

2010

# The Impact of Principial Training in Diffusion of Innovation Theory on Fidelity of Implementation

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**The Impact of Principal Training in Diffusion of Innovation Theory on Fidelity of  
Implementation**

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**Submitted in Partial Fulfillment  
of the Requirements for the Degree  
Doctor of Education**

**Executive Ed.D. Program  
K-12 School Administration  
Seton Hall University**

**2010**

**SETON HALL UNIVERSITY**  
**COLLEGE OF EDUCATION AND HUMAN SERVICES**  
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## ACKNOWLEDGEMENT

I wish to acknowledge Dr. Daniel Gutmore for his patience and guidance throughout this process. I have learned an immeasurable amount about myself as a person and as an educator while writing this dissertation. I also wish to acknowledge the Executive Ed. D. program as a whole. The program that Dr. Caulfield has created has provided me with the greatest professional experience of my life. The format, the instructors, the class schedule, and other aspects have all made for an exceptional experience. I thank my cohort members for their inspiration and support and my instructors for their patience and wisdom.

I also wish to thank Heather, for her undying belief in me as an educator and as a person. I try to be the educator she is, and I can only dream of being the person she is. I thank her for her persistence, her patience, her guidance, and her love. Collectively, they have been the greatest gifts of my life. This dissertation simply would not have happened without her.

## Abstract

### The Impact of Principal Training in Diffusion of Innovation Theory on Fidelity of Implementation

Districts and schools are constantly trying to find ways to increase student achievement. Research has shown a significant correlation between principal leadership skills and increased student achievement. Research has also shown a correlation between fidelity of implementation of new innovations and positive outcomes. This purpose of this study is to examine the correlation, if any, between principal knowledge of diffusion of innovation theory and the level of fidelity of implementation of a new innovation in the school. Since the significance of the quality of principal leadership is already established, and a link between successful implementation and improved outcomes recognized, then a correlation between the principal's ability to efficiently diffuse an innovation during the implementation phase of that innovation in classrooms would be significant to schools when adopting new programs or practices. A quantitative measure will be used to determine the level of fidelity of implementation in classrooms with principals receiving training on the theory and in classrooms with principals that had not received additional training. Recommendations on professional development of principals and stages of implementation will be made based on the outcomes of the study.

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## CHAPTER I – INTRODUCTION

### Background

School improvement efforts are almost as old as schools themselves. Improving student achievement is not an invention of No Child Left Behind, Title 1, the Elementary and Secondary Education Act, or any other specific movement of the last century. It has been a goal of school reformers for nearly 200 years. Early attempts to improve student achievement were structural in nature. Compulsory attendance laws became popular in the nineteenth century (Tyack & Cuban, 1997). Calls for change continued to follow through the decades, sometimes moved by educational theorists such as John Dewey, who wished to move the purpose of schooling away from the needs of society to the growth of the child.

Sometimes changes were demanded by world events, such as the launching of Sputnik in 1957. Despite the world-encompassing events of World War II and post-war Europe, American education had changed little during the early years of the Cold War (Burkhart, 1959). This changed dramatically with the launch of Sputnik, the first man-made object to be launched into orbit and, in essence, the world's first intercontinental ballistic missile. The United States was suddenly shaken out of its complacency of technological superiority and massive attention was directed towards the American education system (Burkhart, 1959). The Sputnik launch had become a historical turning point in American education (Bybee, 1997). For the public, it symbolized a threat to American security, to our superiority in science and technology, and to our progress and political freedom. In short, the United States perceived itself as scientifically, technologically, militarily, and economically weak. As a result, educators, scientists, and mathematicians broadened and accelerated educational reform, the public understood and supported the effort, and



policy makers increased federal funding (Bybee, 1997). In 2003, Marsh and Willis noted (p. 52), “ If Sputnik demonstrated the superiority of Soviet military technology, then, many people argued, that superiority must rest on a superior educational system, particularly in subjects on which technology rests, such as the sciences and mathematics. Based on this kind of reasoning, calls were quickly issued for American schools to train a new and better generation of scientists and mathematicians and to improve the teaching of other subjects as well. This emphasis fit neatly with the trend toward subject-centered curricula that had been building since World War II; only now national security, if not survival itself, seemed to demand nothing less”.

Sometimes changes were dictated by politics, such as seen with No Child Left Behind. President George Bush’s desire to be the “Education President” finds its roots in 1980s Texas. The Texas education system is one of high accountability through standardized testing (Ellis, 2007). This testing decided student promotion, teacher and administrator evaluations and superintendent salary (Ellis, 2007). The architect of NCLB was Secretary of Education, Margaret Spellings. During President George W. Bush’s first term, Spellings served as Assistant to the President for Domestic Policy where she helped craft education policies, including the No Child Left Behind Act. Her previous position was Governor George W. Bush’s Senior Advisor with responsibility for developing and implementing Texas’s education policy, including overseeing the nation’s strongest school assessment and accountability system (Ellis, 2007).

But many changes were less than giant waves like the ones above. Many were, and are, ripples in the water, trying to coax movement along. Examples of such change ripples

that are currently reaching the shores of schools are Professional Learning Communities and Response to Intervention.

Recent methods for improving student achievement have congregated around several large topics: professional development, new practices, new materials, mandated programs, and new roles for leadership. School districts have routinely followed the formula of improving student achievement through the practices of sending teachers to workshops, adopting “proven best practices”, and purchasing “research based” programs. The Federal Government and many State Governments have mandated programs to improve student achievement such as Title 1 and Head Start. Districts invest millions of dollars in program purchases and teacher training. However, once this investment is made, there is often precious little effort made to ensure that the program takes root and that teachers are both well intentioned and well supported in implementing the new program or practice. There has been a historic assumption that once a program was selected and teachers were trained, that the program would be “implemented or used more or less as planned” (Fullan, 1977). Until very recently, it was assumed that those adopting a new program would implement the program exactly as others had before them (O’Donnell, 2008). Rogers explains in *Diffusion of Innovations* (2003) that new implementers were “considered to be rather passive acceptors of an innovation, rather than active modifiers of a new idea.” In actuality, the successful implementation of a planned innovation depends significantly on the efforts of those planning and supervising the implementation.

Also in the past few decades, a greater emphasis has been placed on the principal as a teacher leader. The person, who used to simply be in charge of managing the school, is

now to be its lead teacher and instructional leader. School leaders today must be “educational visionaries, instructional leaders, curriculum and assessment experts” (Darling-Hammond, LaPointe, Meyerson, & Orr, 2007). Some literature suggests a connection between the two issues of program implementation and the successful principal. Virgilio and Virgilio (2001, p.4) state that “as instructional leader of his school, the principal is the major determiner of the success of innovation” and that “success or failure in implementing a new curriculum falls heavily on the shoulders of the school principal.” However, this literature focuses on the principal as a motivator and evaluator in the implementation process.

## The Problem

With desire for improved student achievement reaching new heights in this era of accountability, new programs are being purchased and new practices are being adopted at an exceptional rate. Districts are investing significant amounts of taxpayer money on “research based” programs and practices, but investing too little on the assurance that such programs are being implemented with integrity and effort. This study will determine the effect of the training of principals on diffusion theory, on the fidelity of implementation of that practice in the classroom, as measured by short term behavior changes, and discuss if such training of principals is a valid and effective assurance of program implementation integrity. Diffusion theory is defined by Everett Rogers as “the process in which an innovation is communicated through certain channels over time among the members of a social system” (2003, p.5). For this study, the innovation will be an instructional practice in an elementary school classroom and the members of the social system will be the classroom teachers.

## The Purpose

The primary purpose of this study is to determine the effect principal training of diffusion theory has on the fidelity of implementation of an instructional practice in classrooms of their school as measured by short term behavior changes and to examine the role of the principal in the implementation process. Fidelity of implementation refers to the “demonstration that an experimental manipulation is conducted as planned” (Dumas,

Lynch, Laughlin, Phillips Smith & Prinz, 2001). An innovation can be said to have successful fidelity of implementation if “it can be shown that each of its components is delivered in a comparable manner to all participants and is true to the theory and goals underlying the research” (Dumas, et al, 2001). Aside from the principal simply being a successful motivator or intimidating evaluator, this study is to analyze the effect that a principal with a strong understanding of how innovations are diffused would have on the successful implementation of a program by his or her teachers. The study will review the relevant literature regarding the relationship between successful implementation of a program or practice and increased student achievement to show the relevance of studying actions that may impact the successful implementation of any program or practice.

#### Research Question and Ancillary Questions

The primary focus of this study is to determine what impact, if any, the training of building principals has on the fidelity of the implementation of a new instructional practice. Therefore, the primary research question is, “To what extent does principal training on diffusion of innovation theory have on the fidelity of implementation of that practice in their school as measured by short term behavior changes?” Several ancillary questions are suggested through speculation and review of relevant literature. First, the research suggests that successful principals are effective change agents (Virgilio and Virgilio, 2001). To be a successful change agent, a principal must have an extensive interpersonal skill set. He or she must be able to determine strategies needed for commitment to change in a variety of environments (Patterson and Czajkowski, 1979).

The principal must have strong communication skills and be adept in political maneuvering. The extent to which such skills are present in a principal may influence the impact of any innovation implementation efforts. Therefore an ancillary question must be, "To what extent does the experience level of a principal have on the level of implementation of a new practice in their building?" Simply put, will more experienced principals have greater implementation integrity than less experienced principals? Second, new teachers may be more compliant with implementing a program mandated by a principal and veteran teachers may be more skeptical. In the same vein, newer teachers may be more likely to implement a new program with greater integrity simply because they do not have the experiential background to alter the delivery of the program, while a veteran teacher may make subtle or significant modifications based on the experience and knowledge they have accumulated. A second ancillary question would then be, "To what extent does the experience of the teacher have on their level of implementation?" The impact of both of these ancillary questions will be addressed through the methodology of the study.

### Limitations of the Study

Several limitations to this study must be considered. First, the study is unable to measure or gauge the effect of a prior relationship of the principal with the teachers. With the amount of literature that stresses the importance of relationship building skills for the successful school leader, the efficacy of the principal prior to implementation of a new practice could influence the integrity of the implementation. A well-liked, well-

respected school principal may have developed relationships and a school climate that allows the diffusion of an innovation or the implementation of a new practice to be more successful. While this limitation will be controlled to the extent possible as described in the Methods section, it seems likely that there is a correlation between prior principal credibility and successful implementation of a new program.

Second, this study required training to be provided to the Principals in the treatment group. This training, on Diffusion of Innovation Theory and the potential use in a public elementary school setting, had to be provided by someone thoroughly familiar with Rogers' Diffusion of Innovation Theory and thoroughly familiar with the implementation challenges of a new educational program. Within the scope of this study, the best available person for this was the primary investigator and author of the study. This limitation puts the primary investigator in a role where his performance as a trainer potentially impacts the outcome of his own study. Furthermore, the primary investigator is also the immediate supervisor of the principals being trained. This calls into the question the extent of the Hawthorne Effect, where the subjects of a study improve or modify an aspect of their behavior being experimentally measured simply in response to the fact that they are being studied. I believe that the Hawthorne Effect is minimized in this case however, due to the fact that directives from the primary investigator to the principals is a routine interaction (due to their supervisory-subordinate relationship) and the intent of any directive, whether measured in a study or as part of the normal course, is complied to with full vigor.

An additional limitation to the study is the inability to identify a causal link between effective implementation of new program and increased student achievement. This

limitation will be analyzed carefully in the literature review in order to shed some light on the subtle but significant question as to the relationship between integrity of implementation and student success. Does successful implementation means increased student success? This study will not measure student achievement, only level of implementation, so it will not answer this question. However, the literature review will provide important analysis of this.

### Significance of the Study

“Implementation is where productive change in curriculum and instruction happens or falls apart” (Joyce & Showers, 2002).

This study will have significance to principals, superintendents, school boards, and any member of a school district in charge of curriculum, instruction, or staff development. If the literature shows a positive correlation between the integrity of the implementation of a new program or practice and increased student achievement, then the results of a study on the impact of principals’ diffusion theory training on successful implementation of a program or practice would be significant.

### Conceptual Framework

The framework for this study is the practical application of time and resources for the successful implementation of new program in schools. An environment that is conducive to the adoption of an innovation in a timely and efficient manner will be able to allocate additional time and resources to starting new initiatives or further strengthening existing



ones. The skill set of the instructional leader, in this case the building principal, in creating an environment that encourages the acceptance of innovation is paramount to successful school change. An understanding of Diffusion Theory, how it applies to an educational innovation, and how such innovation can be encouraged to flourish in an educational environment may prove to be invaluable.

The amount of time and effort put forth by school districts in implementing new programs is enormous. In-service days are negotiated into contracts for the expressed purpose of providing training time for teachers. This training often focuses on a new program or practice adopted by the district. Curriculum and materials are reviewed on a regular basis in most districts and, during this review, new materials are often suggested. Schools are in a constant state of change. New research brings new programs and new practices to the list of “research based programs” and “best practices”. No Child Left Behind and other accountability pressures continue to cause professional development planners and instructional leaders to look for the next “best thing”. The failed implementation of these programs is often the reason that other, newer programs are then sought after in successive years.

The results of this study would inform multiple groups in the educational arena. Based on the results, staff developers may be looking to add diffusion theory training for principals to the professional development plan; “diffusion plans” would be a consideration during the planned implementation of a new program or practice, and principals may desire to strengthen their knowledge of diffusion of innovation and change theories to improve their implementation practices.

### Literature Omitted from Review

The literature review process focused on diffusion theory, the role of the Principal in program implementation, and the correlation between successful implementation and student achievement. During the course of this process, several recurring themes and connected topics were reviewed and omitted.

Professional development of staff certainly impacts the ability of a teacher to effectively implement any program and ultimately impacts student achievement. Professional development literature on the impact on program fidelity and student achievement was omitted from this literature review because this study looks to explore the impact of a very specific variable in the implementation process; the level of understanding of diffusion theory on the part of the principal. There is an assumption that all of the teachers that will participate in the interview protocol during this study have had equal access to professional development on the particular innovation. This allows the professional development of the teacher on that innovation to be controlled. Whether the professional development is inadequate or exceptional is not a variable since all teachers are receiving the same opportunities. In this light, the effectiveness of professional development programs or techniques is not relevant to this particular study.

The successful principal is also a factor in student achievement. Attributes of successful principals are well detailed in the literature, as is the connection between successful principals and student achievement. Literature on these attributes was omitted from this literature review because this study focuses on a single characteristic of the principal, their knowledge of diffusion theory. While there is some overlap between

characteristics of successful principals and aspects of diffusion theory, particularly in consensus building and interpersonal skills, this literature was not relevant to this study due to the specific nature of diffusion theory structure and its particular absence in education innovation discussions.

“Communities of innovation” is a term that describes a societal group that structurally embraces, supports, and encourages innovation among its members. While very intriguing in its connections to diffusion theory, communities of innovation literature was omitted from this literature review as it pertains to creating and sustaining an environment conducive to embracing continued innovation. Again, this is intriguingly connected to diffusion theory, however the purpose of this study is to assess the impact of principal knowledge of how an innovation is effectively diffused on the implementation of a specific new program in a school. It is not about how to create an environment conducive to successive or continued innovation.

Lastly, implementation of technology is a topic of great interest in recent literature. With the embracement of computers in society and the exciting possibilities that technology in the classroom brings, implementation in the classroom is receiving a great deal of interest. Literature on technology implementation strategies was omitted from this review because of the nature of what is being implemented. Implementing technology with equipment that a teacher has never seen or used, to accomplish a task the teacher was never trained for, in an age that is foreign to the teacher who attended school before such technology existed, is a very different issue than implementing a reading instruction innovation with a veteran teacher who has been teaching reading for a decade, was trained to teach reading, and was taught how to read when they were in school.

Because of this, the techniques used to diffuse technological innovations in schools are less relevant and therefore omitted. In addition, because of the relative “newness” of technology and its pervasiveness in classrooms, any such literature may be premature and speculative.

### Definition of Terms

*Adaptation* – The alteration or modification of a practice or program during the implementation process.

*Adoption* – A decision to make full use of an innovation as the best course of action.

*Diffusion of Innovation* – The process in which an innovation is communicated to members of a system over time.

*Fidelity of Implementation* – The determination of how well an intervention is implemented in comparison with the original program design.

*Innovation* – An idea, practice, or object that is perceived as new by a group.

*Program Implementation* – The introduction of a new practice or material program through training and defined plan or procedure.

## CHAPTER II – LITERATURE REVIEW

This chapter will provide a review and analysis of the relevant literature and research on the subject. The literature to be reviewed will focus on three distinct areas relevant to a study of the role of principal's knowledge of diffusion theory and the successful implementation of a new practice in the school. The three key areas of literature are: 1) defining diffusion of innovations theory, 2) defining and measuring effective implementation of new programs, practices, and innovations in schools, 3) the role of the principal in the school, and 4) the correlation between successful implementation of programs, practices, and innovations in schools and student achievement. Each of these key areas plays an important role in the significance of the study.

Since improved student achievement is the goal of program implementation, the correlation between the two is significant. Research on the role of the principal in improved student achievement and the role of the principal in program implementation will help frame the problem statement, identify research questions, and interpret the results of the study. Defining effective implementation and identifying credible measurement tools for successful implementation of a new practice is essential for data gathering and interpretation of results.

## Diffusion Theory

Everett Rogers defines diffusion as “the process in which an innovation is communicated through certain channels over time among the members of a social system” (2003, p.5) and identifies the four main elements of diffusion of innovations as the innovation itself, communication, time, and the social system adopting the innovation. Diffusion theory refers to multiple aspects of the diffusion process, how those aspects interact, facilitate or impede adoption of an innovation, and how they can be controlled or manipulated to maximize adoption (Surry, 1997). While diffusion theory has had several important proponents, there is not a singular accepted definition of diffusion theory. Diffusion theory is both relatively new and has had varied applications. It has been applied to areas as different as farming techniques in Midwest America, water boiling in Peruvian villages, prevention of scurvy in the British Navy, and the use of cell phones worldwide. In 1960, Everett M. Rogers presented the most comprehensive “unified” theory of diffusion in his book *Diffusion of Innovations* (Surry, 1997). The Rogers book is currently in its fifth edition, published in 2003. Rogers (2003) discusses four main aspects of Diffusion Theory, the Innovation-Decision Process, the Attributes of Innovations, the Categories of Adopters, and the Change Agent.

### The Innovation – Decision Process

During the Innovation-Decision Process (Rogers, 2003), the decision maker or makers move from an initial understanding of an innovation to seeking reinforcement that the decision was the right one. Between those two stages, the decision makers move through other stages that include the *persuasion stage*, where individual decision makers are

persuaded positively or negatively toward the innovation, the *decision stage*, where decision makers conclude that the innovation should be adopted (or rejected), and the *implementation stage*, where the innovation is put into practice (Rogers, 2003).

The first stage, the *knowledge stage*, can come about two different ways. There may be a perceived need that encourages someone to seek out an innovation to address the need, or someone may become aware of an innovation outside of the perception of a need (Rogers, 2003). For example, my knowledge that there is a faster way to access the Internet than a dial-up connection could come from my need to have a faster speed for my home office, which led to my researching an innovation such as a cable modem. The same knowledge could also have come from a discussion with my neighbor regarding a video that I couldn't see clearly over the Internet, but he could. When he explains a cable modem to me, I become aware of an innovation before I had a perceived need.

During the second stage, the *persuasion stage*, an individual or group actively seeks out additional information on the innovation in order to inform themselves of the advantages and disadvantages of the innovation. This is not persuasion from an outside source, but persuasion through information (Rogers, 2003). In my modem example, I would seek out other opinions, read reviews in magazines, and look for other avenues of information regarding the innovation.

During the third stage, the *decision stage*, an individual or group decides, based on the information gathered in the previous stage, whether or not to pursue the innovation, leading to the *implementation stage*, where the innovation is put into practice (Rogers, 2003).

Within the implementation stage is a sub-stage that Rogers calls *re-invention* (2003, p. 180). Re-invention refers to “the degree to which an innovation is changed or modified by a user in the process of its adoption and implementation” (Rogers, 2003). Re-invention, and its desirableness, will vary greatly across industries. A medical protocol should have minimal, if not non-existent, levels of re-invention. Sales marketing techniques may benefit from the “tinkering” of the protocol by an experienced salesperson. In education, re-invention may be beneficial as the innovation is adjusted by an experienced teacher, or modified for differing student populations. However, re-invention can be of great concern to educational innovators. While teacher experience is an excellent source for positive modifications, the core elements of any innovation must survive in the eyes of the decision makers. The core elements are defined as the features that are responsible for the innovation’s effectiveness (Kelly, Sogolow, and Neumann, 2000). While allowing re-invention increases the likelihood of continued adoption in an education setting (Berman and Pauly, 1975), it is more likely that the innovation will change dramatically to fit the social climate of the school, rather than manipulated to increase the effectiveness of the innovation (Berman and McLaughlin, 1974). Lastly, at the *confirmation stage*, adopters are looking for reinforcement that the decision was the appropriate one for the organization.

#### The Attributes of the Innovation

Rogers (2003, p. 221) defines the rate of adoption of an innovation as “the relative speed with which an innovation is adopted by members of a social system. One of the goals of a building administrator during the implementation of a new program or practice in their school is to maximize the relative speed that the program or practice is faithfully adopted



by the teachers. Thus, the factors that impact the rate of adoption would be important knowledge for such administrators. The perception of several attributes of an innovation impact the rate of adoption of that innovation greatly. Up to 87% of the variance in the rate of adoption of an innovation can be explained by five attributes (Rogers, 1995).

Those five attributes are the relative advantage of the innovation, the compatibility of the innovation to current practice, the complexity of the innovation, the ease of trying the innovation, and how readily observable the benefits of the innovation are to others. The chart below summarizes Rogers' (2003, p. 229-266) explanations of the five attributes of innovations that influence the rate of adoption.

Attribute	Influence	Relationship to Rate of Adoption
Relative Advantage	Degree to which an innovation is seen as advantageous to a current practice	Positive – the greater the perceived relative advantage, the greater the rate of adoption
Compatibility	Degree to which an innovation is seen as compatible to the current needs, culture, and philosophy of the organization	Positive – the greater the perceived compatibility, the greater the rate of adoption
Complexity	Degree to which an innovation is perceived as difficult to adopt and to use by the potential adopters	Negative – the greater the perceived complexity, the weaker the rate of adoption
Ability for Trial	Degree to which an innovation can be tried and experimented with by potential adopters	Positive – the greater the flexibility for trial, the greater the rate of adoption
Ability to Observe	Degree to which the outcomes of an innovation are observable by potential adopters	Positive – the greater the opportunity to observe the outcomes, the greater the rate of adoption

Within the above attributes are significant factors for building administrators to be aware of if their goal is to increase the rate of adoption of an innovation in their school. Within the relative advantage attribute, the principal is in a unique position to promote the

relative advantages of an innovation and impact the positive relationship between that and the rate of adoption. Experts in diffusion research find that relative advantage is one of the most potent influencers on rate of adoption (Rogers, 2003). Innovations perceived as having the greatest reward and the least risk will be accepted most rapidly (Fliegel & Kivlin, 1966). Characteristics of an innovation that are absent from the current practice are the innovation's critical attributes. The more critical attributes are in number and in degree, the greater the positive impact on the rate of adoption (Zaltman, Duncan, & Holbek, 1973). Further impacting the perceived relative advantage of an innovation is the visibility of the critical attributes. The more visible the critical attributes are to potential adopters, the greater the impact on rate of adoption (Zaltman, et al, 1973).

Within the compatibility attribute, a principal can influence the perception of the compatibility of the innovation to the current practices, goals, culture, perceived needs, and beliefs. Recognizing that such connections can positively influence the rate of adoption, the principal can seek out, highlight, and encourage these perceptions to assist in recognition by potential adopters of the compatibility of the innovation. In particular, a building principal must recognize that the innovation must be compatible with perceived needs. Lewin's idea of "unfreezing" indicates an understanding on the part of potential adopters that there is something wrong with the status quo (Lewin, 1961). Couple this with the compatibility attribute, and the goal of the principal is to "unfreeze" the idea of the status quo and promote the compatibility of the innovation to the perceived need.

Within the complexity and ability for trial attributes, a principal can influence the rate of adoption by ensuring that consistent support is available and visible for early adopters.

This will both contribute to minimizing the perception of complexity and offering support for trials. The more complex the innovation is perceived by potential adopters, the greater the negative impact on the rate of adoption will be (Zaltman, et al, 1973). Ability for trial is more important to early adopters than later adopters as observing the early adopters acts as trial experience for later adopters (Ryan, 1948). Principals can also impact the ability to observe attribute by ensuring that all staff, not just the initial adopters, are in communication loops regarding the innovation.

Adoption of an innovation, as measured by number of adopters, generally produces a normal curve over time (Rogers, 2003). When graphed as *cumulative* adopters over time, the curve can be described as a S-shaped curve. The S-shaped curve is a recurring theme in diffusion studies (Mahajan & Peterson, 1985). The curve is formed because of the relative few that adopt very early in the life of an innovation, followed by a rapid increase in adopters as the process progresses (Mahajan & Peterson, 1985). As the adoption rate slows, the top part of the “S” is formed, The S shaped curve reflects the reluctance of early adoption, followed by an increase of adoptions as the number of adopters nears “critical mass”, and finally levels off as the diffusion of the innovation completes (Rogers, 2003). Assuming the S-shaped curve, the object of the principal is to “move the S” to the left of the graph, decreasing the amount of time to “critical mass” of adopters, in other words, increasing the speed of diffusion. Mahajan & Peterson (1985, p. 14) express the diffusion process as a mathematical equation with the speed of diffusion depending on, among other things, communication channels employed and the characteristics of the social system of the adopters. Mahajan & Peterson (1985, p. 15) further note influences on the diffusion model that they reflect in their mathematical

formula. With the addition of an additional variable for external influences, the formula reflects the impact forces from outside the adopting members will have on rate of adoption. Communication channels, outside agencies, and “salespeople” can impact the rate of adoption. From a school perspective, the communication channels can be communication directly from the principal or other outside forces regarding the adoption. Outside agencies and salespeople could refer to outside experts or consultants, in-service speakers or trainers. Taken this way, the building principal can impact the variable representing external influence and positively affect the rate of adoption of the innovation. Internal influence refers to “interpersonal communication or social interaction between prior adopters and potential adopters in the social system” (Mahajan & Peterson, 1985). Such communication pathways and structures can be encouraged by the principal through meetings, common planning time, sharing sessions, etc.

#### The Categories of Adopters

Rogers (2003, p. 281) places individuals into adopter categories, with each category having a different level of innovativeness. He states the importance of innovativeness as “the main objective of any change agency” (2003, p.268) and notes that innovativeness reflects a deliberate behavioral change, not just a change in attitude.

The importance of categorizing adopter categories is found in the ability of the change agent to understand and identify the characteristics present in their potential adopters and use the innovativeness of some members to the advantage of the whole group. The categories of adopters are summarized in the chart below.

Category	Key Attribute	Key Characteristics	Percentage of adopters
Innovators	Venturesome	<ul style="list-style-type: none"> <li>• Interest in new ideas</li> <li>• Communicates with other innovators</li> <li>• Ability to understand and apply new knowledge</li> <li>• Ability to cope with high degree of uncertainty</li> </ul>	2.5% (2 standard deviations from mean)
Early Adopters	Respect	<ul style="list-style-type: none"> <li>• High degree of opinion leaders</li> <li>• Respected by peers</li> <li>• Integrated into the member society</li> <li>• Often looked as a "role model"</li> </ul>	13.5% (1 standard deviation from mean)
Early Majority	Deliberate	<ul style="list-style-type: none"> <li>• Frequent interaction with peers</li> <li>• Not opinion leaders</li> <li>• Follow with "deliberate willingness" but seldom lead</li> </ul>	34%
Late Majority	Skeptical	<ul style="list-style-type: none"> <li>• Often adopt due to increased peer pressure</li> <li>• Approach innovation with skepticism</li> <li>• Innovation must be nearing the norm before adoption</li> </ul>	34%
Laggards	Traditional	<ul style="list-style-type: none"> <li>• Isolated from social networks</li> <li>• No opinion leadership</li> <li>• Have traditional values</li> </ul>	16% (1 standard deviation from mean)

Adapted from Rogers, 2003, p. 282-285

The purpose of recognizing each adopter category is so that change agents can tailor their efforts to each type, choosing the approach, support, and communication strategy based on the needs of that group (Rogers, 2003). The reasons for adoption vary between categories, and the change agent must be cognizant of the communication channels used

to influence each category. A change agent in a school may choose to concentrate efforts on the innovators and the early adopters, recognizing that the chance for successful adoption is greater with these groups. Rogers (2003, p. 296) calls this a strategy of least resistance. The antithesis of this strategy is called the strategy of greatest resistance, where the change agent concentrates their efforts on the group who would be the last to adopt in recognition that this group will need the most encouragement and support. Recognizing that each category will need a measure of communication and in different forms will be an essential tool for the principal attempting to influence the rate of adoption.

### The Change Agent

A change agent is someone who provides a relationship via a communication network between the innovation and its resources, and the potential adopters (Rogers, 2003). The roles of the change agent can be broken down into seven parts: create the need for change from current practice; establish communication networks to establish and ensure credibility of the change agent; diagnose potential problems and concerns likely to be encountered when promoting the innovation; motivate adopters towards the innovation; promote avenues for action through providing material and emotional support; stabilize and reinforce adoption during the individual's confirmation stage; and develop self-renewing behaviors in regards to the innovation, allowing the change agent to remove themselves from the process (Rogers, 2003). While passing through these seven roles, the change agent should be aware of aspects that impact the effectiveness of their efforts. Rogers (2003, p. 373-377) discusses four such aspects.

The *level of effort* of the change agent refers to the amount of time actually spent engaged in communication efforts with the potential adopters. Such efforts contribute positively to the increase in the rate of adoption.

The *orientation* of the change agent impacts the rate of adoption of an innovation. When the change agent is more adopter-oriented, they are more credible, have a greater relationship, and have more honest interactions. These attributes positively contribute to the rate of adoption.

The change agent should be aware of the perceived needs of the adopter and ensure *compatibility* of the innovation to those perceived needs. Without damaging the intended outcomes, the innovation should be adapted and marketed towards the needs of the adopter.

The change agent that possesses the ability to *empathize* has a greater positive impact on the rate of adoption. Empathy is the ability to identify with and understand another's situation and feelings. By empathizing, the change agent can positively impact a potential adopter's attitude towards an innovation and make them more comfortable with the change.

The ability of a change agent to communicate and to create and organize communication channels is critical to positively impacting the rate of adoption of an innovation (Zaltman, et al, 1973). This ability impacts all of the aforementioned attributes of innovations as well as the four stages of innovation diffusion. The ability to create effective communication channels is critical to the adoption process. Rogers (2003, p. 18-19) states, "Diffusion investigations show that most individuals do not evaluate an innovation on the basis of scientific studies of its consequences, although such objective evaluations

are not entirely irrelevant, especially to the very first individuals who adopt. Instead, most people depend mainly upon a subjective evaluation of an innovation that is conveyed to them from other individuals like themselves who have already adopted the innovation.” This statement means that primary communication is critical between a change agent and the innovator and early adopter groups. However, after that, positive, effective, communication channels are critical as the Early Majority and Late Majority members are targeted for adoption. These two groups make up over 60% of the potential adopter pool, and rely heavily on the communication from their peers who have already adopted the innovation. Providing communication channels for this to occur early, often, and effectively is critical. As diffusion reaches “critical mass” (at some point during the Early/Late Majority adopters), non-adopters become increasingly marginalized, increasing the pressure to participate in the adoption (Zaltman, et al, 1973). A change agent such as a principal has to be keenly aware of this need. Diffusion is a social process, requiring interpersonal communication among potential adopters (Rogers, 2003). Recognizing that diffusion is a social process, and that the majority of potential adopters look to their peers that have already adopted for guidance, the change agent seeking to increase the rate of adoption and the fidelity of its implementation needs to know what communication channels will serve that purpose best. Innovators seem to be the likely choice of a change agent to encourage peers to adopt an innovation. However, most innovators are seen as “different” from the social norm and are not looked to by their peers as professional role models. Because of this, their “role in diffusion (especially in persuading other to adopt the innovation) is very limited” (Rogers, 2003). Therefore, the principal as the change agent must look in the Early Adopter group for members who do



carry the credibility with their peers. Rogers (2003, p.26-27) call these members *Opinion Leaders*. This group, which may include Innovators, Early Adopters, or Early Majority members, provide information and opinions about innovations to the other members of the social system. The influence of opinion leaders is not created through formal hierarchical position or title. It has been created and maintained through social interactions with members. Change agents must be aware that opinion leaders can impact the rate of adoption both positively and negatively depending on the opinion leader's perceptions of the innovation. The critical quality of the opinion leader is their position in the communication channels of the social system. Information flows centrally to the opinion leaders, who then disseminate it to other members of the group. This makes the opinion leader's perspective on an innovation crucial as their perceptions will greatly influence many potential adopters during their decision making stage. A change agent must carefully identify and utilize these opinion leaders. As Rogers states (2003, p. 388), "The time and energy of the change agent are scarce resources. By focusing communication activities upon opinion leaders in a social system, the change agent can leverage these scarce resources and hasten the rate of diffusion of an innovation among clients."

#### Theorists and the Concepts of Diffusion and Change

Everett Rogers uses the term "change agent" to describe the person that has the single greatest impact on the success of the innovation diffusion process. In naming four key aspects of his diffusion theory, only the change agent is an actual individual. There is considerable research in the field of managing change in organizations and some significant theorists discuss the characteristics of such an individual.

Michael Fullan (2001) describes a framework for “thinking about and leading complex change” (p.3). This framework describes five leadership characteristics that are critical to effective leadership in an environment of change. Those five components are *Moral Purpose, Understanding Change, Relationship Building, Knowledge Creation and Sharing, and Coherence Making* (Fullan, 2001).

First, Moral Purpose refers to the need for the change agent to desire to make a positive impact on the lives of the people in his or her charge, including employees and customers, through their actions (Fullan, 2001). In a school setting, those people would include the teachers, the students, and the parents.

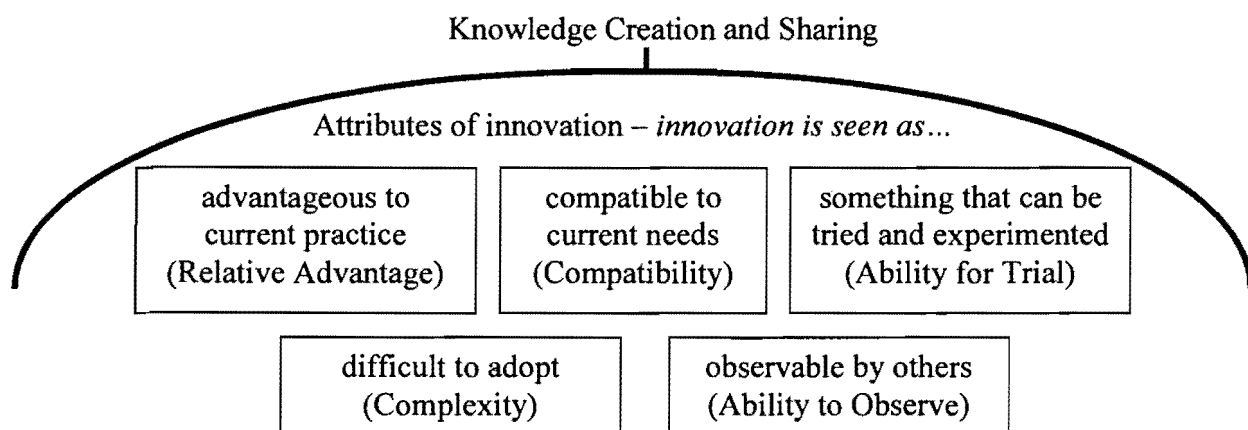
Second, Fullan (2001) describes Understanding Change as the ability to “develop a greater feel for leading complex change and to develop a mind-set and action set that are constantly cultivated and refined” (p.34). There are six identified essential understandings in this second characteristic: The goal is not to innovate the most, it is not enough to have the best ideas, appreciate the implementation dip, redefine resistance, reculturing is the name of the game and, change is never a checklist - it is always complex (Fullan 2001).

“The single factor common to successful change is that relationships improve” (Fullan, 2002). The third characteristic, Relationship Building, therefore, is critical in any effort to affect change. Relationship building is complex in a society such as a school building, with an extensive range of backgrounds and experiences among the staff along with varying goals beliefs. Relationship building is an essential skill not just for short-term success, but also for laying the foundation for long-term cultural shifts towards habits of excellence (Fullan, 2002).

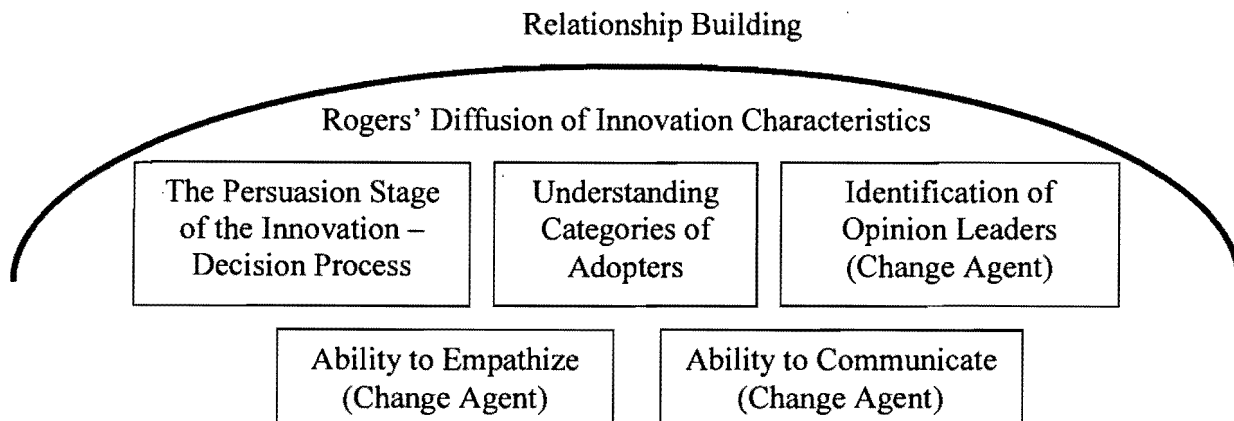
Fourth, the creation and sharing of knowledge is essential to change leadership (Fullan, 2002). Fullan (2001) states “Leading in a culture of change doesn’t mean placing changed individuals into unchanged environments” (p.79). This indicates that knowledge creation and sharing is not the same as knowledge acquisition, nor can effective change take place if only the individuals are asked to change without the environment around them changing. Knowledge sharing, and the change that it encourages and supports, is a social process (Fullan, 2002). A change agent such as a principal needs to create the environment where this social process can take root and grow. It is critical to sustained change not only for knowledge to continue to be accumulated (through professional development) but that the knowledge is shared, discussed, challenged, and dissected by the staff employing the knowledge. This requires structures such as common planning time, professional learning communities, and an atmosphere of safety and trust to exist. Fifth, the concept of Coherence Making is essential to keep all of the moving parts of a complex organization in the midst of change to be working together rather than competing with one another (Fullan, 2002). Overload and fragmentation of new ideas is a natural enemy of coherent and stable change, and a change leader has to be aware of the dangers of such aspects. The effective change leader continues to re-focus the societal group on the stated goals.

Fullan’s writings are focused on the culture of change and the complexities of leading in such an environment. Rogers’ Diffusion of Innovation Theory concentrates on implementation of individual innovations within the culture of the society. The aspects of Diffusion of Innovation theory are present regardless of the level of acceptance of change within the culture that the innovation is being introduced. While that existing

culture will certainly impact the process of diffusion of a new innovation, the purpose of diffusing a new innovation is not to create a culture of change, but to successfully implement a new idea. In that light, the diffusion of an innovation using the theories that Rogers discusses will benefit from a culture of change that Fullan's writings encourage; however they are not a subset of such a culture. Rogers' theory provides a structure for the elements that contribute to successful implementation of a specific new program or idea; Fullan's writings discuss elements of knowledge and skills that a change leader should be aware of in creating an environment tolerant and inviting of change in general. In many aspects, the characteristics of Rogers' Diffusion of Innovation theory would benefit from being in a culture of change that Fullan describes. For example, a map of the "umbrella" of a change leader that has created an environment where Fullan's *Knowledge Creation and Sharing* would show how Rogers' *Attributes of the Innovation* would benefit.



A similar model could describe the relationship between the gestalt of Fullan's *Relationship Building* aspect and other characteristics that Rogers' describes as critical.



James Dearing (2004) notes three theory-based concepts regarding diffusion of innovations. Simply stated, when members of a society decide to adopt an innovation, there are three significant thoughts involved in the decision: what they think about the new idea, what they believe credible others think of the idea, and what they think of the idea in comparison to what other innovations exist (p. 26). Diffusion is more likely to occur when the potential adopters see the characteristics of the innovation as easy to explain, that the benefits of the innovation are clearly apparent, that the risk of adoption is minimal, and that the adoption of the innovation will produce benefit over current practice (Katz, 1963).

Concerning what potential adopters believe credible others think of an idea, Dearing (2004) believes the *opinion leader* to be critical to the successful adoption of an innovation (p.27). For an innovation to gain speedy acceptance, it has to have been accepted at a high level of value by influential members of the adopting society (Dearing, 2004). Such influential members are called opinion leaders (Rogers, 2003, Dearing 2004). The greater the perceived risk and uncertainty is among the potential adopters of a

new idea, the greater the impact that opinion leaders may have on such an adoption (Dearing, 2004). Diffusion occurs through a social process where “pre-existing influence among people or among organizations alternately facilitates and impedes the rate and extent” of adoption (Dearing, 2004). A change agent must enlist opinion leaders to successfully adopt a new innovation throughout a societal group. This group of opinion leaders will be able to ensure successful adoption as long as they have positive attitudes towards the innovation and others in the adopting society recognize a positive correlation between the new idea and the opinion leaders (Valente, 1995). Conversely, opinion leaders that do not think highly of a new idea and act on that through avoidance or overt rejection of the new idea will seriously impede the progress of implementation (Leonard-Barton, 1985).

Concerning the comparative value of the innovation, studies show that adopters of a particular innovation sometimes adopt related innovations during the same adoption time frame (Dearing, 2004).

Dearing (2008) notes that diffusion theory has attracted the attention of scholars and practitioners from a wide variety of interests and fields (p.99). There are many reasons for studying the diffusion process throughout these interests and fields. Such reasons include determining why an innovation is successfully diffused in a certain society, how to replicate successful diffusion to another society, and how to transfer a successful diffusion from one entity in an organization to another (Dearing, 2008). As diffusion research matured, more sophisticated questions were studied such as how to accelerate the diffusion process, how to increase the number of concurrent implementations, how to increase the quality of successful adoptions, and how to sustain the use of successfully

adopted programs (Dearing, 2008). Dearing (2008) calls these more sophisticated questions, which build on prior knowledge of diffusion theory, practices of *dissemination* (p.99). Such dissemination occurs due to a series of circumstances involving members of the society that the innovation impacts. The circumstances are a set of “needs” – the need for a member of the society impacted by the innovation to feel confident when presented with evidence of a new innovation, the need for members of that society to understand what their peers within their society know and are learning about new innovation, and a sense of continuing to belong within a group when members of that group have made a change through an innovation (Dearing, 2008). Recognizing these needs in conjunction with Roger’s Categories of Adopters and the importance of opinion leaders, Dearing (2008) suggests the importance of the relationship between the change agent and opinion leaders for more effectively diffusing an innovation (p.103). Dearing notes the difference in this model from diffusion theory by naming it *dissemination science*. One particular model, called Societal Sectors, emphasizes that the society of adopters is tied together by social or professional interests rather than by proximity (Dearing, 2008). For example, elementary schools are a society of potential adopters of a new reading instruction innovation regardless of their proximity to one another because of the potential impact that such innovation would have on common functions and goals. Dissemination strategy used during planning for the diffusion of an innovation in a sector (one school or district) of this society (all elementary schools) would include the use of credible professional networks from which the society members would likely seek advice. This would include the use of outside experts in training, the distribution of articles written by trusted names in the industry, and the purchase of materials that are

recommended by these experts. Dearing (2008) states that “a key determinant of the likely success in strategic dissemination based in a societal sector perspective is the sophistication of change agents...if a change agent correctly identifies which organizational leaders serve as sources of example, modeling, and advice, ...(then) the change agent’s time can be spent interacting with that subset of opinion leaders who will, in turn, affect other adopters in the course of their normal conversations with those peer followers” (p.104). The concept of societal sectors impacts the efforts of dissemination of a new idea as it guides the change agent in his or her identification of opinion leaders (they should be part of the societal sector that is at the center of the innovation), ensure that these opinion leaders are adequately aware and sufficiently trained in the innovation to be seen as credible to their peers, and to recognize the impact that the needs of the society members will have on their approach to a new innovation.

Thomas Valente (1999) concludes from extensive empirical studies that new ideas and practices are diffused through interpersonal contacts and that those contacts largely consist of interpersonal communication (p. 56). Important influences of the adoption of new practices include social contacts, social interaction and interpersonal communication (Valente & Rogers, 1995). Throughout the 20<sup>th</sup> century, studies on diffusion of new ideas within a society supported the concept that interpersonal interaction between members of the society was an important factor on the successful adoption of the new idea (Valente, 1999). With the extent to which the research supports the idea of diffusion being a social event, methods to determine the types of social contact and to measure the most effective means of such social communication are important. Such analysis of the social interaction involved in the diffusion of an innovation is called



network analysis (Wasserman & Faust, 1994). Such network analysis focuses on identifying individuals in a society that are the most influential during an adoption process. Such individuals are called opinion leaders, and can initiate the diffusion of a new idea or program, functioning as role models and supporters of the new idea (Valente, 1999, Katz & Lazarsfeld, 1955). The plan to use opinion leaders as conduits of information and encouragement to promote change can be referred to as a peer promotion model (Valente, 1999). Such individuals can be influential in creating rapid, sustained change that is implemented with integrity (Valente, 1999). However, the potential effect that an opinion leader has is contingent on the degree of credibility and trust that potential adopters within the society have of them (Valente, 1999).

Valente (1999) suggests that to ensure that selected opinion leaders have such credibility and trust within the society, change agents must allow the members of the society to formally select them (p. 59). This is in contrast with previous theorists that suggest that change agents must identify existing opinion leaders within their society and Valente proposes a more formal selection process. Valente believes that allowing the entire population of the society's members to choose the opinion leaders is a preferred method (Valente, 1999). After a selection process is completed via nominations, the chosen leaders are provided with materials and training to best understand the adoption, and are paired with members that had nominated them. This type of diffusion network matches learning theory that states that learning best occurs when individuals are trained by peers of their own choosing (Rice, 1993). Valente (1999) lays out a three-step approach to the identification of opinion leaders (p. 61):

- 1) Identify 10 percent of individuals that receive the most “votes”, these are the opinion leaders.
- 2) Match opinion leaders to the members of the society that nominated them, or connect them through the least number of connections.
- 3) Assign individuals who nominated no one randomly and proportionately to leaders.

It is then essential for the selected opinion leaders to believe in the innovation, have sufficient training available to them for their confidence in the innovation, and have a desire to help lead the adoption of the innovation (Valente, 1999).

Valente (2005) recognizes the importance of opinion leaders as he notes that “it is clear networks are important influences on behavior because most people acknowledge that they receive information and influence via their social networks and that they model the behavior of others” and takes their selection a step further than other theorists as he essentially proposes an election of peers by peers to lead innovative change (p. 113).

Robert Wright, John Palmer, and Deborah Kavanaugh (1995) suggested that the application of marketing techniques, in particular diffusion theory, be used to promote the speed and fidelity of implementation of an educational innovation. In their article, they presented an “innovation diffusion framework” to “provide educational professionals with a set of recommendations that may lead to more successful marketing of educational innovations” (Wright, Palmer, & Kavanaugh, 1995). This framework was based on the work of Christopher Lovelock and Charles Weinberg who, interestingly enough, discussed diffusion theory in a marketing textbook. Lovelock and Weinberg (1984, p.231) described findings in diffusion theory to be particularly relevant to their subject. In

particular they discuss characteristics of innovations, time of adoption, stages of the adoption process, and “the role of personal influence in encouraging innovation behavior” (Lovelock & Weinberg, 1984). The authors continue to describe characteristics of innovations that impact the success of implementation; relative advantage, compatibility, complexity, trial ability, observability, and perceived risk. Because Wright, Palmer and Kavanaugh use this framework to make recommendations to educational leaders for greater acceptance of innovation and because Lovelock and Weinberg’s descriptions of diffusion theory so closely match that of Rogers, I find this extremely relevant to this proposed study to measure the effect of diffusion theory training of principals on the level of implementation of a new innovation in schools.

#### The Concept of Critical Mass

Random House Dictionary defines critical mass as “the amount of a given fissionable material necessary to sustain a chain reaction at a constant rate.” The term has come to mean any population that has grown to the point where a continued movement is not in need of outside stimulus and is, therefore, self-sustaining. There comes a point in the diffusion of an innovation where the number of adopters as a percentage of members of the social system becomes so great that the diffusion process becomes self-sustaining (Rogers, 2003). This point is called the point of *critical mass*. Until a critical mass point is reached, the rate of adoption of an innovation is relatively slow. Past that point, the rate of adoption increases rapidly (Fisher, 1992). The concept of critical mass is crucial as it pertains to diffusion of innovations because a potential adopter’s behavior towards an innovation is greatly influenced by how peers around them are behaving towards the innovation (Shelling, 1978). The above observation by Shelling

underscores the importance of visibility of perceived advantages, as well as the use of the opinion leaders. The greater the awareness level through observation and communication, the greater chance of reaching critical mass more quickly. Rogers (2003, p.356) calls the absence of observation a high degree of *pluralistic ignorance*. The presence of pluralistic ignorance, or the rate of individuals unaware of the behaviors of others around them, decreases the rate of adoption and makes the efforts towards critical mass more difficult.

Central to the theme of diffusion of an innovation is the interaction between potential adopters and the experiences that their peers have had with the innovation. These potential adopters decide their opinion of an innovation and how much enthusiasm and effort they are going to expend on the innovation based on communication through the social network of the system, making it critical for a change agent to be aware and to understand how to manipulate such communication to positively reflect on the innovation (Rogers, 2003).

To emphasize that a change agent can impact the process of reaching critical mass, Rogers (2003, p.361-362) lists four strategies for attaining critical mass:

1. Target highly respected individuals within the system for initial adoption of the innovation. These should not be targeted because they are the most innovative individuals, but rather because their opinion of the innovation, the implementation process, and the perceived benefits will most greatly impact the opinions of their peers.
2. Actively shape the perceptions of potential adopters. While pursuing the highly respected individuals noted above for early adoption, potential adopters

should be also be pursued with continuous information regarding the innovation, its perceived value, the inevitability of universal adoption, and the level of diffusion that has already occurred.

3. Introduce the innovation to established groups that are likely to be supportive of a new idea. By identifying and targeting like-minded groups, you can establish mutually supportive adopters that help create the perceptions of a highly desirable change. Such groups may not necessarily be comprised of innovators, but may be highly likely to view the status quo as undesirable and, therefore, be more willing to try an innovation.
4. Provide incentives for early adopters. Although financial incentives are difficult in public education, there are opportunities to provide incentives for early adopters outside of monetary compensation. The prestige of being recognized as a leader and innovator can be an incentive, in addition to other, more tangible incentives such as new materials, opportunities to attend workshops, etc.

### Defining and Measuring Effective Implementation of New Program

Measuring implementation is a relatively new phenomenon, especially in education. An innovation is an idea or practice that is perceived as a change over the status quo by individuals within a system (Rogers, 2003). A new program or innovation is *diffused* when it is communicated to members of an organization over time (Rogers, 2003). Rogers (2003) estimates that only 8% of all diffusion research publications are related to educational innovation implementations. Early educational diffusion research

did take place in the 1950s, but disappeared quickly and did not resurface until the mid-1970s (Rogers, 2003).

Fullan and Pomfret (1977) suggested several reasons for studying innovation implementation. First, implementation must be studied if we are to be able to measure what has actually changed. Second, it is important to understand why so many new innovations fail to become established and realize their promises. A third is to determine the difference between successful implementation and improved outcomes. Taken together, these are significant issues when investing in a new program or practice.

To understand why educational implementations have failed allows for a change in tactics to increase success rate. Measuring what has actually changed is the only way to determine if those new tactics have been successful. Most importantly, it is the third question that remains poorly analyzed: Are increases in student achievement the result of successful implementation?

These questions lead to the term *fidelity of implementation*. Fidelity of implementation refers to the “demonstration that an experimental manipulation is conducted as planned” (Dumas, Lynch, Laughlin, Phillips Smith & Prinz, 2001). An innovation can be said to have successful fidelity of implementation if “it can be shown that each of its components is delivered in a comparable manner to all participants and is true to the theory and goals underlying the research” (Dumas, et al, 2001). If we are to measure the degree to which an innovation is implemented and to understand the impact that degree has on student achievement, then we must be able to measure the fidelity of the implementation.

Fidelity of implementation is mainly associated with integrity and compliance (Gresham, Gansle, & Noell, 1993). In the education field, fidelity of implementation has been

defined as the extent to which a program has been implemented as planned or proposed (Loucks, 1983, p.5) (Berman & McLaughlin, 1976, p.350). Effectiveness of implementation is defined as “the ability of an intervention to produce the desired beneficial effect in actual use” (Dorland, 1994, p. 531). Should a school decide that an innovation was not effective in achieving desired results, one must first question the fidelity of the implementation. Was the program implemented as planned? If so, does the innovation need to be altered? These critical questions often go unasked in the implementation of a new program in a school and the only way to sufficiently answer such questions is to measure fidelity of the implementation. To measure fidelity of the implementation, fidelity criteria must be established. Many studies of fidelity of implementation begin with an outlined structure of the essential core components of a new program and a defined level of acceptable variance from the core (Songer & Gotwals, 2005). Tools were refined into a checklist of these core components to be used when observing a new innovation being implemented (Hall & Loucks, 1977).

Several approaches to measuring fidelity of implementation have been recorded in the literature. Of twenty-three works researched in O’Donnell’s meta-analysis of educational implementation studies (2008), five were highlighted for fully meeting the criteria set forth by the author. These studies measured fidelity in a variety of ways. One method was through direct observation of teacher activity and the use of an implementation checklist designed prior to implementation and grounded in the theory of the new program (O’Donnell, 2008). Another method focused on student behaviors and the reflection those behaviors had on the implementation.

Other methods included self-reporting surveys and interviews. Self-reporting of implementation has limitations based on perceptions and integrity of the self-reporter. These were revealed in studies where self-reporting was used in addition to independent observation. In these studies, the independent observers noted lower levels of fidelity than the self-reports (Emshoff, et al., 1987). Despite the field being relatively new, there are existing tools that can be used to measure fidelity of implementation. The importance of successful measurement of fidelity of implementation is summed well as the “failure to establish fidelity can severely limit the conclusions that can be drawn from any outcome evaluation” (Dumas, et al, 2001).

Christine Murray (2009) described the failure of translating research findings into meaningful strategies as the “Research-Practice Gap”. Suggested methods of closing the gap include professional development in the practice for the implementers, training in translating research to practice, hands-on experience with the practice, professional dialogue between researchers and implementers, and efforts on the part of researchers to provide greater clarity, relevance, and ease of use to their studies (Murray, 2009). In a study of counseling innovation diffusion, Murray (2009, p. 115) concludes that the ultimate goal is for research to be disseminated and successfully adopted by practitioners in the field, and encourages a diffusion of innovation theory model to reach that goal. In a study designed to measure and explain the degree of implementation fidelity of Comprehensive School Reform (CSR), it was found that the level of fidelity of implementation could not be predicted by school demographic data (Kurki, Boyle, & Aladjem, 2006). This means that demographics that are out of a school’s control, such as poverty level, percentage of ELL students, and like factors do not determine the fidelity



of implementation (Kurki, et al., 2006). Also found was that high fidelity of implementation was consistently predicted by factors related to the agents of change, such as the principal, the professional support given, and the social environment of the building (Kurki, et al., 2006). In the study, the fidelity of implementation was higher when teachers reported strong principal leadership, where they received support on a regular basis, and where common values and goals existed among the teaching staff. (Kurki, et al., 2006). Kurki (2006, p.14) also found that the aggregate teaching experience of the faculty impacted successful implementation, as teachers with less experience had lower levels of fidelity of implementation. The results of this study “highlight the importance of school-based leadership and assistance in implementation. Increases in principal’s instructional leadership or usefulness of help provided...are positively related to increases in fidelity of implementation” (Kurki, et al., 2006).

### The Role of the Principal

This study proposes to analyze the impact of principal training in diffusion of innovation theory on the level of implementation of a new practice in their school. That is not synonymous with the title of this section. The role of the principal in implementation of program can come in many forms. Research indicates that the principal is key in setting the climate in a school, and that climate plays a major factor in successful program implementation (Sivage, 1982). Virgilio and Virgilio (2001) note four stages in the implementation process that rely on the ability of the principal. The four stages are *change*, *communication*, *staff development*, and *instructional planning*.

Despite the names of these stages, the skills identified have little to do with the principal's knowledge of or expertise in the actual practice.

In regards to *change*, principals are the primary agent of change in their school and any outside influence, such as new curricular practices or innovations, will need the leadership and support of that agent of change. Virgilio and Virgilio (2001) note that the principal will need such skills as reasoning and influence wielding for setting the conditions in which change can occur. *Communication* refers to discussing issues openly, reassuring unsettled staff, and ensuring that staff is aware of available resources. *Staff Development* refers primarily to the development of the staff that will implement, not to the principal. Instead, the principal is charged with ensuring staff development through such options as bringing in outside experts or facilitating information exchanges (Davidson, 1979).

Another role that has been suggested is that the principal should "urge teachers to develop and share instructional materials, and to discuss curricular issues with other staff (Glatthorn, 1981). This statement alone suggests that the role of the principal is not to engage in discussions regarding the practice themselves, but to facilitate discussion among others. Even the ASCD as recently as 1983 stated that two crucial behaviors of principals during program implementation are giving "reminders that use of the new curriculum is a school priority, and informal encouragement and interest". This is a statement remarkably minimizing the role of a principal in program implementation, relegating the principal to a cheerleader. In the *instructional planning* stage, the principal's role again is important, yet relegated to non-instructional matters, such as

ensuring the proper arrival of needed materials and providing a schedule conducive to teacher collaboration (Virgilio and Virgilio, 2001).

A study examining the effect of principal leadership on the implementation of new science innovations in a school noted that the principal was critical in the implementation of the new innovations through explicit and continuous statements of the importance of the innovations, allocating time resources to teachers working on the innovations, and increasing expenditures to the science department (Lewthwaite, 2004). While the above supportive roles of the principal are critical to program implementation, it seems worthy of study to examine the role a principal may play as an knowledgeable, trained participant in the diffusion of the innovation.

While not specifying principals, Rogers (2003) discusses the role of the primary *change agents* during implementation of a new innovation in an organization. One defined stage in the implementation process is the Persuasion Stage, where individuals responsible for implementing the new innovation (the teachers) form attitudes and opinions towards the new program based on inputs from the change agent (the principal). During this stage, the implementers are deciding on the credibility of the information they are receiving and “a general perception of the innovation is developed” that will be critical to the energy and effort put behind implementing the innovation with vigor and fidelity (Rogers, 2003). Also at this stage, implementers are questioning the validity of the innovation, the perceived advantages over the current practices, the degree of difficulty in implementing the new innovation, and the relative efforts that will be given by their peers. Such information, while perhaps available most credibly through professional literature and published research on the innovation, will most often be

sought from the change agent at hand, the principal. Therefore, the principal's reaction to and knowledge of the innovation become critical at this stage.

There are additional aspects, connected to the perceptions of the implementers, which contribute to the effective and successful diffusion of an innovation. One such aspect is status. Implementers will be more inclined to adopt an innovation faithfully if they perceive a gain in organizational status. Such "status" in a school can be related to acceptance by peers and approval of the change agent, the principal. Another aspect impacting implementation is potential incentives. As the leader of the school, the principal holds certain incentives including giving praise and respect, and possibly financial incentives, such as extra-curricular activities. The persuasive power of the principal, as well as their effectiveness to utilize these aspects, can contribute to positive implementation of a new innovation.

The principal will have key roles in acting as a change agent when implementing a new innovation (Fullan & Pomfret, 1977). The first is to develop an environment where a need for change is accepted. There must be acceptance on the part of the implementers that a problem exists and a change is necessary. Once established, the implementers must perceive the change agent as "credible, competent, and trustworthy" if they are to trust the program that the change agent is promoting (Rogers, 2003). This credibility suggests greater knowledge of the factors impacting diffusion on the part of the change agent that exceeds the "cheerleader" role that much of the literature has suggested is the primary role of the principal.

## The Principal and Student Achievement

“Effective leadership matters where it is needed the most with leadership having the greatest bearing on student learning in troubled schools. In fact, there are no documented cases of schools being turned around without highly effective leadership”

(Leithwood, Louis, Anderson & Wahlstrom, 2004). There is a growing body of significant research that validates a strong correlation between principal leadership and increased student achievement. This research attributes as much as 25% of total student growth on effective leadership (Liethwood et al, 2004). Other studies show that leadership activities, with other variables held constant, are good predictors of student performance (Heck, 1991).

Effective leadership has been defined many different ways, but the most exhaustive definition comes from a meta-analysis work by Marzano, Waters, and McNulty who identified 21 categories of behaviors that they call "responsibilities" of school leaders. The work examined 69 studies in leadership and the connection between the leadership of the principal and increased student achievement. This analysis also attributed a correlation of .25 between quality leadership and increased student achievement. Studies in the United Kingdom find a similar correlation regarding school leadership. David Hopkins of the University of Nottingham prefers the title of instructional leader to describe the principal with the necessary skills to improve student achievement. He supports a model of instructional leadership that notes similar behaviors to Marzano's twenty-one, grouped in three broad categories: 1) defining the school mission, 2) managing the instructional program, and 3) promoting school climate (Hallinger and Murphy, 1985). This model has significant support relating to increased student

achievement (Hallinger 1992, Sheppard 1996). Further study in a dissertation entitled *A Model of School Success: Instructional Leadership, Academic Press, and Student Achievement* concluded that principals can affect the “achievement of their students indirectly using their leadership to develop an organizational climate in which academic and intellectual pursuits are central to the school” Alig-Mielcarek (2003).

When comparing student achievement to measured ratings on an Interstate School Leaders Licensure Consortium (ISLLC) standards rubric, a 2003 study found that student achievement levels were higher in schools with principals who scored higher on the ISLLC rubric (Owings, Kaplan, and Nunnery, 2003). While, again, not specific to principals as knowledgeable participants of a specific practice, the above works, the work of Leithwood, the summaries of Hopkins, and the meta-analysis of Marzano all validate the correlation between principal leadership and improved student achievement. Stated succinctly, “It turns out that leadership not only matters: it is second only to teaching among school related factors in its impact on student learning” (Leithwood et al, 2004).

### Successful Implementation of Innovations and Student Achievement

With research on measuring the fidelity of implementation relatively new, it is not surprising that the research on the impact of successful implementation on student achievement is minimal. The statement that successful implementation does not necessarily correlate to increased student achievement seems counter-intuitive to begin with. Why would you implement a program that, if implemented with integrity, wouldn't increase student achievement? Clearly that would never be the intention, but intended outcomes and actual outcomes are never guaranteed to match.

Early research found a strong correlation between a high degree of implementation fidelity and increased student achievement, accounting for 35% of the variance (Leinhardt, 1974). However, the primary instrument for identifying implementation fidelity was a self-assessment tool. Such a tool for this purpose has been called into question in later studies, showing that teachers often rate themselves higher than an independent observer (Emshoff, 1987). Five independent studies over a 30-year period reported significant correlation between fidelity of implementation and increased student outcomes. The studies had another statistic in common: considerable variability within the treatment groups. Such variability with similar measured levels of implementation requires us to question, "What is the variable that causes the differences?"

- Implementation studies in the Health field, where outcomes are easier to measure and
- variables easier to control, suggest that the degree of implementation is the direct cause of the degree of the outcome; that the greater the degree of fidelity of implementation, the greater the outcome (Latimer, 2006).

It is inevitable that variation in implementation will occur when the implementers are classroom teachers. Experience, knowledge, attitude, comfort level, previous training, personal preferences, and other aspects of an individual teacher will impact on their level of fidelity of implementation. This alteration of implementation can have varied effects. It is possible that high fidelity of implementation is the best road to improved student achievement, but it is also possible that some fidelity of implementation coupled with an excellent teacher would produce even higher student achievement. The process by which a teacher is introduced to a new practice and is influenced by new materials presents a challenge when measuring the impact on student achievement by the level of

implementation present. It is important to distinguish between good teaching through fidelity of implementation and good teaching through exposure to new materials (Shulman, 1990). The degree that a teacher modifies the use of a new program or practice is called *adaptation*. The degree of acceptable adaptation that lands within the boundaries of high fidelity of implementation cannot be fixed and is subject to interpretation and personal feeling. Hall and Loucks (1978) argue, “Adaptation is acceptable up to the point of drastic mutations that compromise the program’s integrity and effectiveness.” This is a seemingly valid point, yet the term “drastic mutations” is hard to quantify and would be as open to interpretation and personal opinion as much as “acceptable adaptation” would be.

Such discussion leads to two conflicting points of view of the most effective avenue of implementation, the “high fidelity” point of view and the “evolutionary” point of view (Fullan, 2001). The high fidelity camp would hold that the integrity of the planned implementation is paramount and the best avenue to higher student achievement. The evolutionary camp suggests that the intentional, professional adaptations of a new program by a trained teacher are not only inevitable, but also desirable for increased student achievement. The studies done in the Health Care field are more extensive and support the correlation between fidelity of implementation and increased outcomes. These studies, combined with the unique challenges of implementation in schools, would suggest that the critical components of any school program implementation must be adhered to stringently, with the understanding that some degree of adaptation being inevitable. As O’Donnell (2008) notes, there is a shortage of literature measuring



fidelity of implementation and increased student achievement in the education field; but the studies that have been done suggest a positive correlation between the two.

Based upon the literature both in education and in other industries, I believe that the two camps must converge for success of a program in a school setting. Stringent adherence to planned program implementation as demanded by “high fidelity” believers acknowledges the importance of valid research-based programs. A program or practice that has a successful track record, can prove a causal link between the program implementation and student achievement, and is chosen by a school district for implementation for those very reasons should not be “tinkered with” before mastery of the program is reached.

However, much of teaching is an art form. There is a beauty in the creative nature of teaching. Requiring teachers to strictly adhere to a program is tantamount to requiring an artist to paint by the numbers. Teachers that have successfully mastered a program and understand its intended outcomes and the means of reaching them will certainly find ways to “tweak” it to best serve their particular styles and their particular students. In fact, many research based practices such as guided reading and writer’s workshop have teacher freedom as an essential part of their program. These and other exceptional programs need to have teachers recognizing needs of individual students, diagnosing specific concerns and addressing them with creative interventions. In this light, teacher adaptation of a program or practice, once the program is thoroughly understood through faithful implementation, is essential to taking the program to new, higher levels of success.

If successful implementation means greater student achievement, then the activities and actions that lead to successful implementation are of critical importance for school

leaders. Once effective school practices are identified through research and trial, implementing them in schools becomes the challenge. Schools, as organizations have been extremely durable and resistant to change (Cuban, 1984). Changing the typical educational pattern is very difficult (Tyack & Tobin, 1994). A study conducted out of the University of Memphis identified factors that contributed to “fast starters” and “slow starters” of innovation adoption in schools (Smith, Maxwell, Lowther, Hacker, Bol, & Nunnery, 1997). In studying 34 schools, the authors noted several key factors that characterize schools that quickly and effectively adopted reforms. The first of those characteristics was leadership. “Startup is greatly enhanced by strong administrative leadership within the school. Those schools in which there appeared to be strong commitment and support by the principal, as well as by faculty-elected leadership councils or emerging faculty leaders, were generally perceived to be making good progress relative to other school implementing the same programs” (Smith, et al., 1997). This description continued on to say that schools with principals who had an understanding of the change process, knew their faculty well, and allowed their teachers to “develop ownership” of the innovation had greater success (Smith, et al., 1997). In contrast, schools that struggled to adopt the reforms, had environments where the teachers felt suspicious of the innovation as there was little teacher support for it in the building (Smith, et al., 1997). The parallels to Rogers’ Diffusion Theory are significant. The Memphis study’s “Leadership” factor mirrors Rogers’ “Change Agent” in very substantial ways. Keys to the successful diffusion of an innovation, according to Rogers, include a leader, or change agent, that can identify the early adopters, the “opinion leaders” (Rogers, 2003). The Memphis study speaks of principals “knowing their faculty

well” and “developing ownership” (Smith, et al., 1997). This parallels Rogers’ opinion leaders, early adopters, and early majority. The term “developing ownership” can be equated to the concept of “critical mass” discussed earlier. Once a staff develops a feeling of ownership of an innovation, the culture begins to change and the non-adopters are now the outsiders, instead of the innovators. Critical mass is reached and the late majority begins to adopt.

Another aspect study that parallels Diffusion Theory noted in the Memphis study is the perceived extent of change required by teachers. Successful schools in the study had a faculty that felt that the innovation to be adopted was a design that “represented less change for the faculty and administration” or “reflected areas in which the school had already begun to experiment” (Smith, et al., 1997). Schools that struggled, according to the study, reported teachers being “surprised” by the amount of change the innovation brought, which produced “strong resistance” to the change (Smith, et al., 1997). As noted earlier in this literature review, diffusion theory notes the Attributes of the Innovation as significant to its potential adoption (Rogers, 2003). In particular to the above aspects of the Memphis study, the attribute of “complexity” is significant. Complexity is described as the degree to which an innovation is perceived as difficult to adopt and to use by the potential adopters (Rogers, 2003). The perception of the complexity of the change plays a significant role in the adoption process. Diffusion theory notes that and it is evident in the Memphis study.

Another aspect of the Attributes of the Innovation is “compatibility”. Rogers (2003, p.) describes compatibility as the degree to which an innovation is seen as compatible to the current needs, culture, and philosophy of the organization. The Memphis study noted

that teachers were concerned about the innovation's alignment with their perceived goals, in particular the preparation of students for the Tennessee Comprehensive Assessment Program (TCAP). These teachers did not see the innovation as compatible to their mission. As they felt they "were being asked to implement unnecessary things that took away time that could be used to prepare students for the TCAP", they were reluctant to adopt the innovation. In contrast, teachers that felt the program could be put to immediate use were anxious to adopt (Smith, et al., 1997). "Slow starters" or, as Rogers named the late majority and laggards, reported that they felt confused about the expectations of the innovation in their classroom and were discouraged about the lack of "concrete lessons and examples". This speaks directly to the attributes of an innovation called the "ability for trial" and the "ability to observe" (Rogers, 2003). Teachers in this study wanted to see the innovation in action, and be able to try it out and receive constructive criticism before being asked to deliver. These were contributing factors for these teachers to resist the implementation (Smith, et al., 1997).

### Conclusion

"Understanding the key factors influencing innovations acceptance and using this knowledge to more effectively market educational innovations to target populations may serve to greatly facilitate implementation of such innovations" (Wright, et al., 1995).

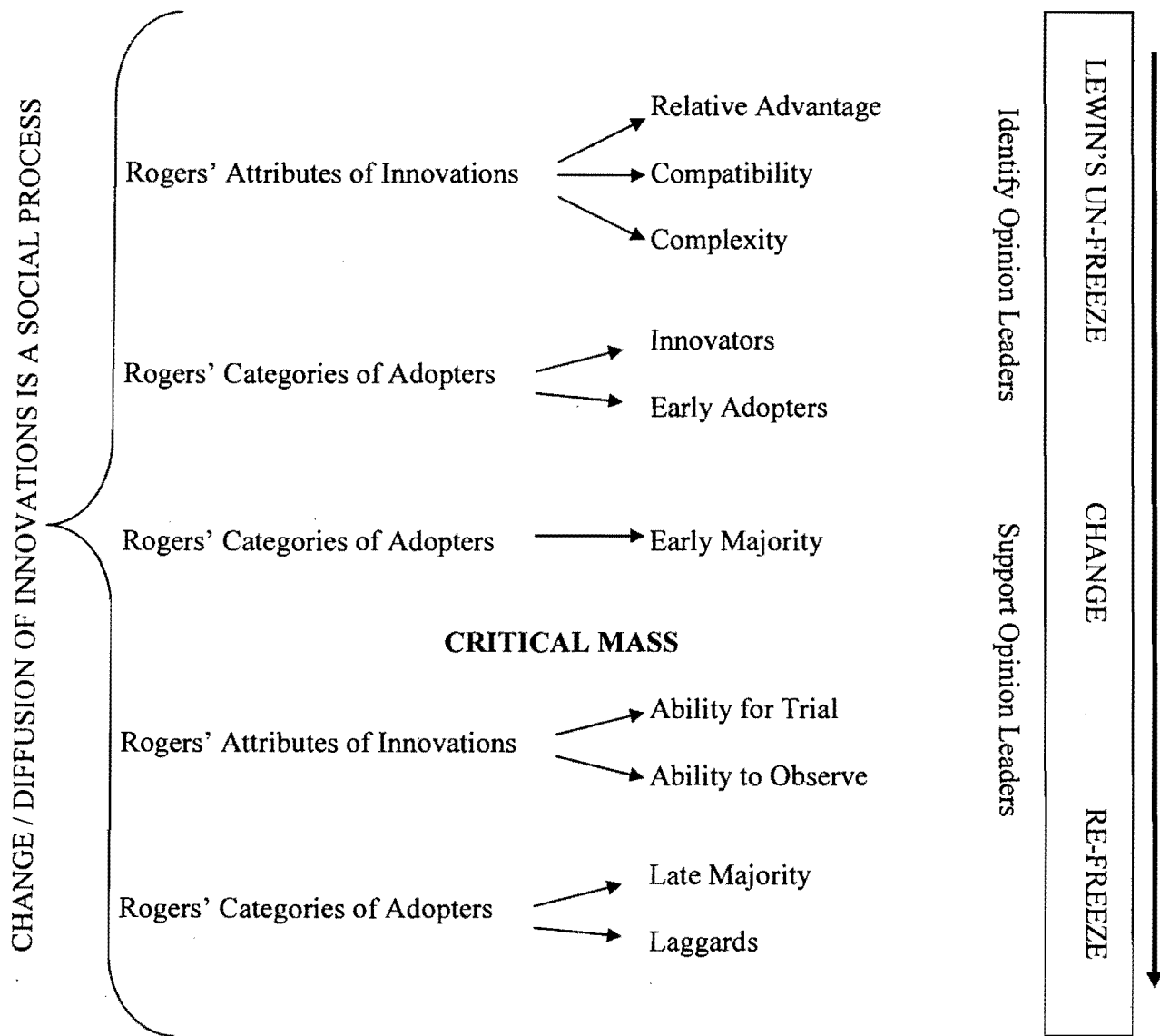
The goal of this study is to quantitatively address the "may serve to greatly facilitate implementation of such innovations" that Wright states.

The crossroads of the theorists examined in this literature review is clearly that innovation diffusion is a social process. Diffusion is a social process, requiring interpersonal communication among potential adopters (Rogers, 2003). Knowledge sharing, and the change that it encourages and supports, is a social process (Fullan, 2002). Diffusion occurs through a social process where “pre-existing influence among people or among organizations alternately facilitates and impedes the rate and extent” of adoption (Dearing, 2004). New ideas and practices are diffused through interpersonal contacts and that those contacts largely consist of interpersonal communication (Valente, 1999). Recognizing that diffusion is a social process, and that the majority of potential adopters look to their peers that have already adopted for guidance, the change agent seeking to increase the rate of adoption and the fidelity of its implementation needs to know what communication channels will serve that purpose best.

This confluence of opinion on the foundation of successful diffusion influenced me greatly as I approached this study. I have always been attracted to Lewin’s description of change needing a first stage of “un-freezing” the status quo. If you were to “overlay” the concept of un-freezing, changing, then re-freezing, on top of Rogers’ Diffusion of Innovations theory, you will find the philosophies support one another. If you further “overlay” Fullan’s, Dearing’s, and Valente’s recognition of the social process of change, you see how Rogers’ specifics become actionable items. Taken as a whole, the convergence of these three lenses shows the potential of having the change agents, in this case the building leadership, schooled in the specifics of Diffusion Theory. In the context of change as a social process, Rogers’ specific attributes of innovations, categories of adopters, and the concept of critical mass become critical knowledge and

skills for the principal trying to un-freeze and change a process in their school.

Understanding the specific attributes of innovations allows a principal to highlight aspects that contribute positively (relative advantage, compatibility), minimize the aspects that contribute negatively (complexity), create structures that maximize the attributes (ability to observe and try), and support the opinion leaders. Understanding the categories of adopters, what motivates them, what impact they have on other potential adopters, and how to impact them, allows a principal to maximize influence on their staff.



The relevant research shows a significant positive correlation between principal leadership and increased student achievement, a positive correlation between fidelity of implementation and positive outcomes, and that fidelity of implementation can be measured. The research further notes the role of the principal in program implementation, but limits those roles to those of manager, organizer, material procurer, and emotional supporter. Research outside of education supports the role of the “change agent” as someone who must be “credible, competent, and trustworthy” in order to positively impact fidelity of implementation.

Research on educational practices such as how children acquire language, how mathematics skills are developed, and other arenas of learning continue in scholarly journals, publishing companies, and other academic environments. Breakthroughs in program and practice are useless unless the innovation effectively and efficiently gets “behind the classroom door”. An understanding of how innovations are diffused to members of a society may be critical to the leader of that environment. This study proposes to close the loop between the principal’s role in implementation as an instructional leader and the fidelity of the implementation by examining the impact of the role of the principal when he or she is trained in diffusion theory and has a firm understanding of how innovations are dispersed throughout a school environment.

### CHAPTER III – METHODOLOGY

This chapter describes the proposed methodology of this study. A review of the problem statement, the general purpose of the study, and specific research questions will be addressed. Also addressed will be the process proposed for the selection of treatment groups and control groups, a description of the participants, the analysis tools used, and substantive evidence of the validity of the tools to be used. This study will employ a quantitative method to explore the relationship among the variables.

#### The Problem Statement and General Purpose of the Study

The purpose of this study is to determine the impact, if any, of training principals in diffusion of innovation theory on the successful implementation of a new innovation in classrooms. A review of the literature has shown a correlation between fidelity of implementation and increased positive outcomes. The literature has also shown a strong positive correlation between leadership abilities and increased student achievement, but the leadership abilities noted were primarily of a managerial and organizational nature and rarely mentioned the principal having an in-depth understanding of how an innovation is successfully diffused.

Should this study show a positive relationship between these variables, it could impact the program adoption process, staff development process, and program implementation process in school districts, as the expertise of the principal on innovation diffusion would become of great importance.



## Research Questions

This study aims to answer this specific research question:

1. To what extent does the training of a principal in diffusion theory impact the fidelity of the implementation of that practice or program in classrooms as measured by short term behavior changes?

Also explored will be the following ancillary questions:

2. If such an impact exists and can be measured, to what degree does the experience of the principal explain the level of fidelity of implementation?
3. If such an impact exists and can be measured, to what degree does the experience of the teacher implementing the practice influence the level of fidelity of implementation?

## Participants and Group Selection

The district selected for this study is a K-8 grade district of 7,700 students in New Jersey. The district has eight elementary schools and each school has a principal. Each of the eight buildings has students from Kindergarten through fifth grade. To determine the impact of principal training on program implementation, four principals will be chosen through a matched pair design to receive training specific to the theories of innovation diffusion. This group of principals will be the treatment group.

### Matched Pairs Design

The eight principals will be divided into two groups to distribute several variables between the two groups. There are two elementary schools that have less than 300 students and six schools with more than 600 students. These two principals will be matched and one will be randomly selected to join the treatment group and the other will be in the control group. Therefore, each of the groups will contain one small school and three larger schools. Of the remaining principals, there are 2 principals with more than 15 years of experience, two with five to ten years, and two with less than three. By matching these pairs and randomly assigning one to the treatment group, each group will also contain one principal with more than 15 years of experience, one with five to ten years of experience, and one with less than three. There are five male principals and three females. After the assignments to the two groups, one group will contain two males and two females and the other group will contain three males and one female.

### Teacher Invitation to Participate

The new practice will be implemented at all eight schools and the level of implementation will be measured over a fixed time at all eight schools at the same grade levels. All teachers implementing the program will be provided the same level of professional development, training, and support throughout the implementation. Grade levels studied will be grades one, two, and three. A total of 102 classrooms will be

invited to participate throughout the eight buildings. This represents 100% of the first through third grade classrooms in the district. All teachers invited to participate hold standard New Jersey Elementary Teacher Certificates or Certificates of Eligibility with Advanced Standing and are considered “Highly Qualified” under the provisions of the No Child Left Behind Act of 2001.

### Unit of Analysis

The unit of analysis of this study will be the classroom teachers. Their responses to the interview questions in the Levels of Use tool will be quantified for analysis. The results of that analysis will inform us on the effectiveness of the diffusion theory training of the principals. Therefore, while the treatment is being applied to the principals, the observable entity being analyzed is the behavior of the teachers.

### Consent and Proxy

Every teacher interviewed for the study provided his or her consent for the interview process. Due to the researcher’s position in the district, a proxy was utilized to perform the interviews and provide anonymous data to the researcher. The proxy was not a direct supervisor of any of the teachers or principals in the study. A proxy was also utilized in approaching the principals regarding the additional training and providing the training. No participant was compensated for his or her role in the study and any teacher may opt, at no penalty to them, to not participate in this study.

## Instrument Description

The instrument to be used for measuring the level of fidelity of implementation will be the Levels of Use (LoU) implementation measurement tool developed by Hall, Dirksen, and George in the 1970s. The validity of the Levels of Use tools have been verified over a 30 year period in dozens of studies in a variety of settings in multiple countries (Hall, Dirksen, & George, 2005) and have been deemed “an excellent tool to support formative program evaluation” (McKinnon & Nolan, 1989) See Appendix A for a complete list of studies concerning the Levels of Use protocol. This instrument will measure implementation on an eight-point scale, with implementation measured independent of teacher attitude towards a program or the quality of the program. The Levels of Use tool is a decision tree interview protocol. Interviewers will ask a series of questions and the answer will determine the “branch” of questioning to be followed. At the end of the branches is a score from zero to six. Level four has two sub-levels (IV-A and IV-B) making for eight potential scores. Each of the eight profiles describes a different set of behaviors and understandings about the implementation and use of the innovation. Hall et al (2005, p.6) describe the levels as “distinct states represent observably different types of behavior and patterns of innovation use as exhibited by individuals and groups. These Levels characterize a user’s development in acquiring new skills and varying use of the innovation”.

Each level is independent of another. There are key indicators, called Decision Points, which distinguish one level from another. By following the decision tree through

these decision points, the interviewer will determine a distinct score for the level of use demonstrated. The decision points allow for the scores to be clearly distinguished from one another based on a cumulative pattern of responses from the interviewee.

The questioning that forms the basis for the decision tree is rooted in classifications of indicators. Those classifications are knowledge, acquiring information, sharing, assessing, planning, status reporting, and performing. Note that only one of these classifications would be observable during a lesson. This demonstrates that the levels of use are measuring not only what can be observed, but the teacher's understanding of the innovation, their understanding of how to use it, the effects of its use, appropriate ways to modify it, etc.

The following table notes the eight determination points of Levels of Use and gives a description of each.

<b>Level of Use (LoU) Level</b>	<b><u>Description</u></b>
LoU 0 Nonuse	State in which the user has little or no knowledge of the innovation, no involvement with the innovation, and is doing nothing toward becoming involved.
LoU 1 Orientation	State in which the user has recently acquired or is acquiring information about the innovation and/or has recently explored or is exploring its value orientation and its demands upon user and user system.
LoU 2 Preparation	State in which the user is preparing for the first use of the innovation.
LoU 3 Mechanical Use	State in which the user focuses most effort on the short-term, day-today use of the innovation with little time for reflection. Changes in use are made more to meet user needs than client needs. The user is primarily engaged in a stepwise attempt to master the tasks required to use the innovation, often resulting in disjointed and superficial use.
LoU 4a Routine Use	Use of the innovation is stabilized. Few if any changes are being made in ongoing use. Little preparation or thought is being given to improving innovation use or its consequences.

LoU 4b Refinement	State in which the user varies the use of the innovation to increase the impact on clients within immediate sphere of influence. Variations are based on knowledge of both short- and long-term consequences for clients.
LoU 5 Integration	State in which the user is combining own efforts to use the innovation with related activities of colleagues to achieve a collective impact on clients within their common sphere of influence.
LoU 6 Renewal	State in which the user re-evaluates the quality of use of the innovation, seeks major modifications of or alternatives to present innovation to achieve increased impact on clients, examines new developments in the field, and explores new goals for self and the system.

Table reprinted with permission of SEDL from Hall, Gene E., Dirksen, Debra J., & George, A. A.S. M. *Measuring implementation in schools: Levels of Use* (p. 7). Austin, TX: Southwest Educational Development Laboratory (SEDL).

#### Methods Table

The following table graphically represents the connections between the research questions, the source of the data needed to answer the related research question, the instrument used in collecting the data, and what the data collected would ultimately determine.

Research/ Ancillary Questions	Data Source	Instrumentation	Data Collection
To what extent does the training of a principal on a specific practice impact the fidelity of the implementation of that practice in classrooms?	Observation of classroom implementation and surveys	Levels of Use Implementation Measurement Tool	Determination of LoU of the practice along an 8-point continuum
To what degree does the experience of the principal explain the level of fidelity of implementation?	principals	Survey of principal experience	Years of experience as building administrator
To what degree does the experience of the teacher implementing the practice influence the level of fidelity of implementation?	Teachers	Survey of Teacher experience	Years of experience as classroom teacher

## Data Collection

A standardized level of training will be given to every teacher implementing the new practice. All eight principals will also receive cursory training on the practice. The four principals in the experimental group will then receive additional training in diffusion theory. A level of use for each classification of indicator will be determined in the first month of implementation for all teachers in the study. During the course of the first three months of the school year, all resources to support the implementation of the program will be available to all teachers. This includes opportunities for outside workshops, workshops provided in-district, access to instructional coaches, and access to instructional supervisors. In the fourth month of implementation, a second level of use will be determined for each classification of indicator for every classroom.

## Data Analysis and Link to Hypothesis

After the level of fidelity of implementation has been determined in all study classrooms, the data can be analyzed to see if the classrooms in schools with a principal in the treatment group differed from classrooms in schools with a principal in the control group. After this analysis is completed, the variables in the additional research questions dealing with the experience level of both principals and teachers can be analyzed. ANOVA will be used to determine the statistically significant difference, if any, between the mean of the treatment group and the mean of the control group as measured by the Levels of Use scale in each classification of indicator. In addition, ANOVA will be used

to determine if any statistically significant impact is made on the implementation of an innovation as measured by the Levels of Use scales by the experience level of the principal or the experience level of the teacher.



## CHAPTER IV – PRESENTATION AND ANALYSIS OF DATA

### Introduction

With current state and federal budget crises adversely impacting many schools across the nation, the effort to do “more with less” is more than just a cliché. School districts that are forced to trim dollars will want to maximize the effectiveness of supply and professional development budgets. The commitment of time and money to new programs can be extensive. School districts spend resources on committee work to research and select new programs and initiatives, spend money on consultants, and invest heavily in new materials and professional development activities. These resources are expended with the goal of impacting student achievement. All of this time and money is wasted without successful implementation of the selected program or initiative in the classroom. Therefore, any avenue or strategy that can increase the chances of successful implementation of a new program or initiative must be pursued.

The literature reviewed in this study suggests that an understanding of the attributes of a new program, product, or practice – often referred to as an innovation – on the part of change agents can positively impact successful implementation of that innovation. This idea that the acceptance of an innovation can be described and even manipulated through an understanding of the attributes of the innovation and the characteristics of potential adopters is summed up in the term *Innovation Diffusion*.

The purpose of this study is to determine what impact, if any, the training of building principals on Diffusion of Innovation theory has on the fidelity of the implementation of a new instructional practice in the classrooms of their school.

## Description of Treatment

Teachers of 1<sup>st</sup> grade, 2<sup>nd</sup> grade, and 3<sup>rd</sup> grade students in the four treatment schools and the four control schools were all invited to participate in the interview process. Tables 1 and 2 reflects the participation rate.

Table 1

### *Participation in Survey by Grade Level Teachers*

Grade Level	Number Invited	Number Participating	Percentage Participating
1	40	27	67.5%
2	32	4	12.5%
3	30	17	56.7%
Total	102	48	47.1%

Table 2

### *Participation in Survey by Group by Grade Level Teachers*

Grade Level	Number Participating Treatment Schools	Number Participating Control Schools
1	15	12
2	2	2
3	9	8
Total	25	22

The teachers that agreed all participated in pre-treatment interviews. The interviews were conducted and scored by two peers. The interview protocol described in Chapter III, Levels of Use (LoU), produced a quantitative description of the level of use of the innovation in seven categories and a total implementation score. The innovation

discussed was the instructional strategy called Guided Reading. All teachers in both groups had previously received identical training and materials, and had available to them continued professional development opportunities and support. In the four treatment schools, the principals then received training in Diffusion of Innovation theories.

The four principals selected for treatment as described in Chapter III received five weeks of training in Diffusion of Innovation Theory. The outline for the five weeks consisted of:

Week 1: Overview of Diffusion of Innovation Theory: An Introduction to Everett Rogers

Week 2: Attributes of an Innovation

Week 3: Categories of Adopters

Week 4: The Concept of Critical Mass

Week 5: Complimenting Change Theories

There were reflection activities assigned to the principals to participate in to illustrate the information presented each week. Principals were asked to do these reflection activities in between training sessions and were used to generate discussion. Specific activities or interventions were not provided or required of principals to implement in their school, rather they were left to interpret the information provided in the training for themselves and to use it as they saw fit.

After 20 weeks from the original interviews, the participating teachers were interviewed a second time. The same interviewers used the same tool, the LoU protocol. A second set of scores were secured for each teacher. Recorded was the status of the school (treatment or control), the years of experience of the teacher, the years of experience of the principal, the pre-treatment scores, and the post-treatment scores.

### Levels of Use Protocol

The Levels of Use interview protocol provided scores in seven categories and a total implementation score. The seven categories and a description of what they reflect are summarized in Table 3.

Table 3

#### *Categories of Levels of Use Interview Protocol*

Category	Description
Acquiring Information	How the user solicits information about the innovation in a variety of ways, including questioning resource persons, corresponding with resource agencies, reviewing printed materials, and making visits.
Sharing	How the user discusses the innovation with others. Shares plans, ideas, resources, outcomes, and problems related to use of the innovation.
Assessing	How the user examines the potential or actual use of the innovation or some aspect of it. This can be a mental assessment or can involve actual collection and analysis of data.
Knowledge	That which the user knows about characteristics of the innovation, how to use it, and consequences of its use. This refers to cognitive knowledge, not feelings or attitudes.
Planning	How the user designs and outlines short and/or long range steps to be taken during process of innovation adoption including aligning resources, schedules, and activities, and meeting with others to organize and /or coordinate use of the innovation.
Status Reporting	Describes personal stand at the present time in relation to use of the innovation.
Performing	How the user carries out the actions and activities entailed in operationalizing the innovation.

After both scores were recorded, a growth score was calculated for each category and the total score. A summary of the sum of recorded growth by treatment/control group is presented in Table 4.

Table 4

*Growth in Measured Levels of Use by Category and Treatment Group*

School Group	Acquire Information	Sharing	Assessing	Knowledge	Planning	Status Reporting	Performing	Total Score
Control	3	4	1	8	0	4	2	8
Treatment	20	20	15	8	2	3	5	8
Sum Total	23	24	16	16	2	7	7	16

*Note:* Table reflects aggregate points gained by group within category

As a total group, each category showed growth over the 20 weeks between interviews.

Analysis of Variance (ANOVA) was used on each category to compare the means of the two groups and to determine if a significant difference could be attributed to the treatment. Following are a series of ANOVA charts for each category.

#### Note on Sample Size and Analysis

The following charts do show a statistical significance in certain aspects of the study. However, it is important to note that the sample size is relatively small in both the treatment schools and in the control schools. With a total of 48 teachers participating in the interview protocols, data has to be analyzed with an understanding of the sample size constraints. In only one grade level (grade one), were there sample sizes over 10. In grade two, there were only two participants in each of the groups. This researcher was cautious in the analysis of the data due to the small sample size and readers should be similarly cautious. The constraint of the sample size is noted later in Chapter five as a limitation of the study and an area of need for future study.

Table 5

*Pre - treatment ANOVA Descriptives in Acquiring Information Category*

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Control	19	4.2105	.53530	.12281	3.9525	4.4685	4.00	6.00
Treatment	28	4.1786	.47559	.08988	3.9942	4.3630	4.00	6.00
Total	47	4.1915	.49512	.07222	4.0461	4.3369	4.00	6.00

Table 6

*Pre - treatment ANOVA Results in Acquiring Information Category*

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.012	1	.012	.046	.831
Within Groups	11.265	45	.250		
Total	11.277	46			

Table 7

*Post - treatment ANOVA Descriptives in Acquiring Information Category*

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Control	19	4.4211	.76853	.17631	4.0506	4.7915	4.00	6.00
Treatment	28	4.9643	.92224	.17429	4.6067	5.3219	4.00	7.00
Total	47	4.7447	.89608	.13071	4.4816	5.0078	4.00	7.00

Table 8

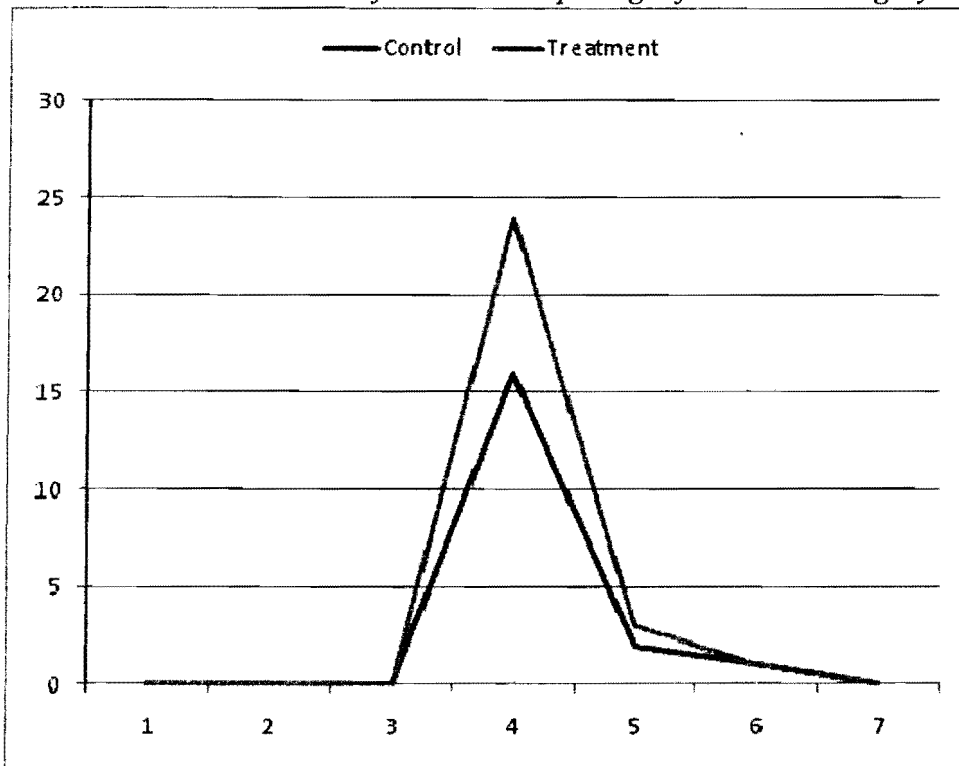
*Post - treatment ANOVA Results in Acquiring Information Category*

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3.340	1	3.340	4.474	.040
Within Groups	33.596	45	.747		
Total	36.936	46			

Tables 5-8 represent the analysis of variance of the Acquiring Information category between the treatment and the control groups. The first pair represents the pre-treatment Level of Use scores and the second pair reports on the post-treatment Level of Use scores. The analysis of variance of the pre-treatment scores is not significant at .520 level. There is little difference in the means of the two groups prior to the treatment. This data suggests that the both sets of observations are from the same population. The analysis of variance of the post-treatment scores is significant at a .049 level. There is a significant difference in the means of the two groups after the treatment. This data suggests that the observations are not from the same population. With a significant model, we can conclude that the difference between the post-treatment means of the treatment group and the control group is not by chance. Therefore, training received by the principals in the treatment schools positively impacted the behaviors described in the acquiring information category for the teachers in their buildings.

The pre-treatment observations of both the treatment group and the control group produce a normal curve. In the control group, 80% of observations fall within one standard deviation and 90% fall within two standard deviations. In the treatment group, 86% of observations fall within one standard deviation and 96% fall within two standard deviations. Graph 1 graphically depicts the similarities between the treatment and control group prior to the treatment.

Graph 1

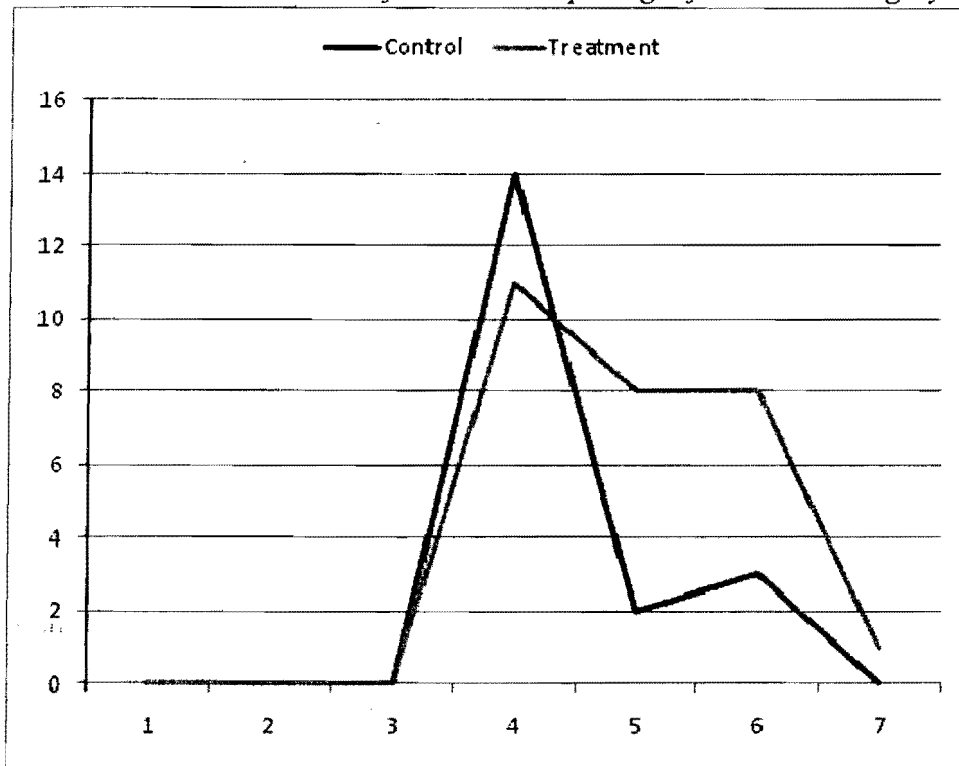
*Pre-treatment Distribution of Means in Acquiring Information Category*

The control group did have one outlier that was more than 4 standard deviations from the mean. With the small sample size, this outlier was removed.

The post-treatment observations of both the treatment group and the control group produce a normal curve. In the control group, 70% of observations fall within one standard deviation and 95% fall within two standard deviations. In the treatment group, 68% of observations fall within one standard deviation and 96% fall within two standard deviations. Graph 2 graphically depicts the positive shift between the treatment and control group after the treatment.



Graph 2

*Post-treatment Distribution of Means in Acquiring Information Category*

The Acquiring Information category is defined as how the user solicits information about the innovation in a variety of ways, including questioning resource persons, corresponding with resource agencies, reviewing printed materials, and making visits. The analysis of variance between the two groups after treatment in this category was significant. Teachers in a school that had a principal in the treatment group showed significant positive difference in the mean of their scores than teachers in schools that had a principal in the control group. A review of the raw scores showed the greatest difference in growth between the two groups in the Acquiring Information category compared to all other categories. A review of the definition of the Acquiring Information category and the specific questions asked during the LoU interviews shows that this

category is more behavioral in nature, probing the actions of a teacher and their desire to seek out new information on the innovation.

There are significant aspects of the Diffusion of Innovation training that the principals received that can account for this growth. During the discussions, a great deal of time was spent on the attributes of an innovation. One of the attributes that received specific attention was "ability to observe". This attribute notes the positive relationship between a potential adopter's opportunities to see the innovation in action and the results of the use of the innovation with the increase in likelihood that the adopter will pursue the innovation themselves. Principals that recognize the importance of this attribute would facilitate the opportunities for teachers to observe one another, observe master teachers and coaches, and have opportunities to discuss the practice with their peers.

Another aspect that focused on acquiring information was from the concept of "opinion leaders". Providing opinion leaders the opportunities to become the "go to" people was identified as significant to an educational innovation's implementation success. The principals discussed the characteristics of opinion leaders and recognized them in some of their staff. The training discussions addressed the need to focus on these individuals, provide them with an informal leadership role in the adoption, and keep them informed of progress. The encouragement and acceptance of the innovation by these individuals would promote greater communication and a greater desire to acquire information regarding the new practice. Since the Acquiring Information category is measured by behaviors that reflect an adopter's early attempts to learn more about the innovation it is reasonable to assume that, in schools with principals making deliberate attempts to increase the opportunity for such information acquisition, greater growth would be seen.

Table 9

*Pre - treatment ANOVA Descriptives in Sharing Category*

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Control	19	4.1579	.50146	.11504	3.9162	4.3996	4.00	6.00
Treatment	28	4.1429	.35635	.06734	4.0047	4.2810	4.00	5.00
Total	47	4.1489	.41592	.06067	4.0268	4.2711	4.00	6.00

Table 10

*Pre - treatment ANOVA Results in Sharing Category*

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.003	1	.003	.014	.905
Within Groups	7.955	45	.177		
Total	7.957	46			

Table 11

*Post - treatment ANOVA Descriptives in Sharing Category*

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Control	19	4.3158	.67104	.15395	3.9924	4.6392	4.00	6.00
Treatment	28	4.7857	.83254	.15734	4.4629	5.1085	4.00	7.00
Total	47	4.5957	.79836	.11645	4.3613	4.8302	4.00	7.00

Table 12

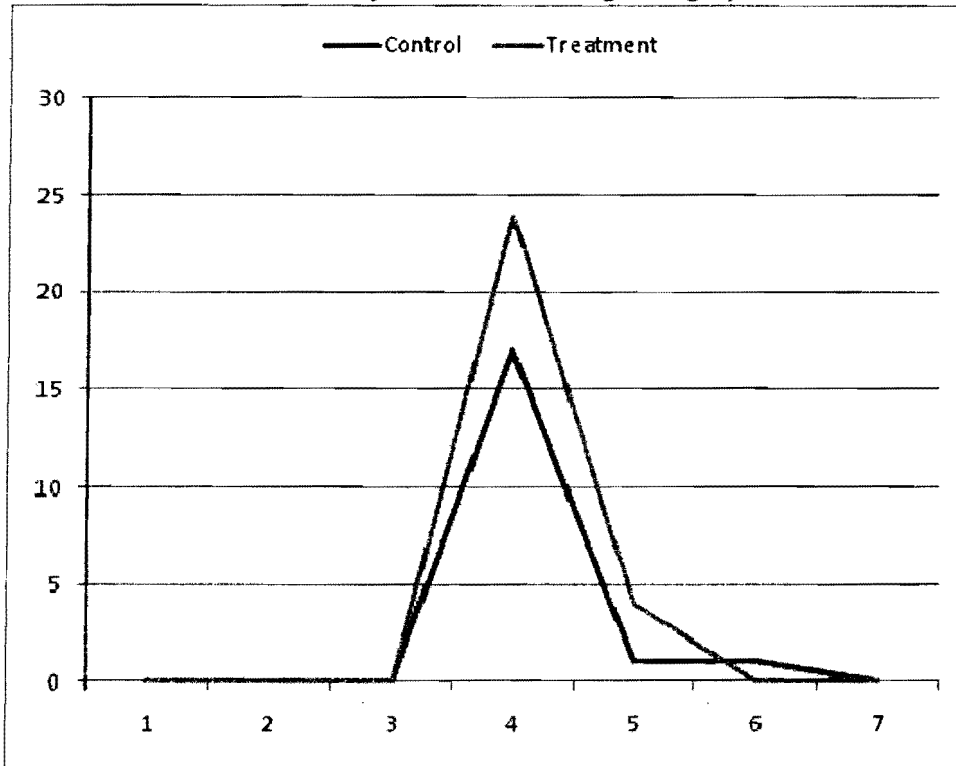
*Post - treatment ANOVA Results in Sharing Category*

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.500	1	2.500	4.194	.046
Within Groups	26.820	45	.596		
Total	29.319	46			

Tables 9-12 represent the analysis of variance of the Sharing category between the treatment and the control groups. The first pair represents the pre-treatment Level of Use scores and the second pair reports on the post-treatment Level of Use scores. The analysis of variance of the pre-treatment scores is not significant at .432 level. There is little difference in the means of the two groups prior to the treatment. This data suggests that the both sets of observations are from the same population. The analysis of variance of the post-treatment scores is significant at a .033 level. There is a significant difference in the means of the two groups after the treatment. This data suggests that the observations are not from the same population. With a significant model, we can conclude that the difference between the post-treatment means of the treatment group and the control group is not by chance. Therefore, training received by the principals in the treatment schools positively impacted the behaviors described in the Sharing category for the teachers in their buildings.

The pre-treatment observations of both the treatment group and the control group produce a normal curve. In the control group, 85% of observations fall within one standard deviation and 90% fall within two standard deviations. In the treatment group, 86% of observations fall within one standard deviation and 100% fall within two standard deviations. Graph 3 below graphically depicts the similarities between the treatment and control group prior to the treatment.

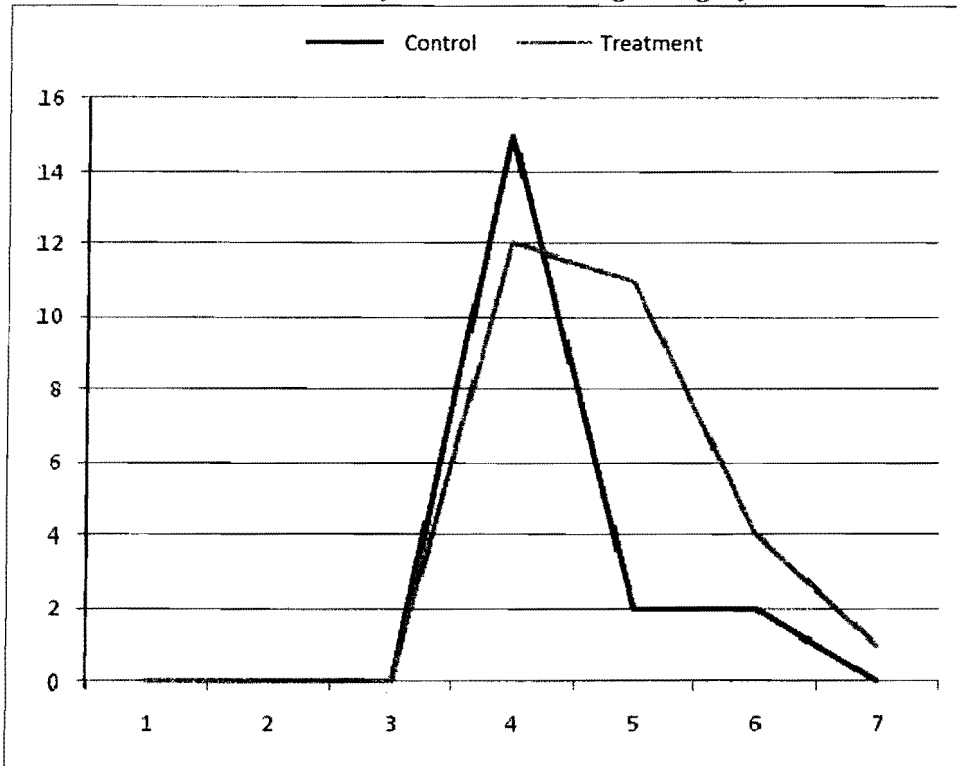
Graph 3

*Pre-treatment Distribution of Means in Sharing Category*

The control group did have one outlier that was more than 3 standard deviations from the mean. With the small sample size, this outlier was removed from the data.

The post-treatment observations of both the treatment group and the control group produce a normal curve. In the control group, 85% of observations fall within one standard deviation and 95% fall within two standard deviations. In the treatment group, 82% of observations fall within one standard deviation and 96% fall within two standard deviations. Graph 4 below graphically depicts the positive difference between the treatment and control group after the treatment.

Graph 4

*Post-treatment Distribution of Means in Sharing Category*

The Sharing category is defined as how the user discusses the innovation with others and how a user shares plans, ideas, resources, outcomes, and problems related to use of the innovation. The analysis of variance between the two groups after the treatment in this category was significant. Teachers in a school that had a principal in the treatment group showed greater mean scores than teachers in schools that had a principal in the control group. Review of the raw scores showed the second greatest difference in growth between the two groups was in the Sharing category. This was the greatest difference in all other categories except the Acquiring Information category. A review of the definition of the Sharing category and the specific questions asked during the LoU interviews shows that this category is also behavioral in nature, probing the actions of a

teacher in regards to discussing and sharing with colleagues and their desire to collaborate about the innovation.

A school is a strong social setting. The adoption of a new practice in such a social setting makes for a strong connection between the Acquiring Information category and the Sharing category. Since collaboration over competition is common in a school setting, the aspects that drove the Acquiring Information category to a significant factor in treatment schools are the same as the aspects that support strong Sharing score growth. In a school setting the desire to learn more about an innovation, to adhere to the example set forth by the opinion leaders, and to take advantage of opportunities to professionally grow created by the building principal, all lead to sharing. Grade level partners are encountering the same obstacles and have similar questions. They are limited by the same supplies and time frames. They often have similar students. This naturally leads to sharing as a means of addressing problems and acquiring information. Treatment group principals would encourage this sharing and provide ample opportunity for it. It is reasonable to assume that providing opportunities for sharing would result in significantly greater sharing and, ultimately, greater implementation success.

Table 13

*Pre - treatment ANOVA Descriptives in Assessing Category*

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Control	19	4.7368	.73349	.16827	4.3833	5.0904	4.00	6.00
Treatment	28	4.5357	.83808	.15838	4.2107	4.8607	3.00	6.00
Total	47	4.6170	.79545	.11603	4.3835	4.8506	3.00	6.00

Table 14

*Pre - treatment ANOVA Results in Assessing Category*

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.458	1	.458	.719	.401
Within Groups	28.648	45	.637		
Total	29.106	46			

Table 15

*Post - treatment ANOVA Descriptives in Assessing Category*

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Control	19	4.7368	.87191	.20003	4.3166	5.1571	4.00	6.00
Treatment	28	5.2143	.68622	.12968	4.9482	5.4804	4.00	6.00
Total	47	5.0213	.79371	.11577	4.7882	5.2543	4.00	6.00

Table 16

*Post - treatment ANOVA Results in Assessing Category*

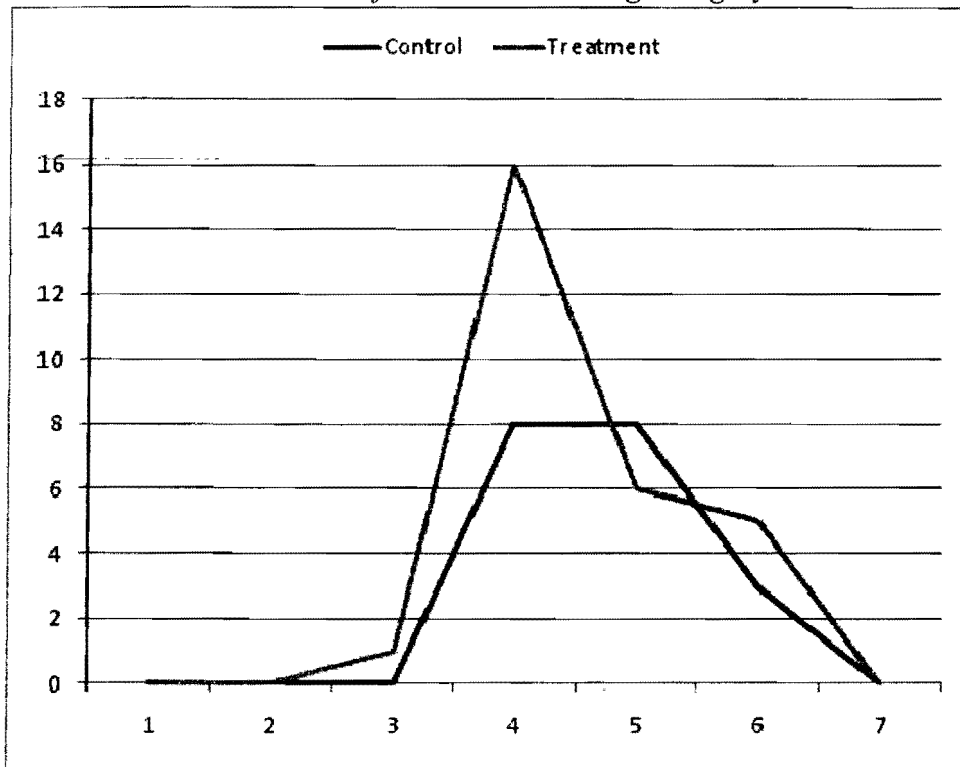
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.580	1	2.580	4.398	.042
Within Groups	26.398	45	.587		
Total	28.979	46			



Tables 13-16 represent the analysis of variance of the Assessing Category between the treatment and the control groups. The first pair represents the pre-treatment Level of Use scores and the second pair reports on the post-treatment Level of Use scores. The analysis of variance of the pre-treatment scores is not significant at .907 level. There is virtually no difference in the means of the two groups prior to the treatment. This data suggests that the both sets of observations are from the same population. The analysis of variance of the post-treatment scores is significant at a .031 level. There is a significant difference in the means of the two groups after the treatment. This data suggests that the observations are not from the same population. With a significant model, we can conclude that the difference between the post-treatment means of the treatment group and the control group is not by chance. Therefore, training received by the principals in the treatment schools positively impacted the behaviors described in the Assessing category for the teachers in their buildings.

The pre-treatment observations of both the treatment group and the control group produce a normal curve. In the control group, 85% of observations fall within one standard deviation and 90% fall within two standard deviations. In the treatment group, 86% of observations fall within one standard deviation and 100% fall within two standard deviations. Graph 5 graphically depicts the similarities between the treatment and control group prior to the treatment.

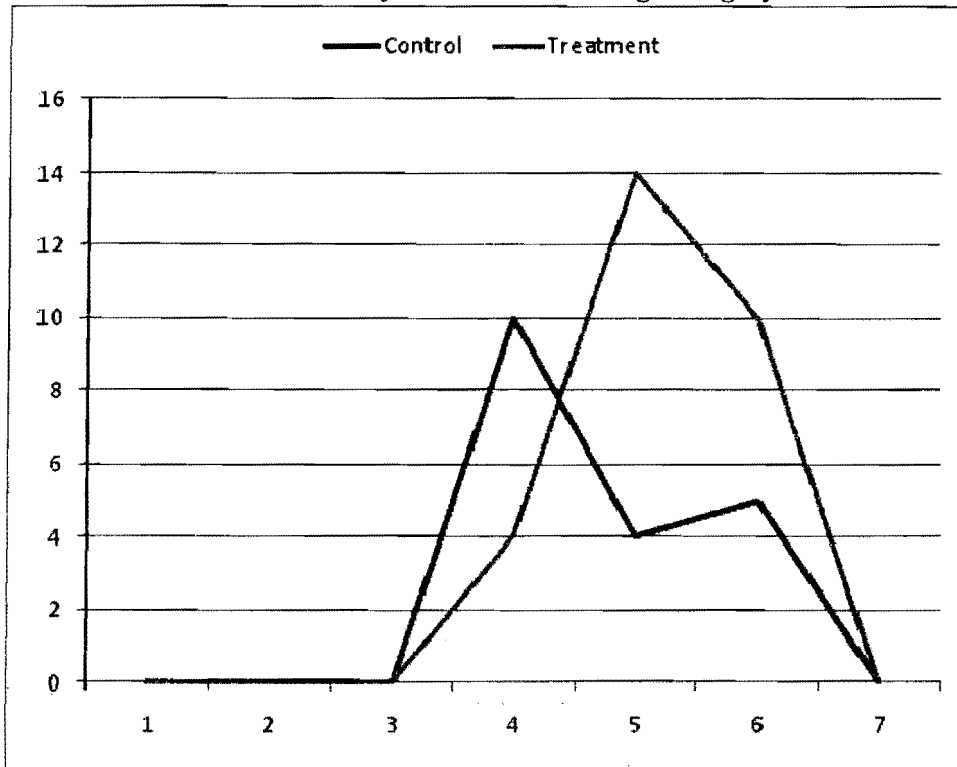
Graph 5

*Pre-treatment Distribution of Means in Assessing Category*

The control group did have one outlier that was more than 3 standard deviations from the mean. With the small sample size, this outlier was removed from the data.

The post-treatment observations of both the treatment group and the control group produce a normal curve. In the control group, 70% of observations fall within one standard deviation and 95% fall within two standard deviations. In the treatment group, 86% of observations fall within one standard deviation and 100% fall within two standard deviations. Graph 6 depicts the positive difference between the treatment and control group after the treatment.

Graph 6

*Post-treatment Distribution of Means in Assessing Category*

The Assessing category is defined as how the user examines the potential or actual use of the innovation or some aspect of it. This can be a mental assessment or can involve actual collection and analysis of data. The analysis of variance between the two group means post-treatment in this category was significant. Teachers in a school that had a principal in the treatment group showed greater mean scores than teachers in schools that had a principal in the control group. Review of the raw scores showed the greatest percentage difference in growth between the two groups in the Assessing category compared to all other categories. This is due in part to there being virtually no growth in scores from the control group in this category. A review of the definition of the Assessing category and the specific questions asked during the LoU interviews shows that this category is about probing the actions of a teacher in regards to how they are

collecting feedback and evaluating the effect of the use of the innovation. In view of the aspects that were covered in Diffusion of Innovation training with the treatment principals, this growth can be explained by the “sense of urgency” created by the focus placed on adoption of Guided Reading in their buildings and by the “piqued interest” of the teachers as they are exposed to opportunities to observe, opportunities to try, the leadership of certain peers (opinion leaders), and the emphasis the building principal is putting on the initiative. This would explain the virtual absence of any growth in this category in control schools. The absence of such a “sense of urgency” or, at least curiosity would lead to an absence of self-reflection or assessment. In a treatment school where the principal has made clear the importance of the innovation through the opportunities to learn and discuss that they have facilitated, teacher interest is higher and efforts are greater to implement. If a teacher has made the effort to implement and is growing in sophistication in their knowledge and understanding of the innovation, it would seem reasonable to believe that they would be anxious to question, formally assess, and informally assess their efforts.

Table 17

*Pre - treatment ANOVA Descriptives in Knowledge Category*

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Control	19	4.0526	.22942	.05263	3.9421	4.1632	4.00	6.00
Treatment	28	4.1071	.41627	.07867	3.9457	4.2686	4.00	6.00
Total	47	4.0851	.35076	.05116	3.9821	4.1881	4.00	6.00

Table 18

*Pre - treatment ANOVA Results in Knowledge Category*

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.034	1	.034	.269	.607
Within Groups	5.626	45	.125		
Total	5.660	46			

Table 19

*Post - treatment ANOVA Descriptives in Knowledge Category*

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Control	19	4.4211	.69248	.15887	4.0873	4.7548	4.00	5.00
Treatment	28	4.3929	.62889	.11885	4.1490	4.6367	4.00	6.00
Total	47	4.4043	.64806	.09453	4.2140	4.5945	4.00	6.00

Table 20

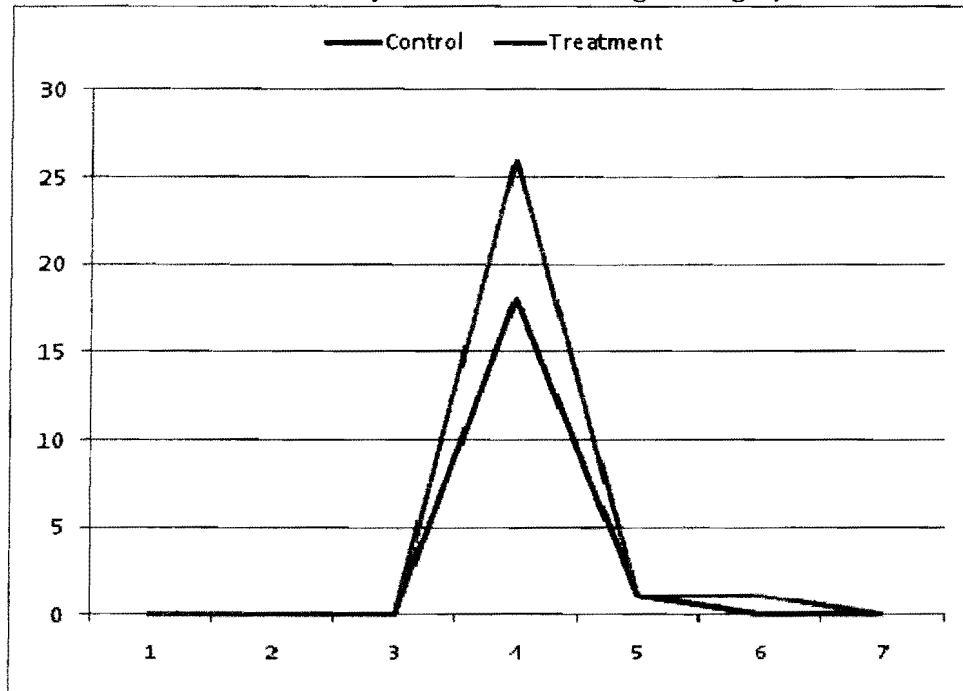
*Post - treatment ANOVA Results in Knowledge Category*

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.009	1	.009	.021	.886
Within Groups	19.310	45	.429		
Total	19.319	46			

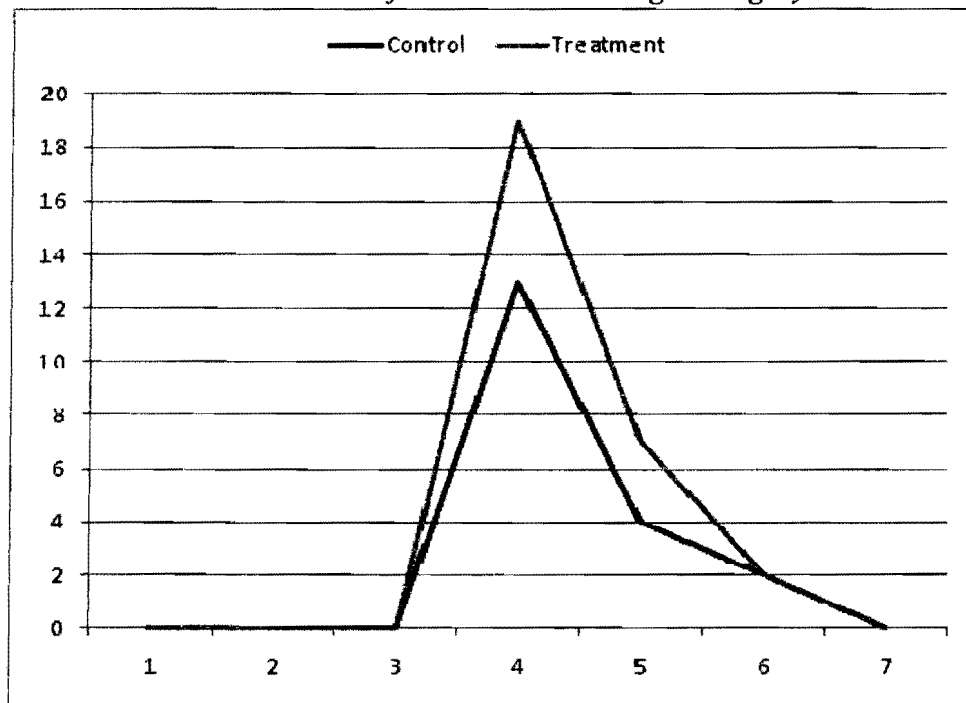
Tables 17-20 represent the analysis of variance of the Knowledge Category between the treatment and the control groups. The first pair represents the pre-treatment Level of Use scores and the second pair reports on the post-treatment Level of Use scores. The analysis of variance of the pre-treatment scores is not significant at .203 level. There is little difference in the means of the two groups prior to the treatment. This data suggests that the both sets of observations are from the same population. The analysis of variance of the post-treatment scores is also not significant at a .551 level. This data also suggests that the both sets of observations are from the same population. Based on this information, there can be no conclusions drawn about the growth in Knowledge category between the control schools and the treatment schools.

Graphs 7 and 8 depicts the similarities between the treatment and control group both prior to the treatment and after the treatment. The control group did have one outlier that was more than 3 standard deviations from the mean. With the small sample size, this outlier was removed from the data.

Graph 7

*Pre-treatment Distribution of Means in Knowledge Category*

Graph 8

*Post-treatment Distribution of Means in Knowledge Category*

The Knowledge category is defined as that which the user knows about the characteristics of the innovation, how to use it, and consequences of its use. This refers to cognitive knowledge, not feelings or attitudes. The analysis of variance between the two groups in this category was not significant. In fact, in raw scores, the increase in the knowledge category was identical between the control and the treatment groups. A review of both the definition of the knowledge category and the specific interview questions asked to probe that category reveals that the category is very fact based in nature. Through the course of the in-services days, the exposure to the materials purchased, and the ongoing support, all teachers should have scored at the basic levels of knowledge of the Guided Reading practices. Since all teachers in both the treatment and control groups had this training and exposure, it is not surprising that there was no difference between the two groups in terms of growth. They all started at basically the same spot and had the same trainings and materials. Given the short duration of the treatment period, it is reasonable to assume that, should the treatment group have an advantage over the control group, any differences in a fact based line of questioning would not present themselves.

It is also important to note that, in raw scores, the greatest growth of any category in the control group was in the knowledge category. It can be assumed that the growth in this category was due to the training provided, the materials purchased, and the ongoing support. Certainly it would be expected that any group of individuals given training and support on a particular topic would have interviews that reflect a growth in knowledge from the time prior to the training to the time after the training. This category required the least amount of initiative on the part of the individual teacher, as the training, support, and materials were provided to them. Therefore growth in both the control and treatment



groups was practically guaranteed. It would be of interest to see if there was a divergence in the knowledge category over a longer period of study, particularly after mandatory trainings subsided. Any growth in knowledge of a new practice at that point would have to be sought out by the individual. Diffusion of Innovation theories state that a change agent can promote such "seeking out" by creating the environment, the desire, and the opportunities for individuals to pursue more knowledge.

Table 21

*Pre - treatment ANOVA Descriptives in Planning Category*

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Control	19	4.2632	.45241	.10379	4.0451	4.4812	4.00	5.00
Treatment	28	4.3929	.73733	.13934	4.1070	4.6788	3.00	6.00
Total	47	4.3404	.63508	.09264	4.1540	4.5269	3.00	6.00

Table 22

*Pre - treatment ANOVA Results in Planning Category*

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.190	1	.190	.467	.498
Within Groups	18.363	45	.408		
Total	18.553	46			

Table 23

*Post - treatment ANOVA Descriptives in Planning Category*

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Control	19	4.2632	.45241	.10379	4.0451	4.4812	4.00	5.00
Treatment	28	4.4643	.79266	.14980	4.1569	4.7716	4.00	6.00
Total	47	4.3830	.67737	.09881	4.1841	4.5819	4.00	6.00

Table 24

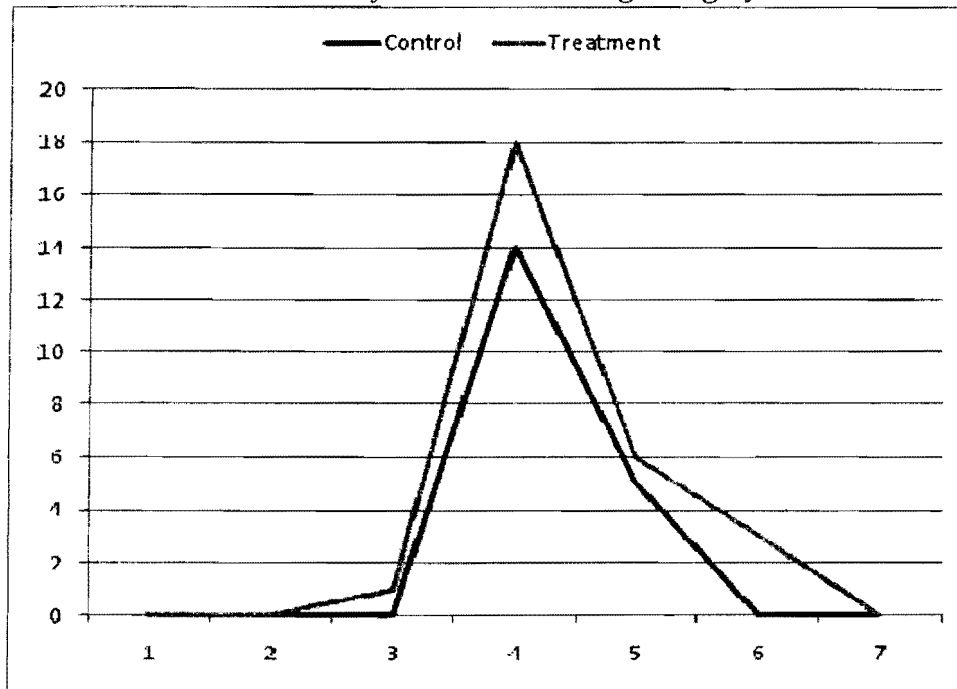
*Post - treatment ANOVA Results in Planning Category*

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.458	1	.458	.998	.323
Within Groups	20.648	45	.459		
Total	21.106	46			

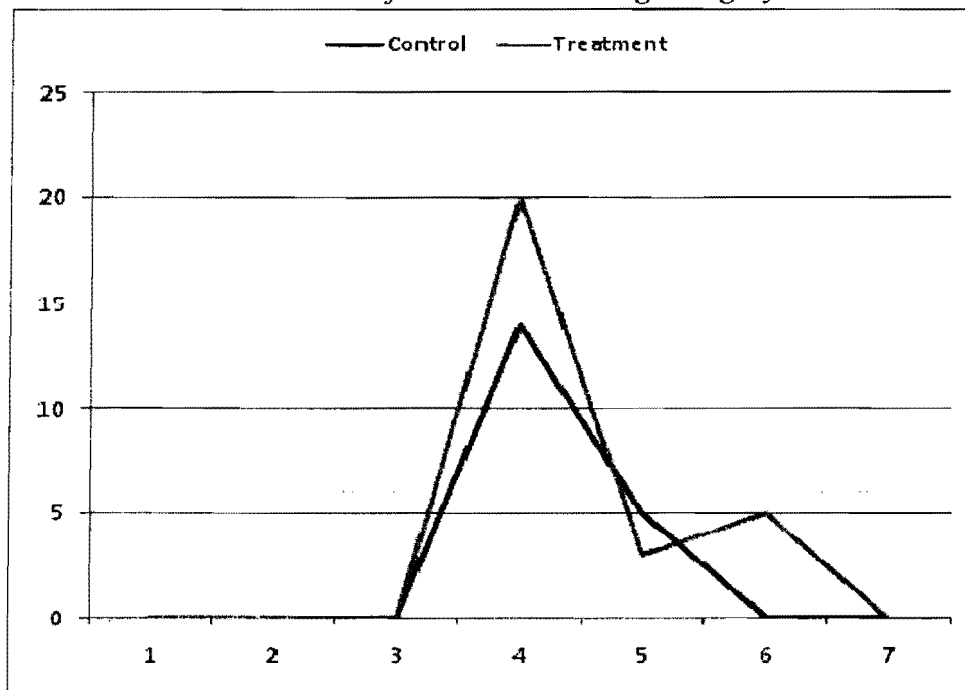
Tables 21-24 represent the analysis of variance of the Planning Category between the treatment and the control groups. The first pair represents the pre-treatment Level of Use scores and the second pair reports on the post-treatment Level of Use scores. The analysis of variance of the pre-treatment scores is not significant at .210 level. There is little difference in the means of the two groups prior to the treatment. This data suggests that the both sets of observations are from the same population. The analysis of variance of the post-treatment scores is also not significant at a .135 level. This data also suggests that the both sets of observations are from the same population. Based on this information, there can be no conclusions drawn about the growth in the Planning category between the control schools and the treatment schools.

The charts below graphically depicts the similarities between the treatment and control group both prior to the treatment and after the treatment. The control group did have one outlier that was more than 3 standard deviations from the mean. With the small sample size, this outlier was removed from the data.

Graph 9

*Pre-treatment Distribution of Means in Planning Category*

Graph 10

*Post-treatment Distribution of Means in Planning Category*

The Planning category is defined as how the user designs and outlines short and/or long range steps to be taken during the process of innovation adoption including aligning resources, schedules, and activities, and meeting with others to organize and /or coordinate use of the innovation. The analysis of variance between the two groups in this category was not significant. In the raw scores, the increase in the Planning category was the smallest for both the treatment and control groups independently. A review of both the definition of the Planning category and the specific interview questions asked to probe that category reveals that the category focuses on more sophisticated concepts of the innovation than other categories. The questions specifically mention “future use” and “future planning”. One question specifically mentions “later this year”. Due to the sophistication of the practice of Guided Reading, expectations for “mastery” were certainly low in the early months. Teachers were focused on the foundations of knowledge and information acquisition. Longer term planning requires a greater comfort level with the innovation and a confidence in assessing and manipulating the practice that could not have come in a period of months. Therefore, it is reasonable to assume that, given the short duration of the treatment period, such sophistication in planning would not yet reveal itself.

Table 25

*Pre - treatment ANOVA Descriptives in Status Reporting Category*

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Control	19	4.3158	.67104	.15395	3.9924	4.6392	4.00	6.00
Treatment	28	4.5357	.74447	.14069	4.2470	4.8244	4.00	6.00
Total	47	4.4468	.71653	.10452	4.2364	4.6572	4.00	6.00

Table 26

*Pre - treatment ANOVA Results in Status Reporting Category*

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.547	1	.547	1.068	.307
Within Groups	23.070	45	.513		
Total	23.617	46			

Table 27

*Post - treatment ANOVA Descriptives in Status Reporting Category*

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Control	19	4.4737	.84119	.19298	4.0682	4.8791	4.00	6.00
Treatment	28	4.6429	.82616	.15613	4.3225	4.9632	4.00	6.00
Total	47	4.5745	.82738	.12069	4.3315	4.8174	4.00	6.00

Table 28

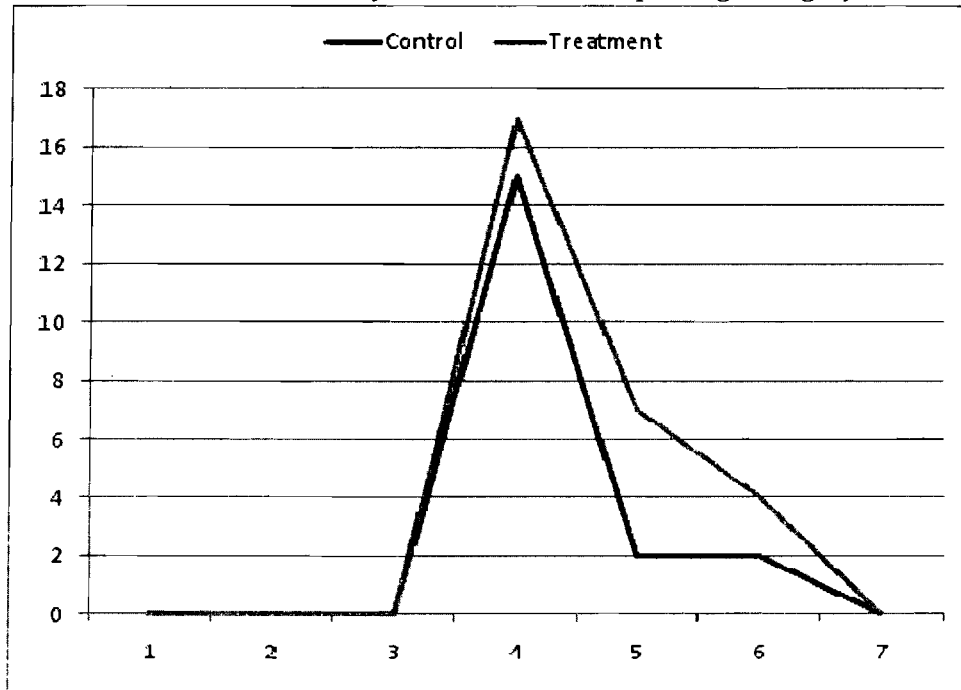
*Post - treatment ANOVA Results in Status Reporting Category*

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.324	1	.324	.468	.498
Within Groups	31.165	45	.693		
Total	31.489	46			

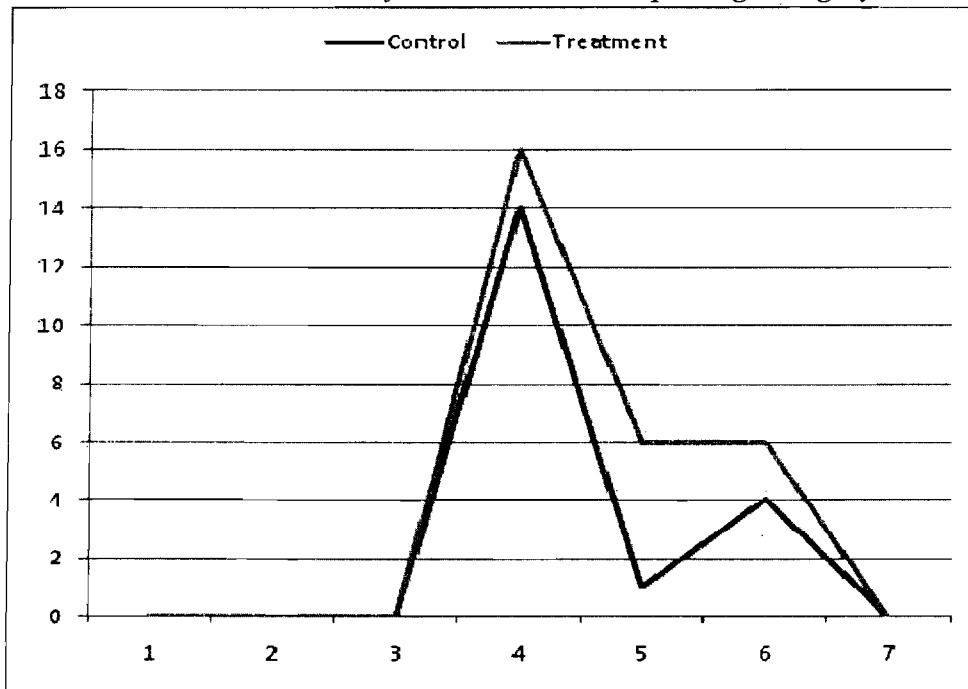
Tables 25-28 represent the analysis of variance of the Status Reporting Category between the treatment and the control groups. The first pair represents the pre-treatment Level of Use scores and the second pair reports on the post-treatment Level of Use scores. The analysis of variance of the pre-treatment scores is not significant at .130 level. There is little difference in the means of the two groups prior to the treatment. This data suggests that the both sets of observations are from the same population. The analysis of variance of the post-treatment scores is also not significant at a .270-level. This data also suggests that the both sets of observations are from the same population. Based on this information, there can be no conclusions drawn about the growth in the Status Reporting category between the control schools and the treatment schools.

The charts below graphically depicts the similarities between the treatment and control group both prior to the treatment and after the treatment. The control group did have one outlier that was more than 3 standard deviations from the mean. With the small sample size, this outlier was removed from the data.

Graph 11

*Pre-treatment Distribution of Means in Status Reporting Category*

Graph 12

*Post-treatment Distribution of Means in Status Reporting Category*



The Status Reporting category is defined as how an individual describes their personal stand at the present time in relation to use of the innovation. The analysis of variance between the two groups in this category was not significant. In the raw scores, the Status Reporting category was the only category that showed a greater growth in the control group over the treatment group. A review of both the definition of the Status Reporting category and the specific interview questions asked to probe that category reveals that the category focuses on explicit terminology that reveals a specific position along a continuum of implementation specific to Guided Reading. In the school district studied, there were clear expectations for both treatment and control schools regarding the implementation of Guided Reading. Guided Reading was an adopted practice by the district and the option of "not doing it" was never present. Therefore, a minimum level of implementation was expected at all schools. Since the levels of implementation are specific, and the sophistication between levels so great, a minimal amount of growth was to be expected in either group. To increase in the Status Reporting category, teachers would have had to report manipulation and experimentation with the practice. Since the practice was so new to all of the teachers, increasing knowledge, acquiring information, sharing, and assessing were all much higher priority. Therefore, it is reasonable to assume that, given the short duration of the treatment period, such manipulation and experimentation would not yet have occurred, leaving most teachers in both groups without growth in this category.

Table 29

*Pre - treatment ANOVA Descriptives in Performance Category*

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Control	19	4.3158	.67104	.15395	3.9924	4.6392	4.00	6.00
Treatment	28	4.5000	.69389	.13113	4.2309	4.7691	4.00	6.00
Total	47	4.4255	.68349	.09970	4.2249	4.6262	4.00	6.00

Table 30

*Pre - treatment ANOVA Results in Performance Category*

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.384	1	.384	.819	.370
Within Groups	21.105	45	.469		
Total	21.489	46			

Table 31

*Post - treatment ANOVA Descriptives in Performance Category*

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Control	19	4.4211	.76853	.17631	4.0506	4.7915	4.00	6.00
Treatment	28	4.6786	.77237	.14596	4.3791	4.9781	4.00	6.00
Total	47	4.5745	.77304	.11276	4.3475	4.8014	4.00	6.00

Table 32

*Post - treatment ANOVA Results in Performance Category*

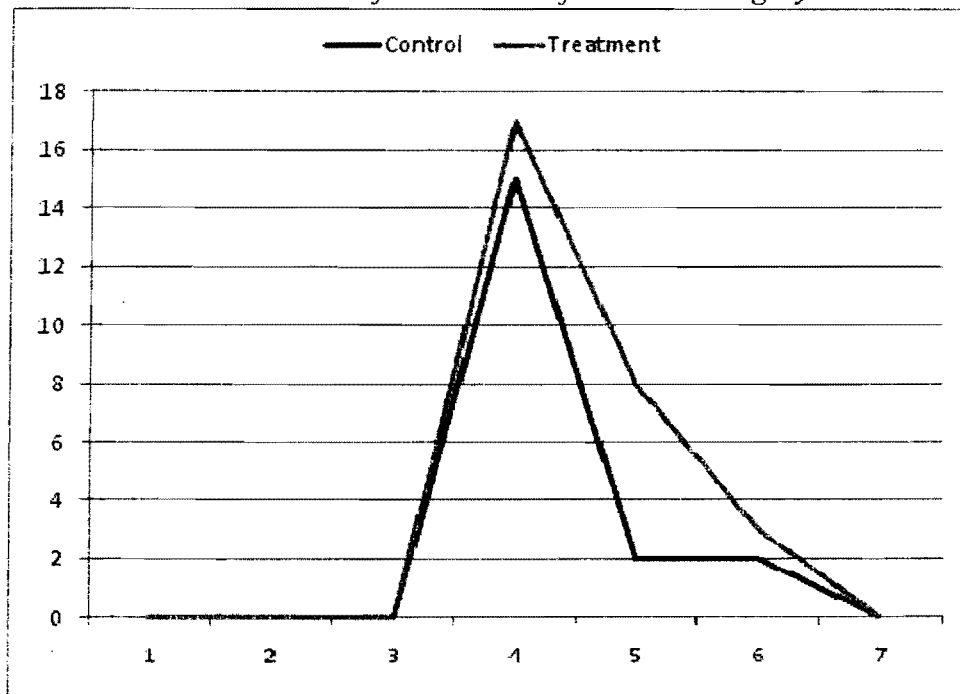
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.751	1	.751	1.263	.267
Within Groups	26.739	45	.594		
Total	27.489	46			

Tables 29-32 represent the analysis of variance of the Performance Category between the treatment and the control groups. The first pair represents the pre-treatment Level of Use scores and the second pair reports on the post-treatment Level of Use scores. The analysis of variance of the pre-treatment scores is not significant at .156 level. There is little difference in the means of the two groups prior to the treatment. This data suggests that the both sets of observations are from the same population. The analysis of variance of the post-treatment scores is also not significant at a .113 level. This data also suggests that the both sets of observations are from the same population. Based on this information, there can be no conclusions drawn about the growth in the Performance category between the control schools and the treatment schools.

The charts below graphically depicts the similarities between the treatment and control group both prior to the treatment and after the treatment. The control group did have one outlier that was more than 3 standard deviations from the mean. With the small sample size, this outlier was removed from the data.

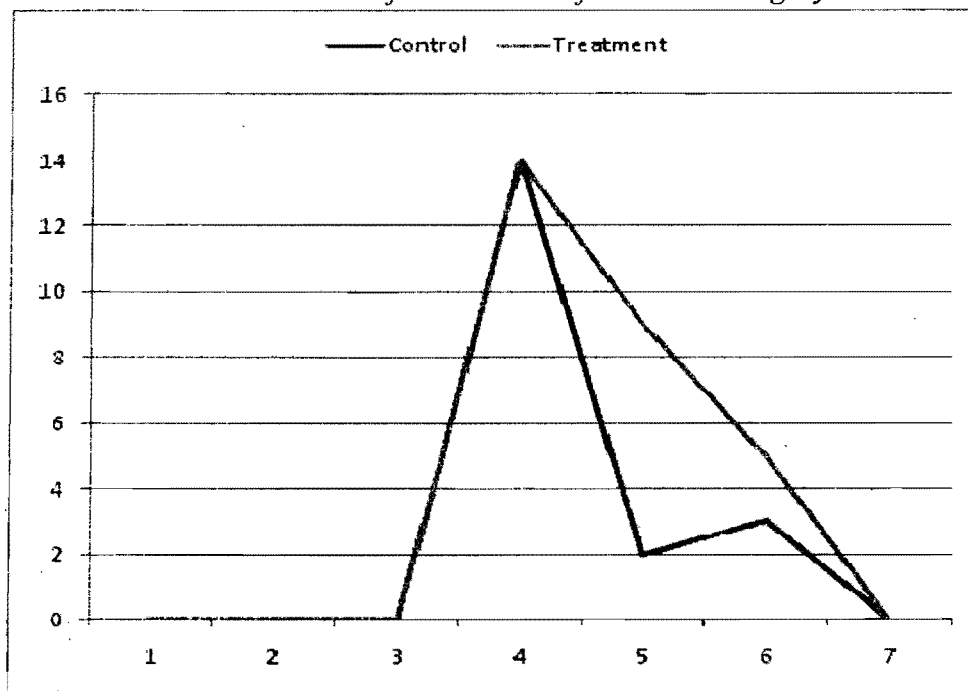
Graph 13

*Pre-treatment Distribution of Means in Performance Category*



Graph 14

*Post-treatment Distribution of Means in Performance Category*



The Performing category is defined as how the user carries out the actions and activities entailed in operationalizing the innovation. The analysis of variance between the two groups in this category was not significant. The raw scores showed a slightly higher increase for the treatment group over the control group, but both groups only showed minimal growth. A review of both the definition of the Performing category and the specific interview questions asked to probe that category reveals that the category focuses on the most sophisticated concepts of the innovation compared to other categories.

Operationalize means to define an abstract concept in such a way that it can be practically measured. Considering the increasingly sophisticated levels of the categories as we move through the LoU protocol, the four month period between pre and post interviews did not allow for significant growth in this category. To operationalize the innovation would require a level of "ownership" and sophistication that comes from a confidence level and experience in experimentation and manipulation that time has not yet allowed for.

Therefore, it is reasonable to assume that, given the short duration of the treatment period, such sophistication in the Performing category would not yet be able to materialize.

Table 33

*Pre - treatment ANOVA Descriptives in Total Scores*

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Control	19	30.0526	2.14667	.49248	29.0180	31.0873	28.00	36.00
Treatment	28	30.3929	2.94819	.55715	29.2497	31.5360	28.00	38.00
Total	47	30.2553	2.63313	.38408	29.4822	31.0284	28.00	38.00

Table 34

*Pre - treatment ANOVA Results in Total Scores*

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.310	1	1.310	.186	.669
Within Groups	317.626	45	7.058		
Total	318.936	46			

Table 35

*Post - treatment ANOVA Descriptives in Total Scores*

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Control	19	31.2632	3.69447	.84757	29.4825	33.0438	28.00	39.00
Treatment	28	33.1429	3.94137	.74485	31.6146	34.6712	28.00	42.00
Total	47	32.3830	3.91515	.57108	31.2334	33.5325	28.00	42.00

Table 36

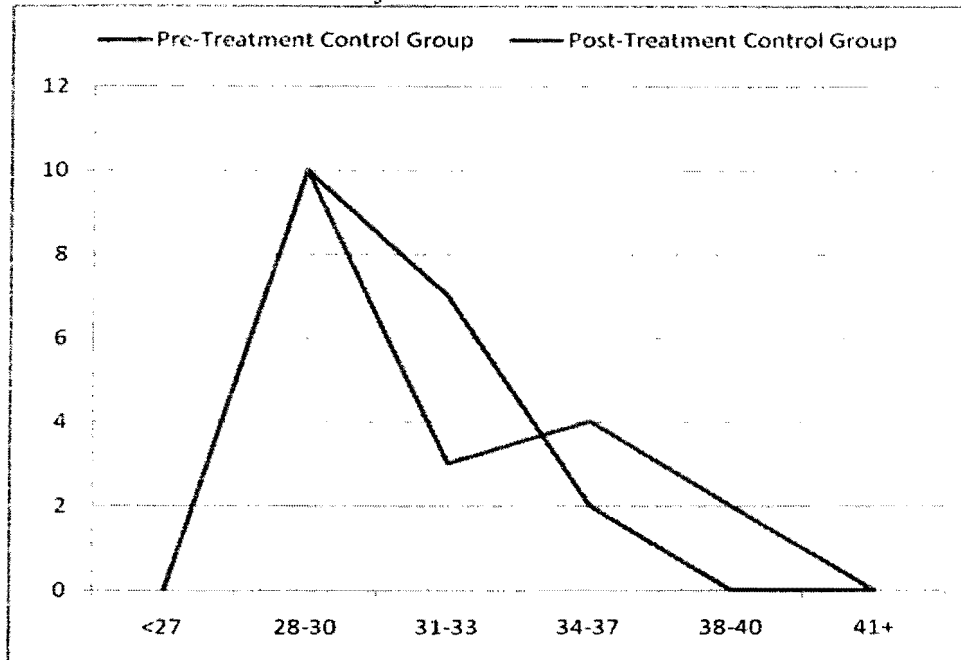
*Post - treatment ANOVA Results in Total Scores*

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	39.994	1	39.994	2.706	.107
Within Groups	665.113	45	14.780		
Total	705.106	46			

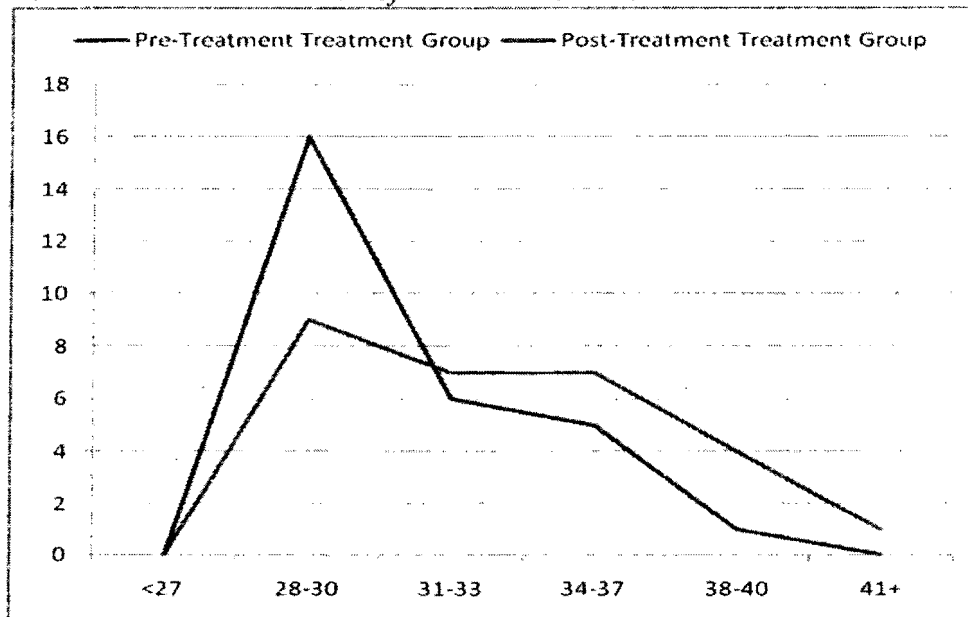
Tables 33-36 represent the analysis of variance of the Total Scores between the treatment and the control groups. One extreme outlier has been removed from the control group data as it was more than 10 standard deviations from the mean and no other observation was more than three standard deviations from the mean. The first pair represents the pre-treatment Level of Use scores and the second pair reports on the post-treatment Level of Use scores. The analysis of variance of the pre-treatment scores is not significant at .669 level. There is virtually no difference in the means of the two groups prior to the treatment. This data suggests that the both sets of observations are from the same population. The analysis of variance of the post-treatment scores is also not significant at a .107 level. There is a greater difference in the means of the two groups after the treatment, but the ANOVA is not significant.

The charts below graphically depict the impact on the scores from pre-treatment to post-treatment in both groups. The first chart shows the control group having some movement towards higher scores, but still has the same number of observations clustered around the lowest scores. The treatment group shows a similar shift towards higher scores but also shows a noticeable decrease in the starting score cluster that shifts towards higher scores. The control group did have one outlier that was more than 10 standard deviations from the mean. With the small sample size, this outlier was removed from the data.

Graph 15

*Pre-treatment Distribution of Means in Total Scores*

Graph 16

*Post-treatment Distribution of Means in Total Scores*



This is supported by the growth in the mean scores depicted in table 37.

Table 37

*Growth in Mean Scores*

Group	Mean Score Pre Treatment	Mean Score Post Treatment	Growth in Mean Score
Control Group	30.05	31.26	4.03%
Treatment Group	30.39	33.14	9.05%

The two tables below represent analysis of variance of Total Scores with the independent variable of Principal experience.

Table 38

*Post-treatment ANOVA Descriptives in Total Scores by Principal Experience*

Years	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
1-5	11	33.0909	2.54773	.76817	31.3793	34.8025	29.00	36.00
5-10	15	31.4000	3.62137	.93503	29.3946	33.4054	28.00	39.00
10-20	22	31.5455	7.12292	1.51861	28.3873	34.7036	7.00	42.00
Total	48	31.8542	5.33152	.76954	30.3061	33.4023	7.00	42.00

*Note:* First column represents years of experience as a building administrator

Table 39

*Post-treatment ANOVA Results in Total Scores by Principal Experience*

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	22.016	2	11.008	.377	.688
Within Groups	1313.964	45	29.199		
Total	1335.979	47			

The analysis of variance of the post-treatment scores is not significant at a .688 level.

This data suggests that the three sets of observations are from the same population.

Based on this information, there can be no conclusions drawn about the growth in the

Total Scores based on the experience level of the principal.

The four tables below represent analysis of variance of Total Scores with the independent variable of Teacher experience. The first two tables represent pre-treatment scores and the second two represent post-treatment scores.

Table 40

*Pre-treatment ANOVA Descriptives in Total Scores by Teacher Experience*

Category	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
1	14	28.8571	7.58396	2.02690	24.4783	33.2360	5.00	38.00
2	22	30.0455	2.35993	.50314	28.9991	31.0918	28.00	36.00
3	12	30.1667	2.40580	.69449	28.6381	31.6952	28.00	36.00
Total	48	29.7292	4.48040	.64669	28.4282	31.0301	5.00	38.00

*Note:* First column represents years of teaching experience – Category 1 = 1 to 5 years, 2 = 6 to 15 years, and 3 = 16 or more years teaching.

Table 41

*Pre-treatment ANOVA Results in Total Scores by Teacher Experience*

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	15.144	2	7.572	.367	.695
Within Groups	928.335	45	20.630		
Total	943.479	47			

Table 42

*Pre-treatment ANOVA Descriptives in Total Scores by Teacher Experience*

Years	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
1	14	30.7857	8.21985	2.19685	26.0397	35.5317	7.00	42.00
2	22	31.5909	2.95456	.62991	30.2809	32.9009	28.00	36.00
3	12	33.5833	4.48144	1.29368	30.7360	36.4307	28.00	39.00
Total	48	31.8542	5.33152	.76954	30.3061	33.4023	7.00	42.00

*Note:* First column represents years of teaching experience – Category 1 = 1 to 5 years, 2 = 6 to 15 years, and 3 = 16 or more years teaching.

Table 43

*Pre-treatment ANOVA Results in Total Scores by Teacher Experience*

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	53.387	2	26.694	.937	.399
Within Groups	1282.592	45	28.502		
Total	1335.979	47			

The analysis of variance of the scores in both the pre-treatment and post-treatment is not significant. In the pre-treatment data the significance is at a .695 level. In the post-treatment data the significance is at a .399 level. This data suggests that the three sets of observations are from the same population. Based on this information, there can be no conclusions drawn about the growth in the Total Scores based on the experience level of the teacher.

## CHAPTER V – SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

### Introduction

The battle for improved student achievement is fought on many levels. Governments adopt national curricula, states create standardized tests and graduation requirements, districts adopt textbooks and provide professional development, schools create programs, and teachers differentiate instruction. Each of these is an example of structures that are put in place to create an environment, whether through support, promise of reward, or threat of consequence, where greater student achievement is the goal. Within all of these structures, a great deal of time and money is spent to find the right program, provide the right training, and create the right environment to maximize student achievement growth. The literature reviewed in Chapter II suggests that there is a significant correlation between the fidelity of implementation of a new program and increased student outcomes. Based on this information, a deliberate effort on the part of school leaders to promote successful implementation of a new program or practice in their schools is a logical attempt to increase student achievement.

Extensive literature has been discussed regarding the aspects of the adoption of a new program, practice, or product in the business and medical fields. The examination of many studies was compiled in the work *Diffusion of Innovations* by Everett Rogers. In this work, Rogers posed that there are specific attributes of an innovation, specific behaviors of intended adopters, and specific stages of the diffusion process that can be manipulated to promote greater fidelity of implementation.

As O'Donnell (2008) notes, there is a shortage of literature measuring fidelity of implementation and increased student achievement in the education field, but the studies that have been done suggest a positive correlation between the two. Combining the two ideas of Rogers and O'Donnell – that there are specific aspects to an innovation adoption that can be manipulated and that there is a positive correlation between fidelity of implementation and increased student achievement – the suggestion can be made that training school leaders on the aspects of innovation adoption would lead to greater fidelity of implementation, and therefore, greater student achievement.

#### Summary of the Study

The primary purpose of this study is to determine the effect principal training in diffusion of innovation theory has on the fidelity of implementation of an instructional practice in classrooms of their school as measured by short term behavior changes. Eight elementary school principals in the same school district were purposefully divided into two groups to balance out variables between the groups. The two groups of principals were balanced to the extent possible in years of experience, gender, and school size. One group was chosen at random to receive exposure and training in the ideas and theories of innovation diffusion. These principals received training during a five-week period during the initial phase of a district-wide implementation process of the reading instructional practice of Guided Reading. Before, during, and after the training the treatment group principals received, teachers in all eight schools were receiving training and support on Guided Reading. The study aims to measure the impact, if any, of the principals'

diffusion of innovation training on the degree of implementation of Guided Reading practices in their schools.

Of the 102 teachers invited, 48 agreed to participate in the study. These teachers were from all eight schools and all three grades levels where Guided Reading was introduced. The teachers participated in an interview process using a protocol called Levels of Use (LoU). The LoU protocol is designed to measure the level of implementation of a school program at the classroom level. Each of the 48 teachers participated in a pre-treatment interview (conducted prior to the training of the principals), and a post-treatment interview after four months had passed. The Levels of Use tool quantifiably measured seven characteristics of implementation. Those characteristics are knowledge, acquiring information, sharing, assessing, planning, status reporting, and performing. A description of these characteristics can be found in Chapter IV. The tool also summarizes a total implementation score. Analysis of Variance was used to determine if there were statistical differences between the treatment group and the control group in both the pre-treatment scores and the post-treatment scores.

During the data collection process, the number of years of teaching experience of the teacher was recorded as was the number of years of administrative experience for the principals. This allowed for further analysis through analysis of variance to determine what impact, if any, the years of experience of the teacher or the principal had on the measured implementation characteristics.



## Findings and Implications

The review of the literature clearly supports the notion that the school principal can have an impact on student achievement. The literature discusses aspects of the principal as an agent of change, a motivator, a vision creator, and a manager. The literature also supports the idea that successful implementation of a new program or practice positively impacts student achievement. The link that this work intends to study is whether a principal can deliberately impact the implementation process through the manipulation of attributes of the innovation and characteristics of the adopters.

The Levels of Use tool provides a total score representing a level of implementation compiled through the seven characteristics noted above. Using analysis of variance, it was found that neither years of teaching experience nor the experience level of the Principal were significant factors. There was no evidence to suggest that the years of experience that a teacher had impacted their level of implementation as measured by the Levels of Use nor was there evidence to suggest that the amount of administrative experience of the principal impacted the implementation scores.

The specific research question of this study was: "To what extent does the training of a principal in diffusion theory impact the fidelity of the implementation of that practice or program in classrooms as measured by short term behavior changes?" The data shows that training of a principal in diffusion theory significantly impacts the fidelity of implementation of a new practice in the classrooms of their school.

There were also two ancillary questions asked:

1 – If such an impact exists and can be measured, to what degree does the experience of the principal explain the level of fidelity of implementation? As shown in the analysis of variance, the experience level of the principal was not found to be a significant factor in impacting the fidelity of implementation of the new practice.

2 – If such an impact exists and can be measured, to what degree does the experience of the teacher implementing ~~the practice~~ influence the level of fidelity of implementation? As shown in the analysis of variance, the experience level of the teacher was not found to be a significant factor in impacting the fidelity of implementation of the new practice.

The principals in the treatment group were presented with information and activities that would have them reflect on their practices and interactions in their buildings in relation to the adoption of Guided Reading by their teachers. They participated in discussions regarding the main elements of Diffusion of Innovations as described by Everett Rogers. Those elements are the attributes of the innovation itself, the time allowed for adoption, the social processes that exist in the adopting environment, and the communication channels available to the change agent. These were discussed at length with examples exchanged between the principals facilitated by the trainer. The principals were also presented with information and examples regarding the categories and characteristics of intended adopters. These categories are innovators, early adopters, early majority, late majority, and laggards and are described in detail in Chapter three. These were discussed at length with and between the principals. Principals participated in reflection activities that asked them to reflect on past practices in light of the information to which they were being exposed. They were also asked to individually

brainstorm ideas to take advantage of each of the attributes of the innovation and the characteristics of adopters.

Two other significant topics were discussed with the principals. The concept of "critical mass" and how it applies to sustained implementation growth was discussed at length. The concept was discussed within the context of a measurable – or at least observable – goal with the awareness of the attributes of an innovation and the characteristics of adopters as tools to reach that goal. Both the idea of reaching a critical mass of adopters and the idea of trying to deliberately influence adoption to reach critical mass sooner were introduced and discussed. Also, the concept of "opinion leaders" was discussed. Principals were exposed to the ideas of change theorists in regards to members of their staff that were socially critical to the success of a new innovation. The characteristics of such staff were discussed so principals could identify them and plan deliberate interactions to facilitate the acceptance of the innovation.

Principals were intrigued with the theories put forward in the training/discussion sessions and saw genuine connections to the things that they could do in their buildings to promote more effective implementation. Much of the information made a great deal of sense and supported certain ideas that they already had. Principals spend a good deal of time looking for ideas and logistical structures that would encourage professional growth among their teaching staff. Many ideas and structures that they have put in place over the years were affirmed by the discussions on diffusion theory. The moments of enlightenment occurred when they realized that such ideas and structures could and should be put in place very deliberately and with clear goals in mind.

### Closer Examination of the Categories

The seven categories that the Levels of Use interview protocol uses to determine the total implementation score are a great source of additional information and guidance. Of the seven categories, differences in the means of the treatment and the control groups in the individual category scores was found to be significant in three of them when using ANOVA. The three categories that showed that being in a treatment school was a significant predictor of growth in implementation were the Acquiring Information category, the Sharing category, and the Assessing category. Being in a treatment school was not a significant factor in the other four categories of Knowledge, Planning, Status Reporting, or Performing. Looking at the categories closer provides some insight for use of this study in practice.

Six of the seven categories can be grouped into two main areas. The first area consists of categories that represent short-term behavioral changes in teachers. Three categories fit into this area and are Acquiring Information, Sharing, and Assessing. The Levels of Use questions probed for information that reflected changes in the behaviors of the teachers in regards to the innovation, Guided Reading. How did teachers seek out information on Guided Reading? Who did they ask? Did they seek out resources, people, colleagues, experts? Did they review current literature or go to voluntary trainings? These are all short-term changes in behavior. The greater the degree at which a teacher looked to take personal responsibility to acquire more information on Guided Reading practices, the greater the fidelity of their implementation would be. The LoU probed further into short term behavior changes. To what degree did a teacher share

what they were learning with colleagues? Were plans discussed, ideas exchanged, problems analyzed, and outcomes compared with others implementing the practice? The greater the degree to which a teacher shares what they have learned and discussed issues and outcomes with their colleagues, the greater their fidelity of implementation would be. Lastly in this area of short-term behavior changes is the degree to which a teacher reflects and assesses their efforts with the new innovation. How is it working? Did I do this correctly? Did this have the intended or expected outcome? The greater the degree of such reflection and assessment the teacher has, the greater the level of fidelity of implementation of the practice.

All three of these categories were found to be significantly impacted by being a member of a treatment school group. Principals who were exposed and trained on the attributes of innovations, characteristics of adopters, the concept of critical mass, and the concept of opinion leadership had staff that demonstrated greater growth in these implementation categories than in schools with principals without the training. Based on the discussions that transpired in the training and sharing sessions, these principals made deliberate changes in their efforts to encourage faithful implementation of Guided Reading practices. These efforts contributed to a growth in these categories.

The second area consists of categories that reflect long-term behavioral changes in teachers. The LoU categories that fit into this area are Planning, Status Reporting and Performing. The Levels of Use questions probed for information that reflected changes in the long term behaviors and attitudes of the teachers in regards to the innovation. What plans are you making to reorganize schedules to maximize the benefits? What organizational changes will you make? What resources will you acquire? These

behaviors reflect long-term planning of people that have attempted the innovation, reflected on the process and progress, and are making conscious decisions about improving their next efforts. The greater the degree of such planning and preparation the teacher has, the greater the level of fidelity of implementation of the practice. The LoU further probed into how teachers described their own level of use with the innovation. Are you comfortable with the innovation? What degree of expertise are you feeling? The answers to such questions reflect a confidence and security in the decision making process on the use of different aspects of the practice. The greater the degree of such confidence and security the teacher has, the greater the level of implementation of the practice will be seen. Lastly in this area of longer-term behavioral changes is the degree that a teacher feels that they have “operationalized” the innovation. In this environment, operationalize refers to a degree of manipulation of the practice based on reflection, feedback, and assessment. How have you changed the innovation? What have you decided to do differently? Are there aspects that you have altered or discarded? The greater the degree of confidence in manipulation the teacher has, the greater the level of fidelity of implementation has occurred.

None of these three categories in this area proved to be a significant predictor between the control and treatment groups in this study. This area focuses on aspects of innovation diffusion that would likely not be seen in an adoption of a complex innovation such as Guided Reading. The area described as short-term behavior changes are precursors for the long-term changes described in the second area. Each of the three long-term behavior categories require experience, trial, and reflection that come from “passing through” the stages described in the short-term categories. Changes in these

categories would require adequate time to proceed through stages of acquiring information, sharing, and assessing that did not exist in this study. It is reasonable to assume that changes in the second area categories, the long-term behavioral change categories would follow changes in the short-term categories. Seeing a significant change in all three short-term behavioral change categories bodes well for future changes in long-term behaviors.

### Closer Examination of the Innovation

Much of the literature on the study of diffusion of innovation relates to innovations with either strict protocols, such as medical or agricultural, or to consumer “products” that have specific uses and procedures. The nature of teaching is, historically, culturally, and practically, an individualized process. It is more akin to an art form than many professions. The nature of a school building – a collection of people working in close proximity to one another with common goals and constraints – makes the profession highly social. The combination of the nature of teaching and the nature of schools makes innovation diffusion in education a unique proposition. Guided Reading as an innovation is a complex proposal. The foundation of Guided Reading is for a teacher to diagnose and intervene on a daily basis. For many teachers, this is a major shift in their responsibilities and their required skill sets. Since the standards movement began in the early 1990s, much of the material and training that has been provided to teachers in many districts has been based on huge programs created by publishing companies specifically designed to ensure standards coverage. This often has led to the

“dummy-proofing” of teaching; ensuring that the teacher always knew what activity was to be done when, what to assign for homework, and what to use to assess. These programs often even told them what to say. Guided Reading requires skills and knowledge that allows a teacher to diagnose specific problems with individual students and mediate with specific interventions. This is a very sophisticated approach which will require extensive teacher training and asks teachers to move far from their comfort zone. Due to the complexity of the innovation, long term behavioral changes will not be noticed in the span of this study, hence the specificity of the problem statement regarding short term behavior changes.

#### Recommendations and Implications for Education Administration

The data supports that there is measurable impact on the level of implementation of a new school practice when the principal of that school is exposed to the theories of innovation diffusion. While the impact on performance of the practice of Guided Reading could not be measured to statistical significance, there is strong rationale that that is a function of the short period of time between pre and post interviews. The impact on the precursor categories of acquiring knowledge, sharing, and assessing was significant and are strong predictors that the more sophisticated categories of planning and performance would follow given time. The literature completes the link to increased student achievement when programs are successfully implemented. Based on this, this study would recommend that schools and districts look closely at the knowledge base and abilities of their principals to successfully impact the implementation process. This study



would further recommend that specific training in the aspects of innovation diffusion be provided to school leaders before the adoption of a new program or practice. This recommendation goes beyond the training of school based leaders. District leadership would benefit from an understanding of the characteristics that impact innovation diffusion. Often, initiatives are directed from district level leadership and the dynamics of innovation diffusion would be important knowledge for this group. District personnel can greatly influence the attributes of an innovation. For example, "relative advantage" can be promoted by prominent keynote speakers that the district hires. "Complexity" can be minimized through programs such as coaching and job-embedded professional development.

Staffing and expensive programs will need district support. The dynamics of innovation diffusion impact more than just the teaching staff. District personnel will want to identify their "opinion leaders" among the building principals. They also need to recognize their "innovators" and "early adopters" (as well as their "laggards") to best utilize district resources. District personnel will want to reach "critical mass" among buildings the same way a principal wants to reach critical mass within the teaching ranks of their school. This study further suggests that there is an area of administrator training that could, by omission of training and knowledge acquisition, actively work against successful implementation of new programs in schools. Recognizing the significant role successful implementation of research based programs plays in increased student achievement, it is imperative that school leaders investigate every aspect that could impact such implementation. The area of Innovation Diffusion and the characteristics that it describes

can be applied to an educational initiative and positively impact successful implementation.

### Connection and Addition to Previous Work

Diffusion of Innovations as described by Everett Rogers and others focuses on the attributes of innovations, the characteristics of adopters, and the efforts of change agents. These studies have been almost exclusively in the realms of agricultural innovation, medical innovation, technological innovation, and social innovation. Educational innovation has received very little attention within the realm of Diffusion of Innovation theory. In Chapter three it was discussed where educational researchers and theory paralleled Diffusion of Innovation theory. While there were many examples of connections to DOI as described by Rogers in educational research, there was never explicit training of educational leaders on Diffusion of Innovation characteristics with the goal of impacting the degree of implementation of a new practice in a school. This study connects the decades of study in Diffusion of Innovations to the strategies employed by educational leaders when implementing a new program within a school. By making the connection between an educational practice and an innovation as described in previous studies (such as the cell phone, agricultural methods, medical protocols, etc.), this study links the significant findings of those studies with their application in education.

## Future Research Recommendations

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This study was intended to determine if there was any impact on the successful implementation of a new practice in a school because the principal of that school was schooled in the characteristics and attributes detailed in innovation diffusion theories. The literature link provided a rationale that, since successful implementation leads to greater student achievement, then positively influencing implementation leads to greater student achievement. While there is evidence that this impact does exist, there are several limitations to this study that need to be addressed in future research.

First and most important, the length of time between the pre-treatment interviews and the post-treatment interviews needs to be increased. The goal of successful implementation in a school setting is for teachers to master the practice to the point where they can make sound modifications and manipulations to best suit each individual student. This only comes over extended periods of time with ample opportunities for professional development, collaboration, sharing sessions, model lessons, etc. As we saw with the data in this study, changes in the foundation characteristics happen first – the desire to collaborate, the need for acquiring more information, and so on. The changes that will impact sustained teacher growth and increased student achievement will not come early with a complex new practice. To determine if the growth demonstrated in this study grows exponentially with more complex stages of implementation or if a control group will “catch up” over time remains to be studied. A longer term study could also factor in a student achievement component. Ultimately, the goal is increased student achievement and showing that link over time would be very powerful.

Second, a future study should incorporate a greater number of schools and teachers. While this study attempted to account for as many variables as possible within the principal ranks – years of experience, size of school, and gender – a greater number of schools would give more validity to the work by providing more principals in the sample and more teachers in the study.

Third, a future study should incorporate a qualitative component with principal interviews. During the course of this study, the principals made many observations and comments that I felt would have been beneficial to collect and report, but I did not have a standardized mechanism in place. A qualitative piece would add richness to the study and provide greater insights into how diffusion of innovations theories mesh with educational initiatives.

Fourth, based on the literature and personal observation, there is reasonable belief that the principal's behavior during the implementation process is a significant factor in the diffusion of the innovation. Since the training was designed to alter the mindset and impact the choices of the principals in the treatment group, the efforts made by each individual principal and their attitudes towards the training and their efforts should be documented. It is likely that the principal's attitude toward the training and philosophies underlying diffusion of innovation theory will impact their choices and decisions. A lack of growth in fidelity of implementation in a building with a principal that made no changes in their behavior will incorrectly reflect poorly on the impact of the diffusion theory on the implementation process since nothing in the theory was applied. This would, perhaps, be a reflection on the training process or the principal themselves, but this would not be studied without deliberate attempts by the investigator to measure and

record. This leads to a further, almost paradoxical, variable, where the understanding and application of diffusion theories by building principals is, in itself, a diffusion of a new innovation. The innovation being the application of Diffusion of Innovation theories by the building principal to enhance fidelity of a new school practice. In effect, this is studying the implementation of the implementation process and would yield important information regarding the application of diffusion ideas in schools.

A common theme that becomes evident throughout this study is the critical role of quality professional development. Although it was not covered in this literature review, it is commonly known in educational circles that most professional development done by schools is ineffective. The most promising professional growth programs are ones that provide for sustained professional development that is incremental, supportive, collaborative, and job-embedded. The complexity of an innovation such as guided reading (or diffusion of innovation theory) emphasizes this critical component of implementation. For changes in behavior to become long-term changes and become part of the culture of a school, professional development programs have to be sophisticated, extensive, patient projects. Key components of diffusion of innovation theory support the notion of sustained, sophisticated professional development such as the ability to try and the ability to observe. Rogers notes the critical nature of sufficient time, as well. As these attributes of innovation diffusion are exploited through a patient training timeline, and complexity is minimized through extensive interactions with materials and knowledgeable trainers, the opportunity for sustained cultural change becomes more possible.

## Final Thoughts

Successful implementation of a new program is a very complex issue. However, it is beyond cliché to suggest that school districts “try and discard” new ideas constantly. Teachers know that they just have to “ride this one out” and everything will go back to their comfort zone. This is possibly the greatest single mistake we make in schools today. We are reluctant to change. We are reluctant to take current research, trust it, and place it into practice. We are too concerned about the safety of what we already know, the fear of failure, and the possibility that we could have been doing it better than we were before. This is a critical mistake since we know so much more about how children acquire language, how the brain wires itself, how math skills develop, how behaviors can be modified, and so many more topics, than we did just a decade ago. Successful implementation is the last stage of a simple formula for school success: Identify proven programs and practices, support them with the appropriate material purchases of personnel and materials, provide sufficient training and sustained professional development, and implement faithfully. This could be done with all subject areas, all intervention programs, and all behavior programs. If this were done with fervor and faithfulness, there could be great strides in public education.

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APPENDIX A  
Studies Related to the Validity of the Levels of Use Protocol

Studies That Examine the LoU Instrument and Process

Year	Author(s)	Sample	Design	Innovation	Findings
1978	George & Rutherford	$n = 146$	Correlational	Team Teaching	There is a significant relationship between change in overall LoU and time, $p < .05$ .
1978	George & Rutherford	$n = 117$	Correlational	Modules	There is a significant relationship between change in overall LoU and time, $p < .05$
1979	Rutherford & Loucks	$n = 42$	Correlational	Glasser's Reality Therapy	Those who became nonusers or who remained nonusers had high awareness concerns
1980	Dominguez, Tunmer, & Jackson	$n = 34$	Ethnographic	ESUSpanish Reading/Spanish Math/Culture	CBAM provides a useful system of instruments (SoC, LoU, and Innovation Configurations Maps) and procedures for building a prescriptive program to facilitate the adoption of bilingual programs
1981	Rutherford	$n=411$	Descriptive	Team Teaching	Levels of Use do exist.
1982	Cantor	$n = 17$	Descriptive	Auto Mechanics Curriculum Project	LoU is viable in vocational education.
1984	Marsh	$n = 59$	Descriptive	Geography Curriculum	LoU provides meaningful data for people involved in curriculum development and implementation activities
1984	Stedman	$n = 25$	Causal Comparative	Competency-Based High School Diploma Program	A multiple regression analysis indicated that Stages of Concern are significantly associated with LoU. All subscales of the Stages of Concern, except for consequence, had a significant effect on LoU, $p < .05$
1988a	Mitchell	$n = 7$	Descriptive	Timeliner	Those with intense individual concerns had low LoU of the software
1988b	Mitchell	$n = 118$	Correlational	Evaluation Data	Although high-achieving schools used evaluation data at a higher LoU no

					significant difference was found between LoU and achievement scores
1992	Savage	$n = 30$	Causal Comparative	Third-Grade District Curriculum Guides	No significant relationships were found ( $p > .05$ ) between the use of the innovation and other factors.
1995	Marcais	$n = 25$	Causal Comparative	Innovation and Teaching and Learning Fellowship	Teaching style and personality had no effect on LoU.
1995	Steele	$n = 13$	Correlational	Functional Skills Curriculum	All subjects were users of the innovation.

#### Studies Related to the Change Process

Year	Author(s)	Sample	Design	Innovation	Findings
1977	Hall	$n = 190$	Longitudinal	Team Teaching	LoU of teaming is associated with years of teaching experience.
1977	Hall	$n = 160$	Longitudinal	Modules	LoU of modules is associated with years of teaching experience.
1977	Hall	$n = 45$	Longitudinal	Science Curriculum Improvement Study (SCIS)	LoU of SCIS is associated with years of teaching experience.
1979	Loucks & Hall	Varied, $n = 52-75$	Longitudinal	Districtwide Science Curriculum	Providing three levels of in-service facilitated the adoption process; however, it may take more than one full cycle of teaching the complete unit to resolve Personal and Management concerns and move to LoU IVA Routine use
1980	Hall, Hord, & Griffin	Varied, $n = 52-75$	Longitudinal	Districtwide Science Curriculum	Implementation varied, primarily because of the actions and concerns of the principal.
1980	Loucks & Melle	Varied, $n = 52-75$	Longitudinal	Districtwide Science Curriculum	The skill of the trainer/facilitator influenced development in LoU.
1982	Horowitz	$n = 41$	Descriptive	Library Services	A lack of change agents, a weak resource system, and

					poor communication influence implementation.
1983	Huling et al.	NA	Correlational	Various	Principal change facilitator style ( $p = .001$ ) and collaboration ( $p = .009$ ) influenced overall LoU.
1988	Evans & Hopkins	$n = 30$	Causal Comparative	Curriculum	Variance in curriculum utilization can be accounted for by the prevailing school climate and the nature of the individual teacher.
1993	Roberts	$n = 18$	Descriptive	Collaboration	There is a relationship between LoU and commitment to collaboration by teachers over time, developmental levels, experience with the innovation and cultural factors within the schools.

Year	Author(s)	Sample	Design	Innovation	Findings
1995	Hope	$n = 16$	Longitudinal	Computers	Although there was limited movement in LoU, the author found that a supportive, non punitive environment with no pressure on teachers to become users of technology promoted teacher use of technology
1999	Geijssel, van den Berg, & Slegers	$n = 64$	Correlational	Going to School Together	Schools that more readily adopted an innovation shared a common vision, had a transformational leader who took responsibility for facilitating joint goals and stimulating a culture of collaboration, had leaders who radiated dedication and demonstrated understanding and respect for personal feelings, had leaders who fostered greater collaboration, and had leaders who facilitated teacher participation

					in decision making; everyone shared a common need and desire for personal growth as well as continued schooling and training.
1999	Hall et al.	$n = 102$ & 106	Longitudinal	Constructivist Teaching	The following factors must be in place to support systemic change: strong strategic leadership, skilled change facilitators, a worthwhile innovation, and systematic data gathering about implementation.
1999	Krasner	$n=8$	Descriptive	Prosocial Skills Curriculum	Those with higher LoU had extensive knowledge and expertise, had a greater sense of responsibility for student success, integrated planning and assessment, evaluated learning materials, students prosocial skills, and spent more time on social skills interaction.

Table reprinted with permission of SEDL from Hall, Gene E., Dirksen, Debra J., & George, A. A.S. M. *Measuring implementation in schools: Levels of Use* (p. 7). Austin, TX: Southwest Educational Development Laboratory (SEDL). Additional studies can be found listed on pages 29-42.



APPENDIX B  
Documents Related to Principal Training on Diffusion of Innovations

Document 1 – Readings

This 17 page document was distributed to Principals as readings and a reference to pace the training over a 5 week period. The communication to the Principals was, “Please find attached a summary of the information that we will be discussing over the next few Thursdays. I believe that we agreed upon 9:15 on Thursdays. The plan for each meeting is to cover a main aspect of diffusion theory and then discuss implications for an educational setting.

Thursday, January 14th - Attributes of the innovation (pages 1-5)

Thursday, January 21st - Categories of Adopters (pages 5- 9)

Thursday, January 28th - The Concept of Critical Mass (pages 9-10)

Thursday, February 4th - Complimenting Theories and Summary (pages 11-17)

If you could familiarize yourself with the pages noted before each meeting that would be great. I am really looking forward to sharing this with you and brainstorming how it applies to the implementation of an instructional initiative. See you Thursday.”

## Diffusion Theory

Everett Rogers defines diffusion as “the process in which an innovation is communicated through certain channels over time among the members of a social system” (2003, p.5) and identifies the four main elements of diffusion of innovations as the innovation itself, communication, time, and the social system adopting the innovation. Diffusion theory refers to multiple aspects of the diffusion process, how those aspects interact, facilitate or impede adoption of an innovation, and how they can be controlled or manipulated to maximize adoption (Surry, 1997). While diffusion theory has had several important proponents, there is not a singular accepted definition of diffusion theory. Diffusion theory is both relatively new and has had varied applications. It has been applied to areas as different as farming techniques in Midwest America, water boiling in Peruvian villages, prevention of scurvy in the British Navy, and the use of cell phones worldwide. In 1960, Everett M. Rogers presented the most comprehensive “unified” theory of diffusion in his book *Diffusion of Innovations* (Surry, 1997). The Rogers book is currently in its fifth edition, published in 2003. Rogers (2003) discusses four main aspects of Diffusion Theory, the Innovation-Decision Process, the Attributes of Innovations, the Categories of Adopters, and the Change Agent.

### The Innovation – Decision Process

During the Innovation-Decision Process (Rogers, 2003), the decision maker or makers move from an initial understanding of an innovation to seeking reinforcement that the decision was the right one. Between those two stages, the decision makers move through other stages that include the *persuasion stage*, where individual decision makers are persuaded positively or negatively toward the innovation, the *decision stage*, where decision makers conclude that the innovation should be adopted (or rejected), and the *implementation stage*, where the innovation is put into practice (Rogers, 2003).

The first stage, the *knowledge stage*, can come about two different ways. There may be a perceived need that encourages someone to seek out an innovation to address the need, or someone may become aware of an innovation outside of the perception of a need (Rogers, 2003). For example, my knowledge that there is a faster way to access the Internet than a dial-up connection could come from my need to have a faster speed for my home office, which led to my researching an innovation such as a cable modem. The

same knowledge could also have come from a discussion with my neighbor regarding a video that I couldn't see clearly over the Internet, but he could. When he explains a cable modem to me, I become aware of an innovation before I had a perceived need.

During the second stage, the *persuasion stage*, an individual or group actively seeks out additional information on the innovation in order to inform themselves of the advantages and disadvantages of the innovation. This is not persuasion from an outside source, but persuasion through information (Rogers, 2003). In my modem example, I would seek out other opinions, read reviews in magazines, and look for other avenues of information regarding the innovation.

During the third stage, the *decision stage*, an individual or group decides, based on the information gathered in the previous stage, whether or not to pursue the innovation, leading to the *implementation stage*, where the innovation is put into practice (Rogers, 2003).

Within the implementation stage is a sub-stage that Rogers calls *re-invention* (2003, p. 180). Re-invention refers to "the degree to which an innovation is changed or modified by a user in the process of its adoption and implementation" (Rogers, 2003). Re-invention, and its desirableness, will vary greatly across industries. A medical protocol should have minimal, if not non-existent, levels of re-invention. Sales marketing techniques may benefit from the "tinkering" of the protocol by an experienced salesperson. In education, re-invention may be beneficial as the innovation is adjusted by an experienced teacher, or modified for differing student populations. However, re-invention can be of great concern to educational innovators. While teacher experience is an excellent source for positive modifications, the core elements of any innovation must survive in the eyes of the decision makers. The core elements are defined as the features that are responsible for the innovation's effectiveness (Kelly, Sogolow, and Neumann, 2000). While allowing re-invention increases the likelihood of continued adoption in an education setting (Berman and Pauly, 1975), it is more likely that the innovation will change dramatically to fit the social climate of the school, rather than manipulated to increase the effectiveness of the innovation (Berman and McLaughlin, 1974). Lastly, at the *confirmation stage*, adopters are looking for reinforcement that the decision was the appropriate one for the organization.

### The Attributes of the Innovation

Rogers (2003, p. 221) defines the rate of adoption of an innovation as “the relative speed with which an innovation is adopted by members of a social system. One of the goals of a building administrator during the implementation of a new program or practice in their school is to maximize the relative speed that the program or practice is faithfully adopted by the teachers. Thus, the factors that impact the rate of adoption would be important knowledge for such administrators. The perception of several attributes of an innovation impact the rate of adoption of that innovation greatly. Up to 87% of the variance in the rate of adoption of an innovation can be explained by five attributes (Rogers, 1995).

Those five attributes are the relative advantage of the innovation, the compatibility of the innovation to current practice, the complexity of the innovation, the ease of trying the innovation, and how readily observable the benefits of the innovation are to others. The chart below summarizes Rogers’ (2003, p. 229-266) explanations of the five attributes of innovations that influence the rate of adoption.

Attribute	Influence	Relationship to Rate of Adoption
Relative Advantage	Degree to which an innovation is seen as advantageous to a current practice	Positive – the greater the perceived relative advantage, the greater the rate of adoption
Compatibility	Degree to which an innovation is seen as compatible to the current needs, culture, and philosophy of the organization	Positive – the greater the perceived compatibility, the greater the rate of adoption
Complexity	Degree to which an innovation is perceived as difficult to adopt and to use by the potential adopters	Negative – the greater the perceived complexity, the weaker the rate of adoption
Ability for Trial	Degree to which an innovation can be tried and experimented with by potential adopters	Positive – the greater the flexibility for trial, the greater the rate of adoption
Ability to Observe	Degree to which the outcomes of an innovation are observable by potential adopters	Positive – the greater the opportunity to observe the outcomes, the greater the rate of adoption

Within the above attributes are significant factors for building administrators to be aware of if their goal is to increase the rate of adoption of an innovation in their school. Within

the relative advantage attribute, the principal is in a unique position to promote the relative advantages of an innovation and impact the positive relationship between that and the rate of adoption. Experts in diffusion research find that relative advantage is one of the most potent influencers on rate of adoption (Rogers, 2003). Innovations perceived as having the greatest reward and the least risk will be accepted most rapidly (Fliegel & Kivlin, 1966). Characteristics of an innovation that are absent from the current practice are the innovation's critical attributes. The more critical attributes are in number and in degree, the greater the positive impact on the rate of adoption (Zaltman, Duncan, & Holbek, 1973). Further impacting the perceived relative advantage of an innovation is the visibility of the critical attributes. The more visible the critical attributes are to potential adopters, the greater the impact on rate of adoption (Zaltman, et al, 1973). Within the compatibility attribute, a principal can influence the perception of the compatibility of the innovation to the current practices, goals, culture, perceived needs, and beliefs. Recognizing that such connections can positively influence the rate of adoption, the principal can seek out, highlight, and encourage these perceptions to assist in recognition by potential adopters of the compatibility of the innovation. In particular, a building principal must recognize that the innovation must be compatible with perceived needs. Lewin's idea of "unfreezing" indicates an understanding on the part of potential adopters that there is something wrong with the status quo (Lewin, 1961). Couple this with the compatibility attribute, and the goal of the principal is to "unfreeze" the idea of the status quo and promote the compatibility of the innovation to the perceived need.

Within the complexity and ability for trial attributes, a principal can influence the rate of adoption by ensuring that consistent support is available and visible for early adopters. This will both contribute to minimizing the perception of complexity and offering support for trials. The more complex the innovation is perceived by potential adopters, the greater the negative impact on the rate of adoption will be (Zaltman, et al, 1973). Ability for trial is more important to early adopters than later adopters as observing the early adopters acts as trial experience for later adopters (Ryan, 1948). Principals can also impact the ability to observe attribute by ensuring that all staff, not just the initial adopters, are in communication loops regarding the innovation.

Adoption of an innovation, as measured by number of adopters, generally produces a normal curve over time (Rogers, 2003). When graphed as *cumulative* adopters over time, the curve can be described as an S-shaped curve. The S-shaped curve is a recurring theme in diffusion studies (Mahajan & Peterson, 1985). The curve is formed because of the relative few that adopt very early in the life of an innovation, followed by a rapid increase in adopters as the process progresses (Mahajan & Peterson, 1985). As the adoption rate slows, the top part of the “S” is formed. The S shaped curve reflects the reluctance of early adoption, followed by an increase of adoptions as the number of adopters nears “critical mass”, and finally levels off as the diffusion of the innovation completes (Rogers, 2003). Assuming the S-shaped curve, the object of the principal is to “move the S” to the left of the graph, decreasing the amount of time to “critical mass” of adopters, in other words, increasing the speed of diffusion. Mahajan & Peterson (1985, p. 14) express the diffusion process as a mathematical equation with the speed of diffusion depending on, among other things, communication channels employed and the characteristics of the social system of the adopters. Mahajan & Peterson (1985, p. 15) further note influences on the diffusion model that they reflect in their mathematical formula. With the addition of an additional variable for external influences, the formula reflects the impact forces from outside the adopting members will have on rate of adoption. Communication channels, outside agencies, and “salespeople” can impact the rate of adoption. From a school perspective, the communication channels can be communication directly from the principal or other outside forces regarding the adoption. Outside agencies and salespeople could refer to outside experts or consultants, in-service speakers or trainers. Taken this way, the building principal can impact the variable representing external influence and positively affect the rate of adoption of the innovation. Internal influence refers to “interpersonal communication or social interaction between prior adopters and potential adopters in the social system” (Mahajan & Peterson, 1985). Such communication pathways and structures can be encouraged by the principal through meetings, common planning time, sharing sessions, etc.

### The Categories of Adopters

Rogers (2003, p. 281) places individuals into adopter categories, with each category having a different level of innovativeness. He states the importance of innovativeness as “the main objective of any change agency” (2003, p.268) and notes that innovativeness reflects a deliberate behavioral change, not just a change in attitude.

The importance of categorizing adopter categories is found in the ability of the change agent to understand and identify the characteristics present in their potential adopters and use the innovativeness of some members to the advantage of the whole group. The categories of adopters are summarized in the chart below.

Category	Key Attribute	Key Characteristics	Percentage of adopters
Innovators	Venturesome	<ul style="list-style-type: none"> <li>• Interest in new ideas</li> <li>• Communicates with other innovators</li> <li>• Ability to understand and apply new knowledge</li> <li>• Ability to cope with high degree of uncertainty</li> </ul>	2.5% (2 standard deviations from mean)
Early Adopters	Respect	<ul style="list-style-type: none"> <li>• High degree of opinion leaders</li> <li>• Respected by peers</li> <li>• Integrated into the member society</li> <li>• Often looked as a "role model"</li> </ul>	13.5% (1 standard deviation from mean)
Early Majority	Deliberate	<ul style="list-style-type: none"> <li>• Frequent interaction with peers</li> <li>• Not opinion leaders</li> <li>• Follow with "deliberate willingness" but seldom lead</li> </ul>	34%
Late Majority	Skeptical	<ul style="list-style-type: none"> <li>• Often adopt due to increased peer pressure</li> <li>• Approach innovation with skepticism</li> <li>• Innovation must be nearing the norm before adoption</li> </ul>	34%
Laggards	Traditional	<ul style="list-style-type: none"> <li>• Isolated from social networks</li> <li>• No opinion leadership</li> <li>• Have traditional values</li> </ul>	16% (1 standard deviation from mean)

Adapted from Rogers, 2003, p. 282-285

The purpose of recognizing each adopter category is so that change agents can tailor their efforts to each type, choosing the approach, support, and communication strategy based on the needs of that group (Rogers, 2003). The reasons for adoption vary between categories, and the change agent must be cognizant of the communication channels used



to influence each category. A change agent in a school may choose to concentrate efforts on the innovators and the early adopters, recognizing that the chance for successful adoption is greater with these groups. Rogers (2003, p. 296) calls this a strategy of least resistance. The antithesis of this strategy is called the strategy of greatest resistance, where the change agent concentrates their efforts on the group who would be the last to adopt in recognition that this group will need the most encouragement and support. Recognizing that each category will need a measure of communication and in different forms will be an essential tool for the principal attempting to influence the rate of adoption.

### The Change Agent

A change agent is someone who provides a relationship via a communication network between the innovation and its resources, and the potential adopters (Rogers, 2003). The roles of the change agent can be broken down into seven parts: create the need for change from current practice; establish communication networks to establish and ensure credibility of the change agent; diagnose potential problems and concerns likely to be encountered when promoting the innovation; motivate adopters towards the innovation; promote avenues for action through providing material and emotional support; stabilize and reinforce adoption during the individual's confirmation stage; and develop self-renewing behaviors in regards to the innovation, allowing the change agent to remove themselves from the process (Rogers, 2003). While passing through these seven roles, the change agent should be aware of aspects that impact the effectiveness of their efforts. Rogers (2003, p. 373-377) discusses four such aspects.

The *level of effort* of the change agent refers to the amount of time actually spent engaged in communication efforts with the potential adopters. Such efforts contribute positively to the increase in the rate of adoption.

The *orientation* of the change agent impacts the rate of adoption of an innovation. When the change agent is more adopter-oriented, they are more credible, have a greater relationship, and have more honest interactions. These attributes positively contribute to the rate of adoption.

The change agent should be aware of the perceived needs of the adopter and ensure *compatibility* of the innovation to those perceived needs. Without damaging the intended

outcomes; the innovation should be adapted and marketed towards the needs of the adopter.

The change agent that possesses the ability to *empathize* has a greater positive impact on the rate of adoption. Empathy is the ability to identify with and understand another's situation and feelings. By empathizing, the change agent can positively impact a potential adopter's attitude towards an innovation and make them more comfortable with the change.

The ability of a change agent to communicate and to create and organize communication channels is critical to positively impacting the rate of adoption of an innovation (Zaltman, et al, 1973). This ability impacts all of the aforementioned attributes of innovations as well as the four stages of innovation diffusion. The ability to create effective communication channels is critical to the adoption process. Rogers (2003, p. 18-19) states, "Diffusion investigations show that most individuals do not evaluate an innovation on the basis of scientific studies of its consequences, although such objective evaluations are not entirely irrelevant, especially to the very first individuals who adopt. Instead, most people depend mainly upon a subjective evaluation of an innovation that is conveyed to them from other individuals like themselves who have already adopted the innovation." This statement means that primary communication is critical between a change agent and the innovator and early adopter groups. However, after that, positive, effective, communication channels are critical as the Early Majority and Late Majority members are targeted for adoption. These two groups make up over 60% of the potential adopter pool, and rely heavily on the communication from their peers who have already adopted the innovation. Providing communication channels for this to occur early, often, and effectively is critical. As diffusion reaches "critical mass" (at some point during the Early/Late Majority adopters), non-adopters become increasingly marginalized, increasing the pressure to participate in the adoption (Zaltman, et al, 1973). A change agent such as a principal has to be keenly aware of this need. Diffusion is a social process, requiring interpersonal communication among potential adopters (Rogers, 2003). Recognizing that diffusion is a social process, and that the majority of potential adopters look to their peers that have already adopted for guidance, the change agent seeking to increase the rate of adoption and the fidelity of its implementation needs to know what

communication channels will serve that purpose best. Innovators seem to be the likely choice of a change agent to encourage peers to adopt an innovation. However, most innovators are seen as “different” from the social norm and are not looked to by their peers as professional role models. Because of this, their “role in diffusion (especially in persuading other to adopt the innovation) is very limited” (Rogers, 2003). Therefore, the principal as the change agent must look in the Early Adopter group for members who do carry the credibility with their peers. Rogers (2003, p. 26-27) call these members *Opinion Leaders*. This group, which may include Innovators, Early Adopters, or Early Majority members, provide information and opinions about innovations to the other members of the social system. The influence of opinion leaders is not created through formal hierarchical position or title. It has been created and maintained through social interactions with members. Change agents must be aware that opinion leaders can impact the rate of adoption both positively and negatively depending on the opinion leader’s perceptions of the innovation. The critical quality of the opinion leader is their position in the communication channels of the social system. Information flows centrally to the opinion leaders, who then disseminate it to other members of the group. This makes the opinion leader’s perspective on an innovation crucial as their perceptions will greatly influence many potential adopters during their decision making stage. A change agent must carefully identify and utilize these opinion leaders. As Rogers states (2003, p. 388), “The time and energy of the change agent are scarce resources. By focusing communication activities upon opinion leaders in a social system, the change agent can leverage these scarce resources and hasten the rate of diffusion of an innovation among clients.”

### The Concept of Critical Mass

Random House Dictionary defines critical mass as “the amount of a given fissionable material necessary to sustain a chain reaction at a constant rate.” The term has come to mean any population that has grown to the point where a continued movement is not in need of outside stimulus and is, therefore, self-sustaining. There comes a point in the diffusion of an innovation where the number of adopters as a percentage of members of the social system becomes so great that the diffusion process becomes self-sustaining (Rogers, 2003). This point is called the point of *critical mass*. Until a critical mass point is reached, the rate of adoption of an innovation is relatively slow. Past that point, the rate of adoption increases rapidly (Fisher, 1992). The concept of critical mass is crucial as it pertains to diffusion of innovations because a potential adopter’s behavior towards an innovation is greatly influenced by how peers around them are behaving towards the innovation (Shelling, 1978). The above observation by Shelling underscores the importance of visibility of perceived advantages, as well as the use of the opinion leaders. The greater the awareness level through observation and communication, the greater chance of reaching critical mass more quickly. Rogers (2003, p.356) calls the absence of observation a high degree of *pluralistic ignorance*. The presence of pluralistic ignorance, or the rate of individuals unaware of the behaviors of others around them, decreases the rate of adoption and makes the efforts towards critical mass more difficult.

Central to the theme of diffusion of an innovation is the interaction between potential adopters and the experiences that their peers have had with the innovation. These potential adopters decide their opinion of an innovation and how much enthusiasm and effort they are going to expend on the innovation based on communication through the social network of the system, making it critical for a change agent to be aware and to understand how to manipulate such communication to positively reflect on the innovation (Rogers, 2003).

To emphasize that a change agent can impact the process of reaching critical mass, Rogers (2003, p.361-362) lists four strategies for attaining critical mass:

5. Target highly respected individuals within the system for initial adoption of the innovation. These should not be targeted because they are the most innovative

individuals, but rather because their opinion of the innovation, the implementation process, and the perceived benefits will most greatly impact the opinions of their peers.

6. Actively shape the perceptions of potential adopters. While pursuing the highly respected individuals noted above for early adoption, potential adopters should be also be pursued with continuous information regarding the innovation, its perceived value, the inevitability of universal adoption, and the level of diffusion that has already occurred.

7. Introduce the innovation to established groups that are likely to be supportive of a new idea. By identifying and targeting like-minded groups, you can establish mutually supportive adopters that help create the perceptions of a highly desirable change. Such groups may not necessarily be comprised of innovators, but may be highly likely to view the status quo as undesirable and, therefore, be more willing to try an innovation.

8. Provide incentives for early adopters. Although financial incentives are difficult in public education, there are opportunities to provide incentives for early adopters outside of monetary compensation. The prestige of being recognized as a leader and innovator can be an incentive, in addition to other, more tangible incentives such as new materials, opportunities to attend workshops, etc.

#### Theorists and the Concepts of Diffusion and Change

Everett Rogers uses the term “change agent” to describe the person that has the single greatest impact on the success of the innovation diffusion process. In naming four key aspects of his diffusion theory, only the change agent is an actual individual. There is considerable research in the field of managing change in organizations and some significant theorists discuss the characteristics of such an individual.

Michael Fullan (2001) describes a framework for “thinking about and leading complex change” (p.3). This framework describes five leadership characteristics that are critical to effective leadership in an environment of change. Those five components are *Moral Purpose, Understanding Change, Relationship Building, Knowledge Creation and Sharing, and Coherence Making* (Fullan, 2001).

First, Moral Purpose refers to the need for the change agent to desire to make a positive impact on the lives of the people in his or her charge, including employees and customers, through their actions (Fullan, 2001). In a school setting, those people would include the teachers, the students, and the parents.

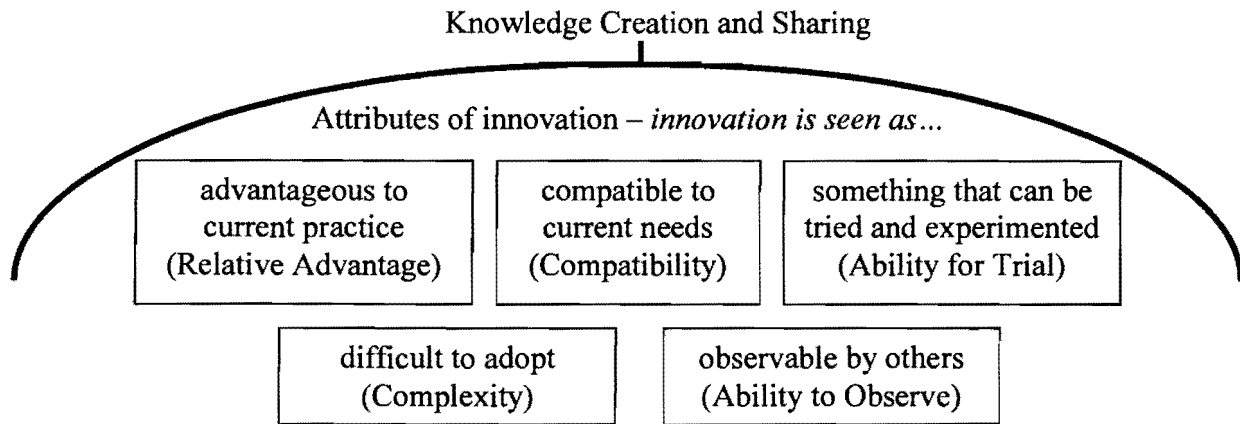
Second, Fullan (2001) describes Understanding Change as the ability to “develop a greater feel for leading complex change and to develop a mind-set and action set that are constantly cultivated and refined” (p.34). There are six identified essential understandings in this second characteristic: The goal is not to innovate the most, it is not enough to have the best ideas, appreciate the implementation dip, redefine resistance, re-culturing is the name of the game and, change is never a checklist - it is always complex (Fullan 2001).

“The single factor common to successful change is that relationships improve” (Fullan, 2002). The third characteristic, Relationship Building, therefore, is critical in any effort to affect change. Relationship building is complex in a society such as a school building, with an extensive range of backgrounds and experiences among the staff along with varying goals beliefs. Relationship building is an essential skill not just for short-term success, but also for laying the foundation for long-term cultural shifts towards habits of excellence (Fullan, 2002).

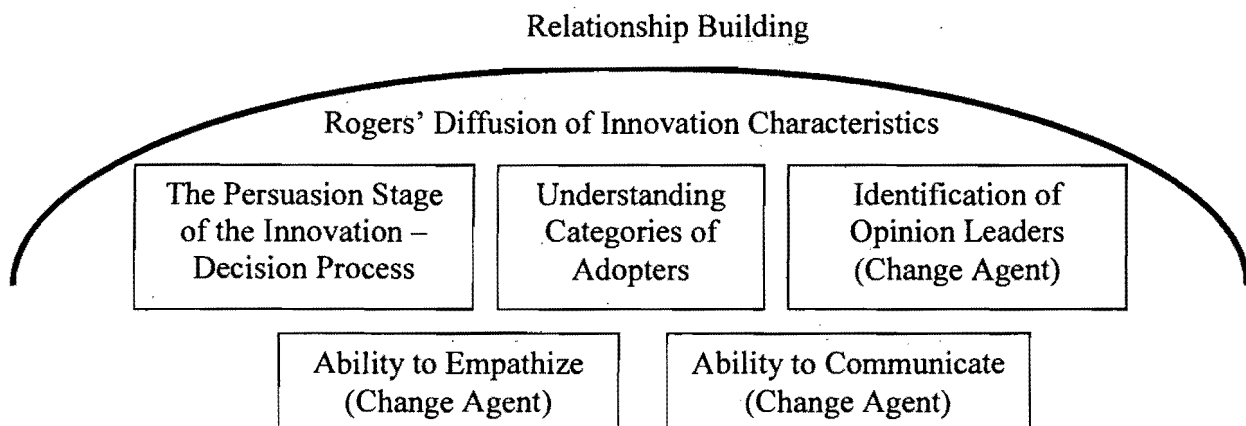
Fourth, the creation and sharing of knowledge is essential to change leadership (Fullan, 2002). Fullan (2001) states “Leading in a culture of change doesn’t mean placing changed individuals into unchanged environments” (p.79). This indicates that knowledge creation and sharing is not the same as knowledge acquisition, nor can effective change take place if only the individuals are asked to change without the environment around them changing. Knowledge sharing, and the change that it encourages and supports, is a social process (Fullan, 2002). A change agent such as a principal needs to create the environment where this social process can take root and grow. It is critical to sustained change not only for knowledge to continue to be accumulated (through professional development) but that the knowledge is shared, discussed, challenged, and dissected by the staff employing the knowledge. This requires structures such as common planning time, professional learning communities, and an atmosphere of safety and trust to exist.

Fifth, the concept of Coherence Making is essential to keep all of the moving parts of a complex organization in the midst of change to be working together rather than competing with one another (Fullan, 2002). Overload and fragmentation of new ideas is a natural enemy of coherent and stable change, and a change leader has to be aware of the dangers of such aspects. The effective change leader continues to re-focus the societal group on the stated goals.

Fullan's writings are focused on the culture of change and the complexities of leading in such an environment. Rogers' Diffusion of Innovation Theory concentrates on implementation of individual innovations within the culture of the society. The aspects of Diffusion of Innovation theory are present regardless of the level of acceptance of change within the culture that the innovation is being introduced. While that existing culture will certainly impact the process of diffusion of a new innovation, the purpose of diffusing a new innovation is not to create a culture of change, but to successfully implement a new idea. In that light, the diffusion of an innovation using the theories that Rogers discusses will benefit from a culture of change that Fullan's writings encourage; however they are not a subset of such a culture. Rogers' theory provides a structure for the elements that contribute to successful implementation of a specific new program or idea; Fullan's writings discuss elements of knowledge and skills that a change leader should be aware of in creating an environment tolerant and inviting of change in general. In many aspects, the characteristics of Rogers' Diffusion of Innovation theory would benefit from being in a culture of change that Fullan describes. For example, a map of the "umbrella" of a change leader that has created an environment where Fullan's *Knowledge Creation and Sharing* would show how Rogers' *Attributes of the Innovation* would benefit.



- A similar model could describe the relationship between the gestalt of Fullan's
- *Relationship Building* aspect and other characteristics that Rogers' describes as critical.



James Dearing (2004) notes three theory-based concepts regarding diffusion of innovations. Simply stated, when members of a society decide to adopt an innovation, there are three significant thoughts involved in the decision: what they think about the new idea, what they believe credible others think of the idea, and what they think of the idea in comparison to what other innovations exist (p. 26). Diffusion is more likely to occur when the potential adopters see the characteristics of the innovation as easy to explain, that the benefits of the innovation are clearly apparent, that the risk of adoption



is minimal, and that the adoption of the innovation will produce benefit over current practice (Katz, 1963).

Concerning what potential adopters believe credible others think of an idea, Dearing (2004) believes the *opinion leader* to be critical to the successful adoption of an innovation (p.27). For an innovation to gain speedy acceptance, it has to have been accepted at a high level of value by influential members of the adopting society (Dearing, 2004). Such influential members are called opinion leaders (Rogers, 2003, Dearing 2004). The greater the perceived risk and uncertainty is among the potential adopters of a new idea, the greater the impact that opinion leaders may have on such an adoption (Dearing, 2004). Diffusion occurs through a social process where “pre-existing influence among people or among organizations alternately facilitates and impedes the rate and extent” of adoption (Dearing, 2004). A change agent must enlist opinion leaders to successfully adopt a new innovation throughout a societal group. This group of opinion leaders will be able to ensure successful adoption as long as they have positive attitudes towards the innovation and others in the adopting society recognize a positive correlation between the new idea and the opinion leaders (Valente, 1995). Conversely, opinion leaders that do not think highly of a new idea and act on that through avoidance or overt rejection of the new idea will seriously impede the progress of implementation (Leonard-Barton, 1985).

Concerning the comparative value of the innovation, studies show that adopters of a particular innovation sometimes adopt related innovations during the same adoption time frame (Dearing, 2004).

Dearing (2008) notes that diffusion theory has attracted the attention of scholars and practitioners from a wide variety of interests and fields (p.99). There are many reasons for studying the diffusion process throughout these interests and fields. Such reasons include determining why an innovation is successfully diffused in a certain society, how to replicate successful diffusion to another society, and how to transfer a successful diffusion from one entity in an organization to another (Dearing, 2008). As diffusion research matured, more sophisticated questions were studied such as how to accelerate the diffusion process, how to increase the number of concurrent implementations, how to increase the quality of successful adoptions, and how to sustain the use of successfully

adopted programs (Dearing, 2008). Dearing (2008) calls these more sophisticated questions, which build on prior knowledge of diffusion theory, practices of *dissemination* (p.99). Such dissemination occurs due to a series of circumstances involving members of the society that the innovation impacts. The circumstances are a set of “needs” – the need for a member of the society impacted by the innovation to feel confident when presented with evidence of a new innovation, the need for members of that society to understand what their peers within their society know and are learning about new innovation, and a sense of continuing to belong within a group when members of that group have made a change through an innovation (Dearing, 2008). Recognizing these needs in conjunction with Roger’s Categories of Adopters and the importance of opinion leaders, Dearing (2008) suggests the importance of the relationship between the change agent and opinion leaders for more effectively diffusing an innovation (p.103). Dearing notes the difference in this model from diffusion theory by naming it *dissemination science*. One particular model, called Societal Sectors, emphasizes that the society of adopters is tied together by social or professional interests rather than by proximity (Dearing, 2008). For example, elementary schools are a society of potential adopters of a new reading instruction innovation regardless of their proximity to one another because of the potential impact that such innovation would have on common functions and goals. Dissemination strategy used during planning for the diffusion of an innovation in a sector (one school or district) of this society (all elementary schools) would include the use of credible professional networks from which the society members would likely seek advice. This would include the use of outside experts in training, the distribution of articles written by trusted names in the industry, and the purchase of materials that are recommended by these experts. Dearing (2008) states that “a key determinant of the likely success in strategic dissemination based in a societal sector perspective is the sophistication of change agents...if a change agent correctly identifies which organizational leaders serve as sources of example, modeling, and advice, ... (then) the change agent’s time can be spent interacting with that subset of opinion leaders who will, in turn, affect other adopters in the course of their normal conversations with those peer followers” (p.104). The concept of societal sectors impacts the efforts of dissemination of a new idea as it guides the change agent in his or her identification of opinion leaders

(they should be part of the societal sector that is at the center of the innovation), ensure that these opinion leaders are adequately aware and sufficiently trained in the innovation to be seen as credible to their peers, and to recognize the impact that the needs of the society members will have on their approach to a new innovation.

Thomas Valente (1999) concludes from extensive empirical studies that new ideas and practices are diffused through interpersonal contacts and that those contacts largely consist of interpersonal communication (p. 56). Important influences of the adoption of new practices include social contacts, social interaction and interpersonal communication (Valente & Rogers, 1995). Throughout the 20<sup>th</sup> century, studies on diffusion of new ideas within a society supported the concept that interpersonal interaction between members of the society was an important factor on the successful adoption of the new idea (Valente, 1999). With the extent to which the research supports the idea of diffusion being a social event, methods to determine the types of social contact and to measure the most effective means of such social communication are important. Such analysis of the social interaction involved in the diffusion of an innovation is called network analysis (Wasserman & Faust, 1994). Such network analysis focuses on identifying individuals in a society that are the most influential during an adoption process. Such individuals are called opinion leaders, and can initiate the diffusion of a new idea or program, functioning as role models and supporters of the new idea (Valente, 1999, Katz & Lazarsfeld, 1955). The plan to use opinion leaders as conduits of information and encouragement to promote change can be referred to as a peer promotion model (Valente, 1999). Such individuals can be influential in creating rapid, sustained change that is implemented with integrity (Valente, 1999). However, the potential effect that an opinion leader has is contingent on the degree of credibility and trust that potential adopters within the society have of them (Valente, 1999).

Valente (1999) suggests that to ensure that selected opinion leaders have such credibility and trust within the society, change agents must allow the members of the society to formally select them (p. 59). This is in contrast with previous theorists that suggest that change agents must identify existing opinion leaders within their society and Valente proposes a more formal selection process. Valente believes that allowing the entire population of the society's members to choose the opinion leaders is a preferred method

(Valente, 1999). After a selection process is completed via nominations, the chosen leaders are provided with materials and training to best understand the adoption, and are paired with members that had nominated them. This type of diffusion network matches learning theory that states that learning best occurs when individuals are trained by peers of their own choosing (Rice, 1993). Valente (1999) lays out a three-step approach to the identification of opinion leaders (p. 61):

- 4) Identify 10 percent of individuals that receive the most “votes”, these are the opinion leaders.
- 5) Match opinion leaders to the members of the society that nominated them, or connect them through the least number of connections.
- 6) Assign individuals who nominated no one randomly and proportionately to leaders.

It is then essential for the selected opinion leaders to believe in the innovation, have sufficient training available to them for their confidence in the innovation, and have a desire to help lead the adoption of the innovation (Valente, 1999).

Valente (2005) recognizes the importance of opinion leaders as he notes that “it is clear networks are important influences on behavior because most people acknowledge that they receive information and influence via their social networks and that they model the behavior of others” and takes their selection a step further than other theorists as he essentially proposes an election of peers by peers to lead innovative change (p. 113).

Robert Wright, John Palmer, and Deborah Kavanaugh (1995) suggested that the application of marketing techniques, in particular diffusion theory, be used to promote the speed and fidelity of implementation of an educational innovation. In their article, they presented an “innovation diffusion framework” to “provide educational professionals with a set of recommendations that may lead to more successful marketing of educational innovations” (Wright, Palmer, & Kavanaugh, 1995). This framework was based on the work of Christopher Lovelock and Charles Weinberg who, interestingly enough, discussed diffusion theory in a marketing textbook. Lovelock and Weinberg (1984, p.231) described findings in diffusion theory to be particularly relevant to their subject. In particular they discuss characteristics of innovations, time of adoption, stages of the adoption process, and “the role of personal influence in encouraging innovation

behavior” (Lovelock & Weinberg, 1984). The authors continue to describe characteristics of innovations that impact the success of implementation; relative advantage, compatibility, complexity, trial ability, observability, and perceived risk.

### Document 3 – Activity

This activity was distributed and used as described in the first two paragraphs below.

As you know, I have hypothesized that if a Principal has a working knowledge of Diffusion of Innovations theory, the rate of adoption of a new program in his or her school will increase. We had interesting meetings and some good discussions, but if the characteristics of innovations and adopters that we discussed do not impact your behavior, then we cannot expect an impact on adoption.

I would like to ask you to reflect on the attributes of innovations that we have discussed with Guided Reading as the innovation in question. Use the following chart to record your reflections. I ask you to look at things that you have done and consider things that you can now do to promote Guided Reading adoption from the perspective of each of the attribute categories.

I have summarized the attribute categories below for your reference:

**Relative Advantage** – The degree to which an innovation is seen as advantageous over a current practice. The greater the perceived relative advantage, the greater the rate of adoption

Compatibility – The degree to which an innovation is seen as compatible to the current needs, culture, and philosophy of the organization. The greater the perceived compatibility, the greater the rate of adoption.

Complexity – The degree to which an innovation is perceived as difficult to adopt and to use by the potential adopters. The greater the perceived complexity, the weaker the rate of adoption.

Ability for Trial – The degree to which an innovation can be tried and experimented with by potential adopters. The greater the opportunity for trial, the greater the rate of adoption

Ability to Observe – The degree to which the outcomes of an innovation are observable by potential adopters. The greater the opportunity to observe the outcomes, the greater the rate of adoption.





Attribute	What I have done	What I can do
<b>Relative Advantage</b>		
<b>Compatibility</b>		

<b>Complexity</b>		
Attribute	What I have done	What I can do
<b>Ability for Trial</b>		
<b>Ability to Observe</b>		

We will come together again soon and compare and discuss our reflections. Thank you again for your efforts.

Document 2 – Presentation

This 27 slide presentation was used with Principals during the training.

Slide 1

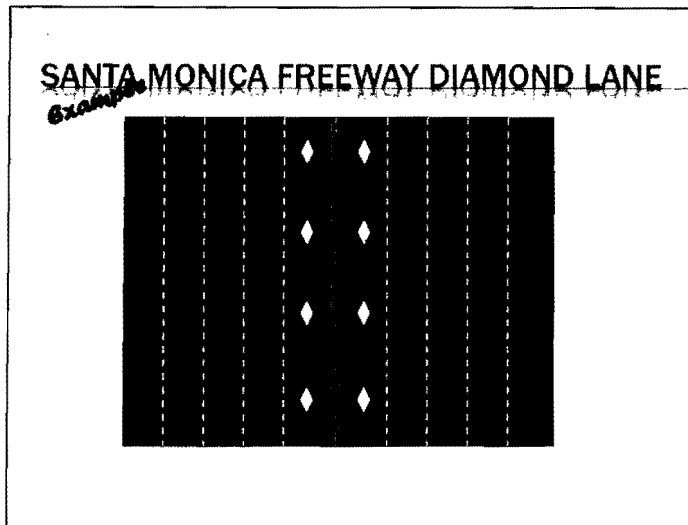
**There is nothing more difficult to plan, more doubtful of success, nor more dangerous to manage than the creation of a new order of things...Whenever his enemies have the ability to attack the innovator, they do so with the passion of partisans, while the others defend him sluggishly, so that the innovator and his party alike are vulnerable.**  
**- Machiavelli, *The Prince*, 1513.**

Slide 2

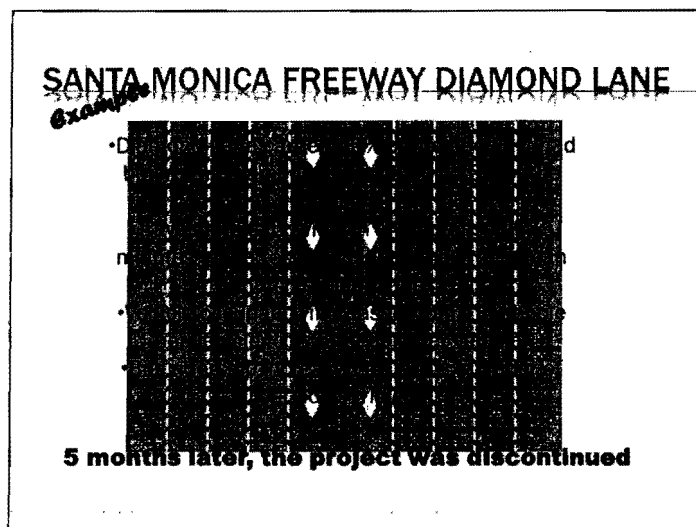
**WHAT IS DIFFUSION OF INNOVATIONS?**

Diffusion of Innovations suggests that there are characteristics of innovations and of those who are asked to adopt them. That these characteristics, if understood by a leader, can be emphasized, accounted for, encouraged, and manipulated to improve the chances for successful implementation.

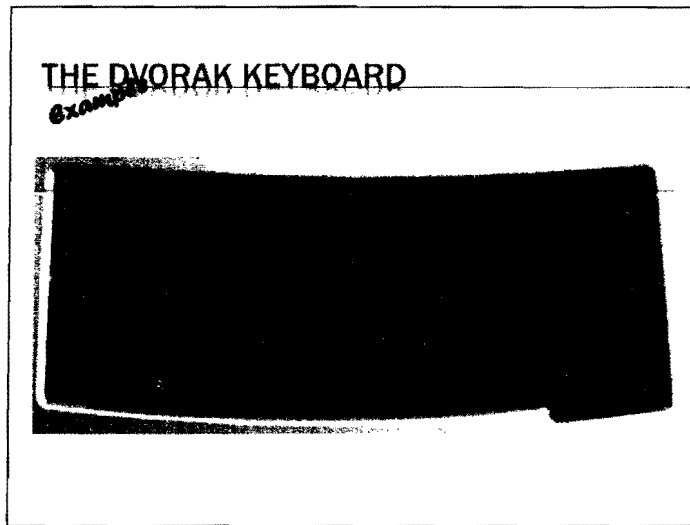
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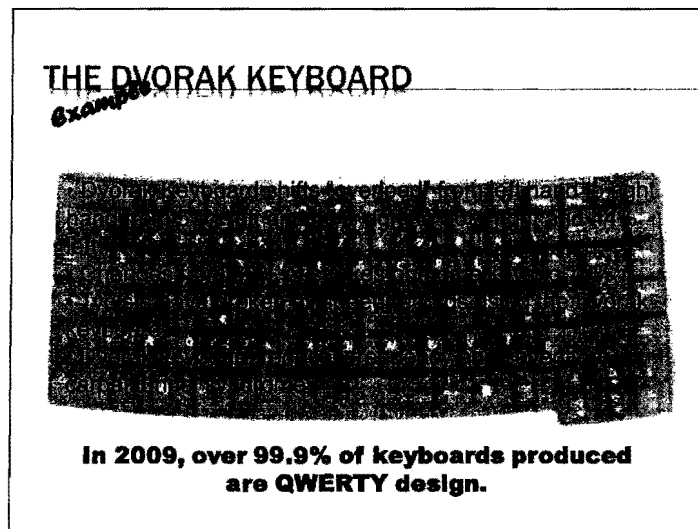
Slide 4



Slide 5



Slide 6



Slide 7

## **BOILING WATER FOR SAFE DRINKING**

**Example**

Public Health Service in Peru in 1950s try to change thinking and behavior to control disease caused by consuming contaminated water in villages.

After 2 year campaign:

- 5 percent of the population was convinced to boil water before consumption
- 11 families out of 200 in the village altered their behavior to include boiling water before consumption

**What went wrong?**

Slide 8

## **THE CELL PHONE**

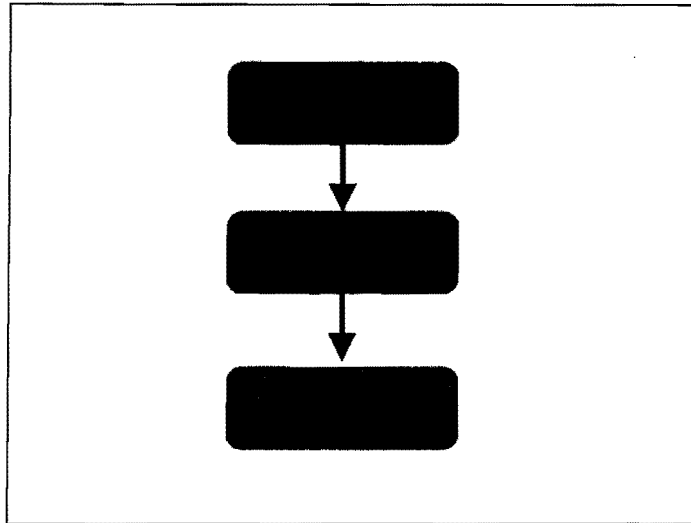
**Example**

The first cell phone was offered to American consumers in 1983.

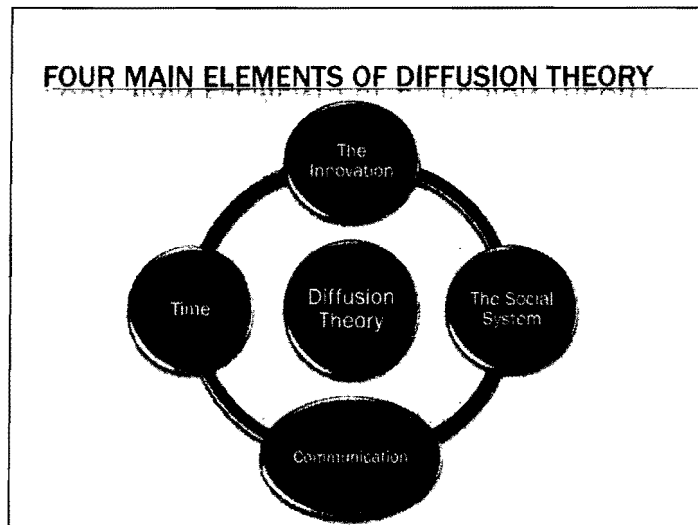
- During the first decade of their availability, 130 million phones were sold.
- During the second decade of their availability, 1.1 billion were sold worldwide

**What went right?**

Slide 9

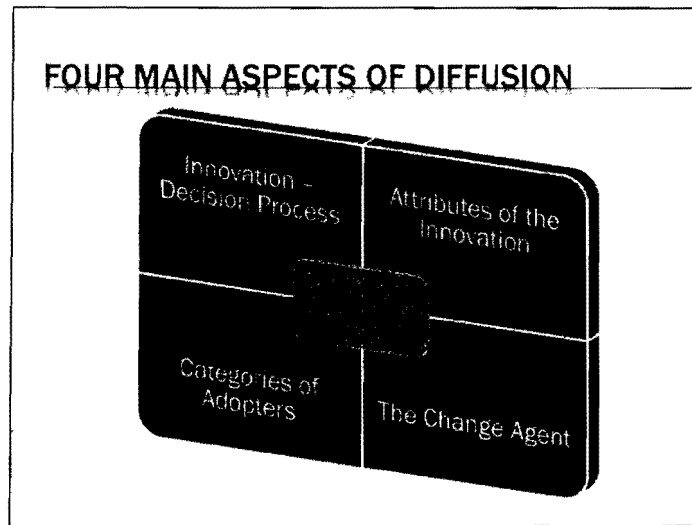


Slide 10

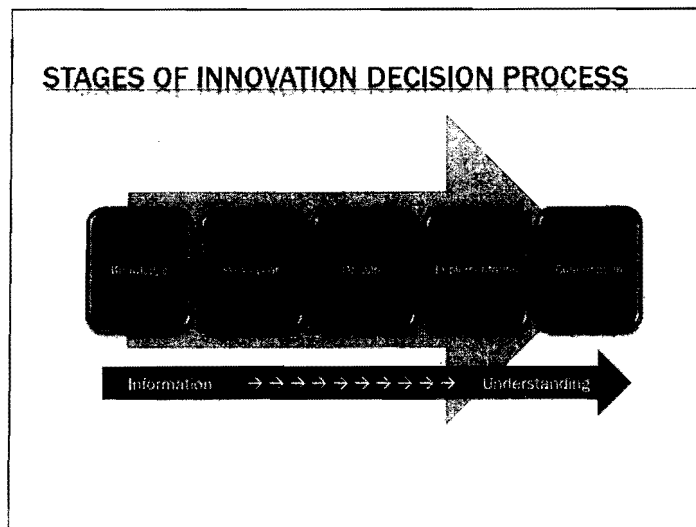




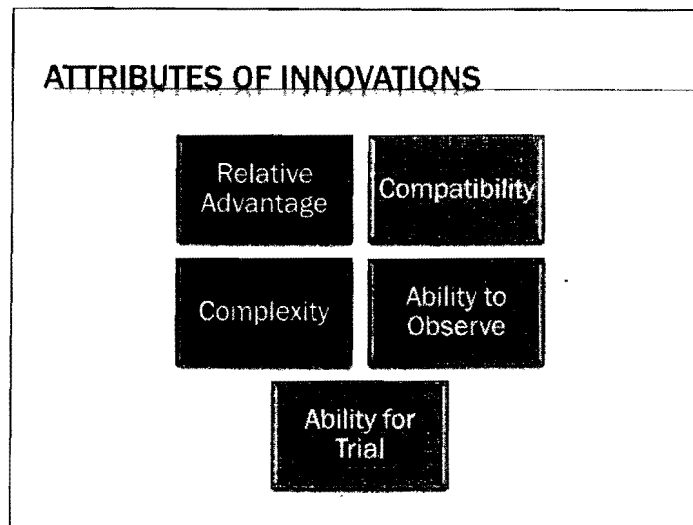
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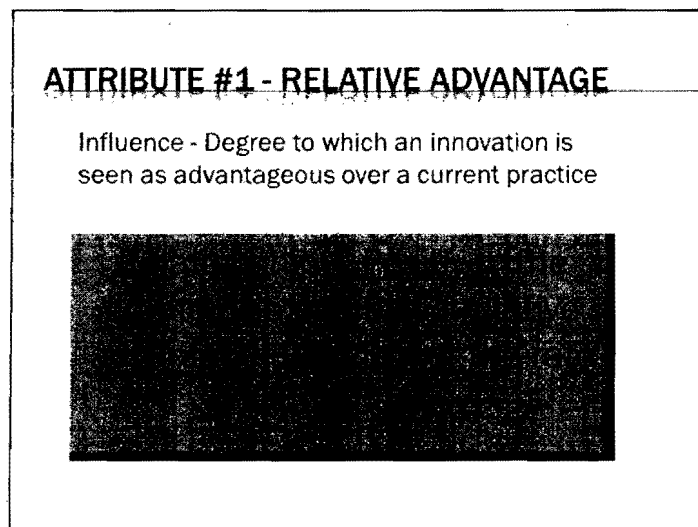
Slide 12



Slide 13



Slide 14



Slide 15

**ATTRIBUTE #2 - COMPATIBILITY**

Influence - Degree to which an innovation is seen as compatible to the current needs, culture, and philosophy of the organization



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**ATTRIBUTE #3 - COMPLEXITY**

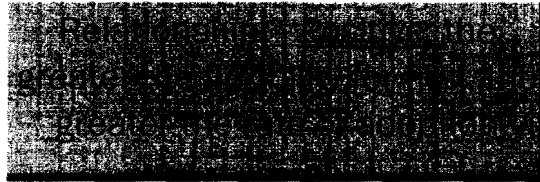
Influence - Degree to which an innovation is perceived as difficult to adopt and to use by the potential adopters



Slide 17

**ATTRIBUTE #4 - ABILITY FOR TRIAL**

Influence - Degree to which an innovation can be tried and experimented with by potential adopters



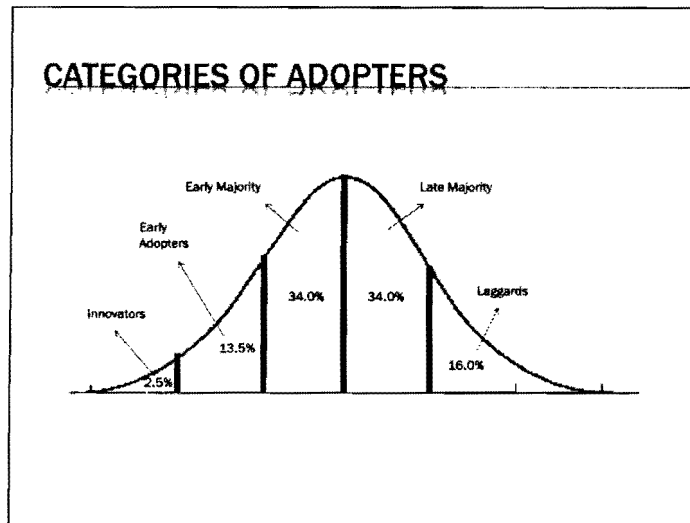
Slide 18

**ATTRIBUTE #5 - ABILITY TO OBSERVE**

Influence - Degree to which the outcomes of an innovation are observable by potential adopters



Slide 19



Slide 20

Category	Key Attribute	Key Characteristics	Percentage of adopters
Innovators	Venturesome	<ul style="list-style-type: none"> <li>Interest in new ideas</li> <li>Communicates with other innovators</li> <li>Ability to understand and apply new knowledge</li> <li>Ability to cope with high degree of uncertainty</li> </ul>	2.5% (2 standard deviations from mean)
Early Adopters	Respect	<ul style="list-style-type: none"> <li>High degree of opinion leaders</li> <li>Respected by peers</li> <li>Integrated into the member society</li> <li>Often looked as a "role model"</li> </ul>	13.5% (1 standard deviation from mean)
Early Majority	Deliberate	<ul style="list-style-type: none"> <li>Frequent interaction with peers</li> <li>Not opinion leaders</li> <li>Follow with "deliberate willingness" but seldom lead</li> </ul>	34%
Late Majority	Skeptical	<ul style="list-style-type: none"> <li>Often adopt due to increased peer pressure</li> <li>Approach innovation with skepticism</li> <li>Innovation must be nearing the norm before adoption</li> </ul>	34%
Laggards	Traditional	<ul style="list-style-type: none"> <li>Isolated from social networks</li> <li>No opinion leadership</li> <li>Have traditional values</li> </ul>	16% (1 standard deviation from mean)

Slide 21

### ROLES OF THE CHANGE AGENT

- Create the need for change from current practice
- Establish communication networks to establish and ensure credibility of the change agent
- Diagnose potential problems and concerns likely to be encountered when promoting the innovation
- Motivate adopters towards the innovation
- Promote avenues for action through providing material and emotional support
- Stabilize and reinforce adoption during the individual's confirmation stage
- Develop self-renewing behaviors in regards to the innovation

Slide 22

### OPINION LEADERS

The MOST INNOVATIVE members of a system are very often perceived as deviant from the social system and are accorded the status of low credibility by the average members of the system.

Because of this, the role of these individuals in diffusion of an innovation is very limited. The members that have a strong role in diffusion are called *opinion leaders*.

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### OPINION LEADERS

- Opinion leadership is the degree to which an individual is able to influence others' attitudes or behavior informally with relative frequency
- This leadership *is NOT* a function of formal position or status
- This leadership *is* earned and maintained through social interactions and technical expertise
- Opinion leaders have a unique, influential, and central position in the system's interpersonal communication network

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### OPINION LEADERS - CHARACTERISTICS

- Exposure to external communication
- Social Accessibility
- Innovativeness relative to system norms
- Socio-economic status

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### **CRITICAL MASS**

The point at which further diffusion becomes self-sustaining. Occurs at the point at which enough individuals in a system have adopted an innovation so that the innovation's further rate of adoption becomes self-sustaining.

Prior to reaching critical mass, adoption of an innovation is relatively slow. After reaching critical mass, adoption accelerates and sustains.

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### **CRITICAL MASS - THE FAX MACHINE**

**Example**

The fax machine was invented in 1843. No one adopted it.

In 1963, Xerox sold fax machines to UPI, AP, and Reuters to send documents and photos to media outlets.

In 1984, Sharp created a low priced (\$2,000) fax and large US companies began to purchase machines to communicate between corporate offices.

In the 1980s, the cost of a fax fell below the cost of a first-class stamp.

In 1987, fax machine sales soared. Everybody "had to have one". Adoption had reached critical mass.



### **CRITICAL MASS - LESSONS LEARNED**

The formula for successful adoption is to:

- promote relative advantages
- provide opportunities to observe and try
  - minimize concerns of complexity
  - emphasize compatibility to goals
- support early adopters in implementation
  - recognize need for confirmation
- recognize and address different needs for different types of adopters
  - identify and utilize opinion leaders efficiently
- actively engage in proven change leader behaviors

**LEADING TO THE GOAL OF REACHING CRITICAL MASS AS EARLY AS POSSIBLE.**