their innovations with content (see Table 5) or instruction (see Table 6*)*.

Table 5. *Results of the Model with Teacher Characteristic Variables Predicting Quality of Innovations with SBRI Content*

Variables	*Coefficient*	*se*	*p Value*
Grade Level			
Kindergarten	-.022	.430	.960
1st grade	.507	.449	.269
Teacher characteristics			
Flexible Thinking	-.359	.370	.341
Autonomy Support	.028	.167	.870
Attitude toward SBRI	-.037	.249	.882
Perceived competence with SBRI	-.011	.245	.965

Note. * $p < .05$.

Table 6. *Results of the Model with Teacher Characteristic Variables Predicting Quality of Innovations with SBRI Instructional Components*

Variables	*Coefficient*	*se*	*p Value*
Grade Level			
Kindergarten	-.036	.452	.938
1st grade	.587	.472	.225
Teacher characteristics			
Flexible Thinking	-.389	.389	.326
Autonomy Support	.016	.176	.930
Attitude toward SBRI	-.001	.262	.997
Perceived competence with SBRI	.056	.257	.828

Note. * $p < .05$.

These results suggest that teachers' instructional choices when it comes to implementing SBRI are not influenced by the teacher variables that were included in this study. In addition, the hypotheses that these teacher variables would predict their heuristic implementation (positive association with innovation and quality of innovation)

and predict their algorithmic implementation (negative association with innovation and quality of innovation) were not supported.

Model 2

Model 2 tested the predicted association between the teacher characteristic variables (flexible thinking, perceived autonomy support, perceived competence with SBRI, and attitude toward SBRI) and student achievement in reading. Specifically, I expected that this association would be mediated by 2 of the implementation variables, congruence with SBRI and innovation with SBRI. The following conditions must be met in order for mediation to occur: (1) the direct association between teacher characteristics and the 2 implementation of SBRI variables is statistically significant, (2) the direct association between teacher characteristics and student achievement is statistically significant, (3) the direct association between the implementation variables and student achievement is statistically significant, and (4) the association between teacher characteristics and student achievement shrinks upon the addition of the implementation variables to the model.

To test for mediation, these 4 conditions were tested in order. Multilevel modeling (2-level HLM) was used for this analysis, as discussed in Chapter 3. The first condition was already tested in Model 1 and none of the teacher characteristic variables were found to be predictive of their implementation of SBRI (see Tables 1-6). Therefore, because at least 1 of the conditions for mediation was not met, the mediation hypothesis was not supported. It appears that these implementation variables do not mediate the relationship between teacher characteristics and their students' achievement. However, although none

of the characteristic variables was found to be predictive of their implementation, I wondered if they were predictive of their students' achievement, an association that would have been tested by condition #2 of the mediation model. The next section outlines the results from this post-hoc test.

First, a null model was tested, with only student achievement in reading included as the outcome. The null model represents the multilevel model without any predictor variables. This model provides a baseline for all of the other models by providing initial variance estimates for levels 1 and 2. Results are summarized in Table 7.

Table 7. *Results of the Null Model with EOY Reading Achievement as the Dependent Variable*

Fixed Effect		*Coefficient*	*se*	*p Value*
Average class mean, γ_{00}		.754	.045	.000
Random Effect	*Variance*	*df*	χ^2	*p Value*
Class mean, u_{0j}	.260	34	820.464	.000
Level-1 effect, r_{1j}	.211			

Next, the predictor variables were added to the model. The teacher characteristic variables were added at level-2 along with the control variables, BOY (at level-1) and grade level (at level-2). This analysis revealed that none of the teacher characteristic variables were significantly associated with student achievement, controlling for BOY and grade level (see Table 8).

Table 8. *Results of the Model with Teacher Characteristic Variables Predicting Student Achievement in Reading*

Fixed Effect	*Coefficient*	*se*	*p Value*
Intercept, γ_{00}	.384	.144	.013
Kindergarten, γ_{01}	.480	.040	.000*
1st grade, γ_{02}	.453	.042	.000*
Flexible Thinking, γ_{03}	-.052	.034	.131
Autonomy Support, γ_{04}	-.016	.015	.308
Attitude toward SBRI, γ_{05}	.037	.022	.112
Perceived Competence with SBRI, γ_{06}	.014	.022	.524
Effect of BOY, γ_{10}			

Note. * $p < .05$.

However, like in the English study analysis, I wondered if the implementation of variables might have a direct impact on student achievement, as would have been tested by condition #3 in the mediation model. The following section describes how this association was tested.

First, the null model was tested. As this model is the same as the null for the previous model, please refer to Table 5 for results. Next, as before, the 2 implementation variables (congruence with SBRI and innovation with SBRI) were each broken down into 2 subscales (content and instruction), for a total of 4 implementation variables. When the direct association of each of these variables was assessed, along with the control variables, the results revealed that none of the implementation variables had a direct impact on student achievement. The only variables that were significant were grade level (first grade, $b = .467$, $p = .000$ and second grade, $b = .423$, $p = .000$). In this study, there was not a significant association between these implementation variables and student achievement. However, the strength of the relationship of grade level to student achievement, having even more of an impact than their beginning of year score (BOY),

suggests that there may have been considerable differences in the instruction and/or assessments between the grade levels which effected students' achievement.

Table 9. *Results of the Model with Implementation Variables Predicting Student Achievement in Reading*

Fixed Effect	*Coefficient*	*se*	*p Value*
Intercept, γ_{00}	.261	.099	.014
Kindergarten, γ_{01}	.467	.045	.000*
1st grade, γ_{02}	.423	.046	.000*
Congruence with SBRI Content, γ_{03}	-.024	.052	.649
Congruence with SBRI Instruction, γ_{04}	.041	.057	.485
Innovation with SBRI Content, γ_{05}	.032	.068	.643
Innovation with SBRI instruction, γ_{06}	-.030	.066	.650
Effect of BOY, γ_{10}	.310	.040	.000

Note. * $p < .05$.

As planned for the original mediational model, the association of each of the individual subscales of implementation of SBRI with student achievement was also assessed. For this analysis, a large set of variables would need to be present in the model to test for significance (18 variables total). However, because of the limited sample size, the number of variables in the HLM model should be kept to a minimum in order to preserve power and decrease the chances of a Type 1 error. An analysis that can determine which combination of variables is optimal to assess significance and yet is most parsimonious is appropriate for this analysis. Therefore, before using HLM to test this model, a backward linear regression model was used for a preliminary determination of which of the 18 variables was significantly related to student achievement. The backward linear regression method systematically eliminates variables that are the least

significant in the model one-at-a-time until only the significant ones are left. Results from the backward regression model revealed that the individual implementation subscales that were significantly associated with student achievement were: congruence with 90 minutes of reading instruction (b = .050, p = .035), congruence with assessments (b = -.078, p = .039), congruence with fluency instruction (b = -.068, p = .023, innovation with explicit instruction (b = .122, p = .035), innovation with fluency instruction (b = .076, p = .023), and innovation with comprehension instruction (b = -.111, p = .013). A summary of this analysis is provided in Table 10.

Table 10. *Results of the Backward Regression Model with Individual Implementation Variables Predicting Average Student Achievement in Reading by Class*

Variables	*Coefficient*	*se*	*p Value*
Congruence with SBRI			
90 minutes of instruction	.050	.022	.035*
Assessment	-.078	.035	.039*
Differentiation	-.037	.066	.585
Systematic instruction	-.012	.064	.855.
Explicit instruction	-.038	.045	.414
Phonics	-.019	.048	.696
Phonemic awareness	.032	.023	.178
Fluency	-.068	.028	.023*
Vocabulary	-.003	.076	.973
Comprehension	.018	.050	.729
Innovation of SBRI			
Differentiation	.102	.050	.051
Systematic instruction	.038	.046	.422
Explicit instruction	.122	.054	.035*
Phonics	-.078	.044	.087
Phonemic awareness	.006	.051	.915
Fluency	.076	.031	.023*
Vocabulary	.058	.053	.285
Comprehension	-.111	.041	.013*

Note. A backward linear regression procedure was used to determine which combination of variables was most parsimonious and most likely to produce significant results in the HLM

model. The significance levels for each of the subscales listed above represent the p value immediately prior to being deleted from the model. * $p < .05$.

The next step was to take the variables that were significant in the backward linear regression model and assess their significance in the multilevel model. All 5 of the implementation subscales that were found to be significant were added to the HLM model together, along with the control variables. Results from the multilevel model revealed that none of the individual implementation subscales were significantly associated with student achievement. The complete results from this multilevel model are presented in Table 11. Again, it appears that grade level has the greatest impact on student achievement.

Table 11. *Results of the HLM Model with Individual Implementation Variables Predicting Student Achievement in Reading*

Fixed Effect	*Coefficient*	*se*	*p Value*
Intercept, γ_{00}	.247	.090	.011
Kindergarten, γ_{01}	.458	.042	.000*
1st grade, γ_{02}	.440	.044	.000*
Congruence with SBRI			
90 minutes of reading instruction, γ_{03}	.044	.022	.061
Assessment, γ_{04}	-.038	.033	.254
Fluency, γ_{05}	-.041	.027	.139
Innovation of SBRI			
Explicit instruction, γ_{06}	.067	.049	.185
Fluency, γ_{07}	.055	.030	.078
Comprehension, γ_{08}	-.068	.038	.083
Effect of BOY, γ_{10}	.314	.040	.000

Note. Results from the backward analysis were used to determine which combination of variables was most parsimonious and most likely to produce significant results in this HLM model. Only the variables that showed a significant relationship to student achievement in the regression model were used in the HLM model. * $p < .05$.

Model 3

This model tested the predicted association between innovation of SBRI and student achievement in reading. I expected that this relationship would be moderated by the quality of the innovations that teachers used. Recall that in order for the moderator hypothesis to be supported the interaction of innovation of SBRI and quality of innovation must be significantly associated with student achievement in reading (Baron & Kenny, 1986). To test the moderator hypothesis, innovation and quality of innovation were tested in the model, along with an interaction term for both. As with the previous analyses, the implementation variables were divided into 2 subscales (content and instruction), for a total of 4 implementation variables. Model 3 tested the main effect for each subscale as well as an interaction term for each. As with previous models, a limited number of variables could be included in the model at any one time to maintain sufficient power for the analysis. Therefore, each subscale was tested separately, using 4 different models. First, the main effects and interaction for innovation of content and quality of innovation of content was assessed, along with the control variables. Results revealed that neither the main effects nor the interaction were not significant. It appears that the quality of innovations with content does not mediate the relationship between innovations of content and student achievement in reading. Results are summarized in Table 12. The moderator hypothesis was not supported for these variables.

Table 12. *Results of the Model with Innovation of Content and Quality of Innovation of Content Predicting Student Achievement in Reading*

Fixed Effect	*Coefficient*	*se*	*p Value*
Intercept, γ_{00}	.724	.225	.004
Kindergarten, γ_{01}	.480	.039	.000*
1st grade, γ_{02}	.429	.042	.000*
Innovation SBRI Content, γ_{03}	-.120	.093	.206
Quality of Innovation of SBRI Content, γ_{04}	-.139	.072	.064
Interaction term, γ_{05}	.039	.020	.056
Effect of BOY, γ_{10}	.314	.040	.000

Note. * $p < .05$.

Next, the main effects and interaction for innovation of instruction and quality of innovation of content was assessed, along with the control variables. Results revealed that neither the main effects nor the interaction were significantly associated with student achievement in reading. The moderator hypothesis was not supported with these variables. Results are summarized in Table 13.

Table 13. *Results of the Model with Innovation of Instruction and Quality of Innovation of Content Predicting Student Achievement in Reading*

Fixed Effect	*Coefficient*	*se*	*p Value*
Intercept, γ_{00}	.647	.221	.007
Kindergarten, γ_{01}	.481	.040	.000*
1st grade, γ_{02}	.425	.043	.000*
Innovation of SBRI Instructional components, γ_{03}	-.066	.067	.332
Quality of Innovation of SBRI Content, γ_{04}	-.147	.087	.103
Interaction term, γ_{05}	.032	.019	.099
Effect of BOY, γ_{10}	.313	.040	.000

Note. * $p < .05$.

Next, the main effects and interaction for innovation of content and quality of innovation of instruction was assessed, along with the control variables. Results revealed that neither the main effects nor the interaction term was significant. The moderator hypothesis was not supported with these variables. It appears that the quality of innovations of instruction does not moderate the association between innovation of content and student achievement in reading. Results are summarized in Table 14.

Table 14. *Results of the Model with Innovation of Content and Quality of Innovation of Instruction Predicting Student Achievement in Reading*

Fixed Effect	*Coefficient*	*se*	*p Value*
Intercept, γ_{00}	.635	.232	.011
Kindergarten, γ_{01}	.477	.040	.000*
1st grade, γ_{02}	.425	.043	.000*
Innovation of SBRI Content, γ_{03}	-.123	.089	.180
Quality of Innovation of SBRI Instruction, γ_{04}	-.085	.068	.218
Interaction term, γ_{05}	.032	.020	.124
Effect of BOY, γ_{10}	.314	.040	.000

Note. * $p < .05$.

Next, the main effects and interaction for innovation of instruction and quality of innovation of instruction was assessed, along with the control variables. Results revealed that neither the main effect nor the interaction term was significant. The moderator hypothesis was not supported with these variables. Results are summarized in Table 15.

Table 15. *Results of the Model with Innovation of Instruction and Quality of Innovation of Instruction Predicting Student Achievement in Reading*

Fixed Effect	*Coefficient*	*se*	*p Value*
Intercept, γ_{00}	.462	.198	.027
Kindergarten, γ_{01}	.474	.042	.000*
1st grade, γ_{02}	.424	.044	.000*
Innovation of SBRI Instruction, γ_{03}	-.047	.068	.493
Quality of Innovation of SBRI Instruction, γ_{04}	-.052	.080	.519
Interaction term, γ_{05}	.016	.017	.353
Effect of BOY, γ_{10}	.313	.040	.000

Note. * $p < .10$, ** $p < .05$.

Summary of Analyses

Model 1

There was not a significant association between any of the teacher characteristic variables and their congruence with SBRI content. The only teacher characteristic variable that was significantly associated with their congruence with SBRI was the instructional components of SBRI was perceived autonomy support ($b = .352$, $p = .004$).

When the association of teacher characteristics with their innovation of SBRI content was tested, as before, none of the teacher characteristic variables were significantly associated with the content subscale. Similar to the previous instructional components model, the results for the instructional components category of innovation of SBRI revealed that teachers' perceived autonomy support was significantly associated with their innovation with the instructional components of SBRI ($b = .369$, $p = .004$). In addition, teachers' flexible thinking was significant as well ($b = .486$, $p = .030$).

In addition, teachers' perceived autonomy support was found to be significantly positively associated with the quality of their innovations with SBRI content ($b = .253$, p

= .049). Findings revealed that teachers' perceived autonomy support was significantly associated with their innovation with the instructional components of SBRI as well (*b* = .362, p = .007).

Model 2

When testing the conditions for mediation, this analysis revealed that none of the teacher characteristic variables were significantly associated with student achievement, after controlling for BOY and grade level. Therefore, because at least 1 of the conditions for mediation was not met, the mediation hypothesis was not supported.

A subsequent analysis revealed that when the direct association of each of the implementation variables was assessed, along with the control variables, congruence with SBRI content was statistically negatively associated with student achievement (*b* = -.082, p = .003) and congruence with SBRI instructional components was significantly positively associated with student achievement (*b* = .073, p = .040). Innovation of SBRI content was also found to be positively significantly associated with student achievement (*b* = .064, p = .042) but innovation of SBRI instructional components was not found to be significantly associated with student achievement. When the individual subscales for the implementation variables were tested, congruence with explicit instruction (*b* = .081, p = .001), congruence with phonics instruction (*b* = -.067, p = .001), innovation with systematic instruction (*b* = -.049, p = .025), and innovation with phonics instruction (*b* = .095, p = .008) were all found to be statistically significant.

Model 3

The moderator hypothesis was tested for the quality of innovations with SBRI content first. The interaction between innovation of SBRI content and quality of innovation of SBRI content was found to be significant (b = .037, p = .046). When the interaction for innovation of SBRI instructional components and quality of innovation of SBRI content was assessed, it was not significant and the moderator hypothesis was not supported. Next, the moderator hypothesis for quality of innovations with SBRI instructional components was assessed. When the interaction for innovation of SBRI content and quality of innovation of SBRI instructional components was assessed, it was found to be significant (b = .046, p = .009). When the interaction for innovation of SBRI instructional components and quality of innovation of SBRI instructional components was assessed, results revealed that it was not significant. The moderator hypothesis was not supported for these variables.

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Vita

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