The Uses of Systems Thinking Tools for School Improvement

by

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Abstract

Cornfield High School is a school located in St. Louis, Missouri, serving just over a thousand students, grades nine through twelve. While sharing many similarities of other high schools throughout the United States, Cornfield High School has a very unique feature. Cornfield High School has made an intentional effort to integrate systems thinking theory into their leadership practices. While many high schools use data to make decisions, Cornfield High School chooses to use systems thinking tools to help address causes to problems for the purpose of school improvement.

The purpose of this study was to explore specific ways that systems thinking tools have been used at Cornfield High School for the purpose of school improvement. The participants consisted of teachers as well as members of the leadership team at Cornfield High School. Interview data, field note data, and a systems thinking document were all coded, and warrants and assertions were made based on patterns found in the data.

Some administrators at Cornfield see systems thinking tools as a way to get people involved who might not otherwise be given a voice in the decision making process. The most common successes cited by members of the leadership team included practical uses that allowed for more involvement among all stakeholders, classroom utilization, and higher order thinking skills among students who used it. The most common successes identified by teachers include a more effective decision making processes, instruction in the classroom, increased collaboration among faculty members, and professional growth of teachers who us systems thinking tools.

The most common possibilities of future uses of systems thinking tools identified by the leadership team were more mandated widespread usage of systems thinking tools, use of tools in conjunction with data, and a school wide deeper level of problem solving. The most common possibilities teachers identified for future uses of systems thinking tools included continued increase in administrator and teacher effectiveness, an ability to tackle deeper level problems, and using systems tools to further increase student achievement.

Acknowledgments

I intentionally planned on writing the acknowledgments toward the end of my dissertation journey. Something about acknowledging the people who helped me reach this point seemed special, and I wanted to remember writing this part. I will start by thanking the members of my committee: Dr. Kensler, Dr. Patrick, and Dr. Andrzejewski. It was a pleasure to write for you all. You challenged me to go beyond basic dissertation production, and challenged me not to settle for mediocrity. Though you are all extremely intelligent, you never once made me feel unworthy of your time and effort. Thank you for your criticism, accountability and every encouraging word along the way. I always knew you had my interests at heart, and letting people like you down was never an option for me.

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War Eagle.

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CHAPTER I. NATURE OF THE STUDY

Introduction

Educational leaders are constantly looking, and have always been in the search, for ways to improve the conditions of their schools. From test scores, to safety, more and more emphasis is being placed on being able to assess improvements made in multiple areas within the educational setting. There are countless examples of ways in which educators try to combat the ever-changing demands being placed on them. Some try to conquer the problem alone, assuming that if they fail, it is best to do so trying to do what they think is best. Some seek the help of outside so-called professionals or consultants that promise their programs will guarantee results. It can be argued though, that sustainable change happens most often when there is ownership or acceptance of the change, throughout the organization, and when all members of the organization have an active voice in the decision making process. Research argues that the key to sustainable change is engagement by multiple stakeholders in the decision making process (Wegner, 1998, p. 45).

The Research Problem

Creamer (2004) claimed that differing opinions can be a valuable tool to the learning organization. She writes "Consideration of different perspectives and competing explanations are important dimensions of the collaborative process associated with knowledge construction" (p. 558). Any organization in any discipline is made up of one or more systems. Meadows (2008) defined a system as "an interconnected set of elements that is coherently organized in a

way that achieves something" (p.11). Because systems are often complex with many different parts, it is quite difficult for an organization to achieve sustainable success without contributions from within. Just how can organizations create an environment where all stakeholders can bring something to the table? Enter the idea of systems thinking tools. Systems thinking tools are designed to allow members of an organization to identify causes to problems, and give them deeper understanding of specific issues. This deeper understanding allows for better decision making that is likely to address root causes of problems, rather than basic symptoms. Currently, we are unaware of how systems thinking tools are being utilized for improvements within a school. What we do know is that organizational change is equal to personal change (Bruckman, 2008). We also know that systems thinking tools provide a real and practical way to give stakeholders a voice within the organization (Raines, 2004; Senge, 1994). The research problem that will be addressed in this study is this: How can systems thinking tools be utilized for the purpose of school improvement?

Conceptual Framework

In looking at how systems thinking tools can be utilized for school improvements, several themes emerged through the available empirical research. The first is that systems thinking tools are best utilized through a teamwork atmosphere and are conducive to be utilized by learning communities. Mahoney and Schamber (2011) wrote "Learning communities also utilize constructivist learning, a view that knowledge is developed in community, not solely as an individual process…co-constructed knowledge can make course material meaningful, relevant, and part of their personal growth" (p. 235). The second concept is the idea that utilizing systems thinking tools for school improvement is largely driven by the willingness of those within the organization to adapt or change. Meadows (2009) wrote "Social systems are the external

manifestations of cultural thinking patterns and of profound human needs, emotions, strengths, and weakness. Changing them is not as simple as saying now all change, or of trusting that he who knows the good shall do the good" (p. 167). For this reason, change theory is an important aspect of this conceptual framework. Similarly, leadership style also impacts the ability of systems thinking tools to be utilized for school improvement as the personality of the leaders within the school often drive how and in what capacity systems thinking tools will be utilized.

Evidence-based decision making is another important concept, as there is much empirical evidence that relates evidence-based decision making with school improvement (Bernhard, 2004; Howard, McMillen, & Pollio, 2003). Evidence-based decision making provides leaders with decisions that are data-driven. This helps leaders make decisions that are likely to correct the problem. Knowing the answers to problems is only half the battle though. Leaders need to know root causes of problems. For this reason, it is important to analyze the relationship between evidence based decision-making and systems thinking tools. Eraut listed three conditions that must be met for practitioners to effectively utilize evidence-based practice:

1. Practitioners must have easy and quick access to substantial amounts of information.
2. Professions must facilitate relevant research and practitioners must integrate research outcomes into practice.
3. Practitioners must use modern technology to access and apply data.

(As cited in Kowalski 2009, p.12)

Finally, foundations of systems thinking tools are an important concept, as it is worth noting which tools are the most valuable, and how they are utilized. Systems thinking tools were created for the purpose of identifying root causes to problems for the purpose of better decision making. These tools allow the user to see trends, patterns, and events, and respond accordingly.

Several types of systems thinking tools include the ice berg model, causal loop diagrams, behavior-over-time graphs, stock-flow charts, and the ladder of inference (Senge, Cambron-McCabe, Lucas, Smith, Dutton, & Kleiner, 2012). These three components made up the conceptual framework of this study.

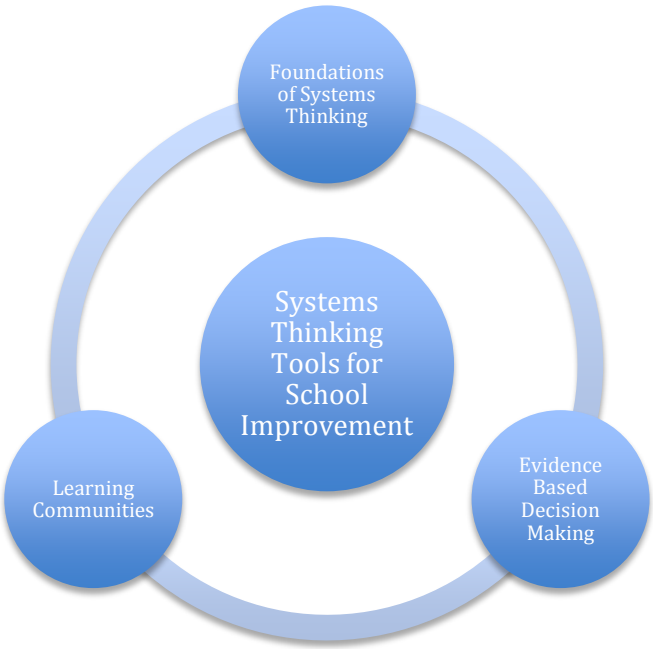

Figure 1. Conceptual Framework

Purpose Statement

The purpose of this study was to determine how high school teachers and administrators in Cornfield High School were using systems thinking tools within the setting of a professional learning community for school improvement.

Research Questions

1. How did members of the Cornfield High School leadership team report using systems thinking tools?

2. How did teachers of Cornfield High School report using systems thinking tools?

3. What successes did the leadership team relate to the use of systems thinking tools?

4. What successes did the teachers of Cornfield High School relate to the use of systems thinking tools?

5. What possibilities did the leadership team see for future use of system thinking tools?

6. What possibilities did the teachers of Cornfield High School see for future use of systems thinking tools?

Significance of Study

The purpose of this study was to look at how systems thinking tools could be utilized for the purpose of school improvement. In doing so, the study helped to begin to tie systems thinking tools to evidence based decision making for the purpose of school improvement. There is a great deal of research that warrants the usage of evidence based decision making, but not many studies that explore the uses of systems thinking tools to identify causes of problems. This is hopefully one of many systems thinking studies to come. It was a study based on topics which were grounded in research, but really have yet to be explored thoroughly in the empirical literature.

Beyond the classroom, this study had potential to impact other areas where systems thinking tools could and were being implemented. Ideas such as the sustainability movement could have benefited from studies that showed how systems thinking tools allowed users to identify problems on a deeper level. Certainly the same concept held true for lawmakers,

economists, sociologists, and virtually anyone else who wished to identify and understand root causes to problems (Kensler, Reames, Murray, & Patrick, 2012).

Most importantly though, principles of this study could have an impact on the way in which children are educated by impacting the perspective of those who taught. Educators who understood systems thinking tools understood the world from a totally different perspective. They are global thinkers, able to analyze problems from multiple points of view. Because of this, they were able to relate to students of whom they might otherwise have had little or no understanding. Systems thinking tools would have been able to open up an entirely new relational aspect that would have otherwise gone unaddressed.

This study allowed educational leaders to look at things that were being done at Cornfield High School, and apply it to their individual school setting. To this end, it was fully acknowledged that not everything done at Cornfield was necessarily transferable to other schools, but certainly some things were. Though this study focused on the use of systems thinking tools in one high school, several implications emerged that common in many school settings. The result had the potential to be a potent transformation of one's organization.

Delimitations

This study took place over the course of approximately one and a half years with the bulk of the research being conducted during one week in January 2013. The researcher visited the site twice beforehand and initiated several conversations with the assistant superintendent of curriculum, who was instrumental in arranging interview sessions. The high school in which this study took place was located in St. Louis, Missouri where only five of the teachers were interviewed. In addition to these teacher interviews, interviews with the four members of the high school leadership team were conducted. Interview questions were designed in a way that

were open-ended, and allowed the conversation to flow organically as to not direct answers in a specific direction. Though only one school was involved, it should also be noted that this allowed for responses to consistent topics. For example, when discussing the principal of the school, it helped to know that the teachers all referred to the same principal in the particular school. This allowed for a clearer picture to be gathered as to what exactly was going on in this school.

Assumptions

There were several assumptions associated with this study. The first assumption was that participants, especially teachers, gave honest answers to all interview questions. It was important that we gained an accurate perception of the teachers in regards to systems thinking tools. Since there was obviously the possibility that teachers felt pressured to give answers that reflected positively on their school, assurance of confidentiality was given.

A second assumption was that the assistant superintendent chose a representative group of teachers that were diverse enough to represent all types of teachers at Cornfield High School. It was possible that due to the time of day in which the interviews were conducted, we may have missed out on a particular type of teacher such as one who had after-school coaching duties. We assumed though, that the generalities gained from the teachers interviewed were applicable to other teachers within the high school as well.

Definition of Terms

Behavior-over-time graph – A specific systems thinking tool, designed to track events over a specific period of time (Senge, 1994).

Data Room – A physical part of a building where data are present and used by stakeholders to aide in the decision making process (Bernhard, 2004).

Evidence-Based Decision Making – Using data to drive the decision making process (Bernhard, 2004).

First Order Change – Change that is likely to be perceived as minor or insignificant.

Iceberg Model – A type of systems thinking tool developed by Peter Senge to help identify root causes to problems (Senge, 1994).

Perception – The way one views and values a specific thing or idea.

Professional Learning Community – A group composed of all stakeholders within the organization who all contribute for the growth of individuals and the organization as a whole (Meirinka, Imants, Meijer, & Verloop, 2010).

Response to Intervention (RTI) – Specific strategies used to help determine causes to specific problems students are having, and practical ways of addressing them.

School Improvement – Any change to the learning organization that is perceived as positive (Greenwood, Bradfield, Kaminski, Linas, Carta, & Nylander, 2011).

Second Order Change – Change that is likely to be perceived as major, and is often met with resistance. Second order change might be considered first order change in some organizations.

Stakeholder – Anyone within or impacted by the actions of an organization.

Systems Thinking – Senge (1994) defines it as "a way of thinking about, and a language for describing and understanding, the forces and interrelationships that shape the behavior of systems" (p. 7).

Organization of the Study

The remainder of this study is separated into five chapters, the bibliography, and appendixes. Chapter two is a review of literature that looks at the concepts and theories related

to systems thinking tools and evidence-based decision-making. Chapter three details the methodologies and qualitative research design used for this study. In this third chapter, instruments and samples are described. Chapter four discusses data analysis and the program used to help code and analyze data, and chapter five concludes the study with a summary and recommendations for future research. A bibliography and appendixes follow chapter five.

Summary

This chapter presented an introduction to the purpose of this study, and the potential value of studying schools that implement systems thinking tools for the purpose of school improvement. Attention was paid to the research problem, conceptual framework, purpose statement, research questions, significance of the study, delimitations, assumptions associated with the study, definition of terms, and organization of the study.

CHAPTER II. REVIEW OF THE LITERATURE

Introduction to Learning Communities and Change

Perhaps today more than ever, a greater emphasis is being placed on how educational leaders initiate change within an organization for school improvement. Many scholars agree that school improvement takes place and is sustained through a team like approach. Meirinka, Imants, Meijer, and Verloop (2010) stated as much when they wrote "fostering teams which exchange ideas, discuss their experiences and their underlying assumptions and which aim to solve shared problems may be regarded as a promising direction for initiatives aimed at teacher professional development with respect to educational innovation" (p. 177). School improvement requires efforts of multiple stakeholders who, if utilized correctly, can use diversity to their advantage to contribute to the learning community.

Perhaps if schools were utopian communities, learning communities wouldn't be as necessary. This simply isn't the case. Gibbs and Rankin (2009) provided some statistics that are quite staggering. They suggested a need to modify the way change takes place in our schools. These statistics include: 68% of business firms report educational shortcomings in their employees. Only one in five 21–25 year-olds can read a bus timetable or draft a job application letter. Eighty percent (80%) of students entering school feel good about themselves. By fifth grade, only 20% do. Only one out of five high school students has positive self-esteem. Ninety percent (90%) of U.S. students are dismally behind international averages in math and science. Thirty-six percent (36%) of American companies spend about $20 billion per year on remedial

courses in math, reading, and writing. More than 25% of high school students fail to graduate. Some high schools never graduate more than 50% of their students (p. 18). Clearly, these statistics must improve if students are going to thrive in an ever-evolving world.

Initiating Change

There has been much debate made about the best way to initiate change. Anne Hynds was interested in the ability to initiate change through predicting those most likely to resist it. Not only is response to change difficult to predict, Hynds (2010) explained that change is often resisted by both stakeholders who are in the majority and those who are in the minority. She wrote:

> Within each school's Maori community, there were conflicting views about major conceptual issues related to the development of culturally appropriate practice and the degree to which power and decision-making should be shared with students. The resistance of Maori teachers was less visible; demonstrated through passive disengagement with the work of reform. Subsequent interviews and members checks with Maori teachers and with parents/caregivers of Maori children also revealed that they wanted greater consultation and involvement in the reform initiative. These results highlight the lack of shared vision about the goal of reform. (p. 389)

It serves as a powerful statement that even those who make up what could be considered a repressed minority would be resistant to change if not given a voice.

Organizational change is not a natural process. It requires deliberate action from leaders. Bruckman (2008) equated organizational change to personal change. He wrote that a correlation exists between the amount of change, and the mental health of people who work there (p. 213). The implication is that change can result in stress, and some scholars believe change can be tied

to physical health as well. This is further illustrated by Baltzer, Westerlund, Backhans, and Melinder (2011) who wrote "downsizing, but also expansions and other forms of organizational instability could lead to sickness absence" (p. 15). Organizational leaders must therefore be aware of potential consequences of change, and prepared to help employees deal with them. We live in a complex society, where sustainable change is quite difficult. We need help. This is where learning communities come in.

Learning Communities

Learning communities allow leaders within organizations to involve as many stakeholders as they like into the decision making process within their organizations. The benefits of doing so are quite substantial. This co-creation and sustaining of the school environment are accomplished through learning communities. How does one define a learning community? What does it look like? Wenger (1998) referred to learning communities as communities of practice. These communities do not happen naturally. Wenger showed how a learning community is created by painting a picture of these practices when he wrote:

> As we define and engage in pursuit together, we interact with each other and the world and we tune our relations with each other and with the world accordingly. In other words, we learn. Over time, this collective learning results in practices that reflect both the pursuit of our enterprises and the attendant social relations. These practices are thus the property of a kind of community created over time by the sustained pursuit of a shared enterprise. It makes sense, therefore, to call these kinds of communities *of practice.* (p. 45)

A recurring theme that scholars address when writing about learning organizations is that of time. They often view learning organizations as a process that requires deliberate effort on the

part of the leader. Like Wegner, Dufour and Dufour (2006) also rejected this concept of natural growth of learning communities. They maintained that true effort is needed to grow and sustain learning communities, or as they referred to them, professional learning communities. They described the PLC journey as dangerous, and recognized the potentials for failure (p.11).

Why do we need learning communities? Cross (1998) provided three practical reasons for a growing interest in learning communities. She wrote,

> I think the reasons can be divided into three broad categories: *philosophical* (because learning communities fit into a changing philosophy of knowledge), *research based* (because learning communities fit what we know about research and learning…), and *pragmatic* (because learning communities work). (p. 4)

Educators are familiar with ideas such as best practices that are said to be data based. If these are to be valued in education, then we can certainly use Cross's rationale for the institution of learning communities. One core feature of all learning communities is that they involve more than one or a select few people. Marsick and Watkins (1999) wrote about the importance of learning communities in initiating change while involving everyone in the organization. They stated, "Change agents use models that they have developed over time… They typically have access to resource networks and exemplars upon which they draw… Within the system are stakeholders and an infrastructure that must be considered to support learning and change" (p. 19). Not only are stakeholders necessary, but they must be ready to be contribute if success is to be sustained.

Another benefit of learning communities is that they foster professional growth of the stakeholders through learning. The type of learning that takes place in learning communities is

sometimes referred to as team learning. Watkins and Marsick (1993) described their version of team learning.

> When a team adopts something new, members reinforce one another's thinking and spread these ideas faster and further through their combined contacts elsewhere through the organization. Teams are crucibles through which opposing ideas can be brought together and confronted-ideas that otherwise would remain within the heads of individuals and not be linked together in new combinations. (p. 97)

As with students in a classroom setting, stakeholder learning takes place in different ways. In addition to providing a definition of learning communities, Watkins and Marsick (1993) identified five processes for team learning. These include "framing, reframing, integrating perspectives, experimenting, and crossing boundaries" (p. 96).

Team Learning

The first aspect of team learning identified by Watkins and Marsick (1993) is framing. They wrote "Framing is an initial perception of an issue, situation, person, or object based on past understanding and present input" (p. 99). Framing occurs because of the impact of our past experiences on current perceptions. We learn from our past, both from mistakes as well as rewards. Fredrickson (2000) wrote, "People's past and ongoing affective experiences guide their decisions about the future. These affective experiences include emotions, moods, and other subjective states like pleasure and pain, liking and disliking, hope and dread" (p. 577). Framing is an important component of team learning to keep in mind. Self assessing the framework of team members is quite necessary before reframing, the second component of team learning, can take place.

After an understanding of the initial framing takes place, the second phase known as reframing comes into play. Watkins and Marsick (1993) defined reframing as "a process of transforming that perception into a new understanding or frame" (p. 99). Reframing will not take place without intentional effort, and neglect can be harmful to the team learning process. Watkins and Marsick (1993) wrote that failure to reframe results in "a collection of individually held, unshared perceptions rather than openly negotiated agreement about differences" (p. 100). Members of a learning organization must not be afraid to bring their individual experiences to the table when engaging each other. Palmer claimed that learning takes place, despite differences in opinions, because of a commitment to a common goal (as cited in Creamer, 2004, p. 556). The implication then for educational leaders wishing to establish a team work atmosphere within the learning community is not to shy away from conflict, but to create a transparent atmosphere, where stakeholders can feel safe to voice ideas and disagreements.

The third step identified by Watkins and Marsick (1993) is integrating perspectives. In explaining integrating perspectives, they wrote, "Divergent views are synthesized and apparent conflicts resolved, though not through a compromise or majority rule" (p. 99). This is perhaps the most difficult step in their team learning process, as it requires individuals to be open to the possibility that their perspective can be changed. The detrimental result of individual perspectives is that humans tend to feel like they have the answer. To this end, there must be a framework in place, and almost assuredly grounded in respect to work through differing opinions to come to the best conclusion.

The fourth step to team learning identified by Watkins and Marsick (1993) is experimenting. They wrote "Experimenting is an action undertaken to test a hypothesis or a move to discover something new" (p. 99). In the educational setting, experimenting often takes

the form of action research. The concept of action research is not a brand new idea. West (2011) wrote that action research became popular during the 1960s. Up until this point, human perspectives in research had been widely ignored. Cochran-Smith and Lytle (as cited in West, 2011) described action research as "practical inquiry, emphasizing its utility as a way to generate or enhance practical knowledge" (p. 89). Action research is unique in that it allows the researcher to fully immerse him/herself in the topic. Holter and Schwartz-Barcott (as cited in Coghlan & Casey, 2001) wrote that the greatest benefit of action research was that it allowed the researcher direct access to what was being studied (p. 675). There are several key steps in action research. Glanz's model of action research included the following components: A) Select a focus, B) Collect data, C) Analyze and interpret data, D) Take action, E) Reflect, and F) Modify actions (as cited in West, 2011, p. 90).

The fifth step to team learning identified by Watkins and Marsick (1993) is crossing boundaries. This happens when "two or more individuals and/or teams communicate" (p. 99). It is worth noting that crossing boundaries will not happen simply by being in the same room with others, but requires authentic communication, including the component of active listening.

Active Listening

Active listening requires concerted effort on the part of participants to engage in the communication process. It requires the ability for one to take time to not respond, but rather give time and speaking priority to whomever they are engaging. Active listening is critical for dialogue to place. Marsick and Watkins (1999) wrote that the key to successful dialogue was centered on an ability to speak without judgment (p. 141). Obviously, allowing dialogue to really take place in the organization requires a willingness to make the organization vulnerable to

criticism. If an organization is to foster an environment with complete openness and transparency, there must be some sort of safeguards in place to deal with threats of criticism.

In the business world, criticism can have extreme economic consequences. McCorvey (2012) wrote, "In a recent study, researchers found that when customers witness employees being disrespectful to one another-yelling, using profane language, or openly criticizing another's job performance-customers not only get mad, but they often try to punish the company" (p. 26). It is not far-fetched to say that some forms of criticism might also have negative implications in the educational setting as well. The implication then is that safeguards must be put in place if a culture of dialogue is going to be adopted. Learning communities cannot exist without dialogue. To help teach stakeholders how to engage in appropriate dialogue, it is critical to foster a community of respect. Lee (2009) wrote the following concerning lack of respect in schools:

> We fail to see the person beyond the faults. If we reduce others to their perceived faults, whether they are students in our classes or others whose lives intersect with ours, we deny their humanity. We overlook that they are human beings just like us, with hopes and fears, moments of triumph and failure, and times of joy and sadness. Moreover, many of us, when entering the classroom, are so preoccupied with our anxieties and insecurities that we fail to realize that our students almost always experience far greater anxieties and insecurities. It is essential that teachers focus on their students, rather than on their anxieties and insecurities. (p. 173)

McCorvey (2012) recognized that aspects such as employee bickering are difficult to police, but stated that businesses can create a culture built on respect (p. 26). Educational leaders wishing to utilize learning organizations can do the same.

Benefits of Professional Learning Communities

The benefits of professional learning communities appear to be numerous, however there often exists some disconnect with what educational organizations want to happen, and what actually does happen. In an empirical study conducted by Sheppard and Brown, the researchers found that organizational learning hinged on the ability of leaders to grow. Sheppard and Brown (2009) wrote:

> Unfortunately, the evidence is convincing that many schools have adopted the terminology of organizational learning, but have not engaged in the complex and difficult work required. In fact, we have found that organizational learning will not occur within schools or school districts without leaders who ascribe to an emergent leadership approach. (p. 56)

What does an emergent leadership approach look like? Gibb (1967) believed the key foundation of emergent leadership is trust. He wrote that trust leads to more openness between leaders and employees (p. 378). He used adjectives like openness, frank, and non-controlling. Critics of emergent leadership can cite the problem of leader identification to be an issue. Gleason, Seaman, and Hollander (1978) offered several measures to identify emergent leaders when they stated:

> Among the most prominent are: (1) manifest influence over group decisions, (2) ascendancy and task directiveness, (3) quantity of verbal output in discussion with other group members, (4) sociometric choice of the person named most as leader by others in the group, and (5) control over key resources in the group. No one measure, on any *a priori* grounds, has gained consensus as the best or most appropriate indicator of who is the leader in emergent situations. (p. 33)

To create lasting positive change through learning organizations requires a radical paradigm shift in the way educational leaders have made decisions. Rather than doing things a certain way because they have traditionally been done that way, this new paradigm is one in which decisions are described as data-driven and evidence-based. What does evidence-based decision making look like? Howard, McMillen, and Pollio (2003) described it in the following way:

> Education supporting evidence-based practice should foster greater appreciation for the role scientific findings can play in enhancing professional practice; provide the general knowledge and skills needed to select, evaluate, and apply the best supported interventions; and help student practitioners learn to successfully cope with the many information needs that will arise throughout their practice as they confront diverse practice problems on a regular basis. (pp. 239–240)

It is worth noting that Howard et al.'s description is meant for social workers, but is applicable for educational leaders who wish to initiate change through learning communities as well. Learning communities require collaboration. Earl (2009) described this collaboration as "collaboration where relationships are challenging, focus on substantive issues, problem identification and problem-solving that goes beyond what is known" (p. 50). An interesting adjective used by Earl is challenging. If collaboration were dealing with easy issues, it wouldn't be necessary. Collaboration in the learning community is meant for difficult issues, and therefore leaders should not be afraid to engage stakeholders in dealing with them.

One of the benefits of learning communities is that they provide a way for leaders to affect change through groups. Before going much further in talking about initiating change in learning organizations, it is worth mentioning that scholars recognize distinctions between levels

of change. These types of change are labeled first order change, second order change, and third order change. Hall (2011) described first order change as that which "is likely to be characterized by incremental, routinized, satisfying behavior" (p. 657). Organizations initiating first order change are making what would be considered by most stakeholders within the organization to be slight modifications to the organizational structure.

Of course it is worth noting that what may be small to some, might be significant to others. Incorrect identification of change type is not uncommon. An interesting study conducted by marriage and family therapists revealed this much. Davey, Duncan, Kissil, Davey, and Fish (2011) designed a study in which the goal was to have experts in the field of Marriage and Family Therapy come to a consensus as it related to second-order change concepts. They wrote, "only 3 out of 16 items were agreed upon by our final panel of 21 experts…there seems to be no shared meaning in the field regarding its definition as there are different conceptualizations of what it looks like" (p. 109). Keep in mind these are trained professionals who showed unpredictability in distinguishing first order change and second order change. Certainly this shows potential for disagreements and miscues in the educational setting as well.

It is then quite possible that a leader wishing to make a first order change is in fact making a second order change. Hall (2011) stated, "second order change is characterized by the selection of new policy instruments and techniques and policy settings due to previous policy experience but the overarching policy goals remain the same" (p. 657). Second order changes are naturally met with more resistance than first order changes. What if a leader wants to overhaul the organization completely? This initiative falls into another change category.

The third, and most difficult, type of change described by Hall is third-order change. Hall (2011) wrote, "third-order change, or a policy paradigm shift, takes place when the new

goal hierarchy is adopted by policy makers because the coherence of existing policy paradigm(s) has been undermined" (p. 657). Though uncomfortable at times, extreme measures are often necessary.

Educational leaders speak openly about needing to get everyone on the same page. Raines (2004) wrote,

> Shared vision is a discipline for bringing into alignment the vision and efforts of people organization-wide. The principle of shared vision leverages the most productive usage of capital, technology, and human capital since resources are coordinated toward the same ends. Processes, job functions, system-wide problem solving, and so forth, flow in a common direction. (p. 2)

In education, establishing professional learning communities does not guarantee positive results. Principals today are charged with the task of producing results utilizing evidence-based practice.

Evidence-Based Practice

Evidence-based practice is a term that educators routinely throw around in today's data-driven culture, but it is often hard to define. Slocum, Spencer, and Detrich (2012) stated that evidence-based practice be composed of what they refer to as best available evidence. They claimed there to be three complimentary approaches to identifying best available evidence. These include "conducting systematic reviews to identify empirically supported treatments, using methods other than systematic reviews to summarize evidence, and considering research on treatments that are not multi-component packages" (p. 153). Not all data are created equal. Wendt and Miller (2012) supported these claims by calling on users of evidence based practice to "consider published empirical support for item construction and validity" (p. 264). By

studying credible data, organizational leaders can make better informed decisions to improve the organization. Earl (2009) wrote the following concerning evidence-based practice:

> School leaders can take charge of change and use data as a powerful tool for making wise and timely decisions that are consistent with the exigencies of their local contexts and responsive to their unique perspectives, not by slavishly applying external standards to their work, or by plotting to ensure that they meet their targets. Rather, they can create their own future through careful planning, honest appraisal, and professional learning, always focused on improved conditions for teaching and learning, as a way of being. (p. 43)

Program evaluation is a formative process. Zachary (2000) wrote, "evaluating progress regularly helps maintain momentum, keeps learning goals at the forefront of the relationship, and holds partners accountable for achieving the goals" (p. 128). Without really thinking about what constitutes evidence based decision making, it might be easy for one to quickly analyze a data set, implement an intervention, and expect positive results. Strain and Barton (2012) warned that this is not necessarily the case when they wrote:

> Choosing an intervention with prior data on effectiveness does not ensure effectiveness in the present, individual case. Simply put, no psycho-educational treatment is known to be universally effective and no psycho-educational treatment is known to be universally acceptable either. Ensuring effectiveness and acceptability of practices and outcomes requires extent data collections. (p. 197)

Choosing evidence based practices to implement that are data saturated and research based seems like common sense, but is not always an easy task. How does one determine evidence based practices that are grounded in quality research? Wendt and Miller (2012)

suggested using appraisal tools "to assess the methodological quality of experimental studies…to identify the most rigorous research suitable for evidence-based decision making" (p. 235). Other researchers though, warned to be cautious of unique environmental circumstances. Gardner, Spencer, Boelter, Dubard, and Jennett (2012) wrote, "A downside also exists when defining the scope of evidence too narrowly. In many areas the literature base is limited by too few high quality studies. Even when there is an extensive research base the studies may not include the dimensions that match the local circumstances" (p. 326).

Ultimately, the decision to use data to drive decisions lies in the hands of organizational leaders. It is the responsibility of these leaders to use sound judgment as to how they use data to drive the instruction. Cooper, Sureau, and Coffin (2009) wrote, "data in education will never end discussion or controversy; but they can open doors to new ideas, and give some feedback on new programs-in a quasi-experimental, limited scientific manner" (p. 389).

So how does one begin to utilize evidence based practice? Cooper, Sureau, and Coffin (2009) identified five recommendations to keep in mind in regards to the decision making process that fall under the evidence-based practice umbrella. These include considering both methods and results, encouraging good research, making connections, avoiding partisanship but recognizing the importance of politics in education decision making, and studying policies in relationship to each other (p. 393).

The first recommendation made by Cooper, Sureau, and Coffin (2009) was to consider both methods and results. They wrote that policy makers "should avoid quick over-simplification of methods and findings, and consider not only the results but also the variety of methods used to learn about certain data at all levels" (p. 393). This suggestion would seem to address the concerns of those who feel data driven decision-making is based solely on numbers.

The implication from this suggestion is that educators find a way to constantly assess what they are doing along the way. This is reminiscent of the idea of formative assessment in education. Hoole (2005) wrote the following concerning assessment:

> Assessment works best when it is ongoing rather than episodic. While United Way organizations try to focus agencies on developing and using outcome information for ongoing program improvement, too often agencies undertake outcome assessment to fulfill funding requirements and do not continue the efforts or translate the results into program improvement. Many times, organizations receive foundation or government funding to undertake a short-tem program with outcome assessment requirements. Often, an organization has several such programs and diligently assesses them, but the assessment process does not become part of the mainstream of the organization's culture. (p. 5)

Considering data collection methods along the way allows educators to assess programs that can become engrained in the learning organization. Knowing the best means to collect the data comes with practice, and an understanding of good research.

The second recommendation given by Cooper, Sureau, and Coffin (2009) was the idea of encouraging good research. They wrote, "models do exist for tracking the effects of policies over a period of time, for comparing different treatments and programs to determine their effects, and involving teachers and students in assessing their own experience in school" (p. 393). Simply put, if an organization is fortunate enough to have leadership that is aware of what the research says to do in place, then the leaders should strive to put research into practice.

There is research that exists that suggests principals allow their personal knowledge, experiences, and beliefs to guide their decision-making practices. Carlyon and Fisher (2012)

demonstrated this to be the case in a study they did in which they wanted to examine principal reasoning for having teachers teach specific classes. They wrote, "This study revealed that tacit knowledge is central to guiding a principal's decision making in relation to teacher class placement. Personal experience is shaped on only by the number of years as a principal but also by the varied experiences principals have within different schools" (p. 79). If knowledge does indeed drive the decision making processes, and thus the practices of those within the educational organization, it is vitally important that the principal be grounded in research based best practices.

The third recommendation given by Cooper, Sureau, and Coffin (2009) was the idea of making connections (p. 393). It is important for policy makers to look at causal relationships, and consider the impact factors, such as legislation, can have on all three levels of school. For example, consider the effect the federal law, No Child Left Behind, had on local school systems. A common criticism of No Child Left Behind is that the law put pressure on educational leaders to emphasize certain subjects for which they are held accountable. The assumption then is that subjects such as art, foreign languages, music, and physical education are neglected. Ringwalt, Hanley, Ennett, Vincus, Bowling, Haws, and Rohrbach (2011) wrote that although little empirical research exists that proves whether or not this cause and effect relationship is true, "a study of NCLB's effects in Chicago Public Schools, published in 2003, found that the resources devoted to non-tested material seemed to be decreasing over time"(p. 266). Whether or not this is truly the case, it is worth considering, and provides a real world example of how the actions of the national government can have a trickle down effect which impacts the local school system. The chart below shows a connection between federal state, and local government.

Figure 2. A causal chart showing connections between federal, state, and local government

The fourth recommendation from Cooper, Sureau, and Coffin (2009) was to stay unbiased while having the ability to be aware of politics in education. They wrote, "Whenever resources and values are being allocated, politics will appear. So decision makers should resist the temptation to ignore the research of others who might contradict them" (p. 393). Schools are political organizations. Bolman and Deal (2002) identified two primary reasons for schools being political organizations when they wrote, "The first is they are inevitably coalitions of different individuals and groups with enduring differences in background, beliefs, and agendas…The second essential feature is scarce resources" (p. 51). Regarding the first reason given, one has to be able to recognize and accept the fact that people are different. This is where being an effective educational leader comes into play. One must possess an ability to get stakeholders within the organization to buy in to ideas, policies, and procedures. Inevitably however, the first essential feature, compounded with the second feature of scarce resources brings a rise in conflict. Bolman and Deal (2002) identified five strategies for effective politicians. These included: clarifying your agenda, building relationships and alliances, soothing in place and learning from the opposition, dealing with differences, and negotiating

(p. 53). Clarifying your agenda can be as simple as communicating the vision and mission of your organization. Consider this a list of directions to get from point A to point B.

Building relationships and alliances with important people within the organization can help to counteract any rebellion by those whose differences with you are too great to work out. Soothing and learning from the competition can lead to opposition buying in to your point of view, or at least help them understand that you are coming from a place of caring. Dealing openly with differences allows problems to be addressed right away rather than fester and blow up into something larger later. Finally negotiating is an art that many educational leaders fail to master. Bolman and Deal (2002) wrote, "When you know what you and other key players want, you're ready to talk about options and possibilities for win-win solutions" (p. 53).

The final recommendation from Cooper, Sureau, and Coffin (2009) was to be a student of policies. They wrote, "Often, research and policies need to look at a cluster of qualities-which are more powerful and effective together, where it is not easy to isolate and measure the effects of one variable alone" (p. 394). The consequences of incorrectly identifying factors tied to student achievement can be quite detrimental to the educational process. Kowalski, Lasley, and Mahoney (2008) cited ambiguity as one of the primary culprits for frustrated educational leaders who are unable to accomplish their task. They wrote the following concerning ambiguity within the education organization:

> Ambiguity has been produced primarily by philosophical dissonance. Some elements of society, for instance, believe that the primary mission of public schools is preparing students for the workforce. Others believe that it is preparing good citizens. And still others believe it is preparing students for college. As a result, educators are often unclear about their primary objectives and the preferred strategies for achieving them. (p. 39)

Ambiguity makes the task of getting all stakeholders on the same page and achieving but in a difficult, if not altogether impossible task. Ambiguity does not just impact teachers, principals and parents. Students are the ones perhaps most impacted by ambiguity. Research shows that often times, students demonstrate confusion as to the purpose of assessments and school in general.

Graser, Sampson, Pennington, and Prusak (2011) conducted a study measuring the perceptions of middle school students regarding the purpose of an implemented fitness program in their physical education class. While students who showed understanding of the purpose of the fitness test tended to perform well and have a positive outlook, "students who misunderstood the intended purpose of fitness testing may feel dissatisfied following the testing experience" (p. 185). The researchers were also able to tie these perceptions of testing to their perceptions of overall health as well. The implication here is that perception data are important as to help clarify goals within the learning organization. Following these suggestions for evidence based decision-making can lead to best practices being implemented within the learning community. Therefore, it is important to be able to define a learning community.

Characteristics of Learning Communities

Levine and Shapiro (1999), co-authors of the book *Creating Learning Communities*, stated that learning communities in schools all share the following characteristics: being organized into smaller groups within organization, integration of curriculum, establishment of support networks, bringing people together in meaningful ways, focusing on learning outcomes, community based involvement, and continuous self-assessment. (p.3). They wrote:

> These characteristics-or essential elements-create an integrated teaching and learning experience for participants in learning communities. But regardless of the definition on

> which the foundation of a learning community initiative is based, learning communities are defined by the participants: those who put them together, those who live and learn in them, and those who mentor and teach in them. (p. 6)

It is important to note that data driven decision making is more than just numbers. Morrisey (2010) discussed the importance of using qualitative data in conjunction with quantitative data. He wrote that people who do not do the research themselves will often ignore numbers because they have no personal connection to them (p. 289). Deciding to use data does not guarantee success. Research has shown that data illiteracy is a real concern for many professionals, including educators. McAlevey and Sullivan (2009) wrote that "Today, as never before, society lives in a stream of statistical information. Consequently, there is a need for increased numeracy and, in particular, what could be termed statistical literacy…Without statistical literacy, correct policy and decisions often cannot be made in the face of uncertainly" (p. 911).

Seifer (2009) discussed methods by which adults can become statistically literate when he wrote, "The major path is self-instruction, with few good resources available. The main goal of statistical presentation, from the perspectives of both the producers and consumers of statistics, should be to make information transparent" (p. 7). For educators, this requires understanding the types of data that are important and available to them. Cooper, Sureau, and Coffin (2009) wrote, "The key to school improvement is making data available, useful, and long-term, so that decision makers can track progress and change, using common measures and outcomes" (p. 385). One of the keys to effective data driven decision making is making sure data are useful, and that key data do not go unchecked. Because of this, organizational leaders must be aware of various types of data.

The Four Types of Data

According to Bernhard (2004), there are four types of data that can be analyzed by educational leaders. Types of data include perception data, demographic data, process data, and student learning data. What follows are examples of each type of data, and how scholars have utilized this data to reach conclusions which could in turn be used to drive decisions in the classroom.

The first type identified by Bernhard is perhaps the most common type of data used everyday in schools. This type is referred to as student-learning data. Bernhard (2004) wrote, "Student learning data include a variety of measurements – norm-referenced tests, standards assessments, teacher-assigned grades, and authentic assessments – that show the impact of your education system on your students" (p. 26).

With transparency and accountability weighing on educational leaders now more than ever, the call for them to do something to improve results has administrators scrambling to make decisions to improve student achievement. Practical examples of using student-learning data to drive decisions include focusing on what will be taught, and how students will best learn this material. For example, a principal who finds his or her students are below state average on a reading test might require all content area teachers to document the implementation of reading into their specific areas.

Student learning data is utilized in even the lowest performing schools. Other types of data exist, and are readily accessible. One example that comes to mind is data that describe the population of the school. The second type of data identified by Bernhardt was demographic data. In defining this data, Bernhardt (2004) stated that:

> Demographic data describe the students, the school's staff, the school, and the surrounding community. This information delineates the context in which the school operates and is crucial for understanding all other data. By disaggregating information by demographics (for example, by gender of ethnicity), you can understand what impact the education system is having on different groups of students. (p. 26)

Demographic data is perhaps the most common type of data seen in schools today. With the click of a mouse, it is easy to get an idea of the racial and gender makeup of local schools, and what languages are spoken within the homes. Income level can give the most novice of researchers an idea of how the school is doing financially. But how does one use demographic data to make decisions?

Perhaps the best example lies with demographers who used demographic data to drive major decisions. Yi, Vaupel, and Zhenglian (1998) conducted a study as to how changes in demographic data could be used to project household structures in the United States. Using demographic data available to them, they were able to create a model to help them attribute household size to demographics such as fertility rate, marriage rate, and divorce rate (p. 80). Similarly, educational leaders can focus on demographic data for building plans, as well as combining it with other types of data to determine whether or not gaps exist in specific demographics.

The third type of data is process data. Bernhardt (2004) described process data as "data school's programs, instructional strategies, assessment strategies, and classroom practices. Keeping track of these processes through careful documentation helps you build a continuum of learning for all students" (p. 27). Process data can be described as the tracking of solution effectiveness that comes about as a result of evidence based program implementation. Much of

the process data usage comes from the central office level, although empirical studies have shown multiple ways that data can be processed. One example can be seen through an empirical study on the overall status of implementation of an intervention known as Response to Intervention (RTI).

The core of the RTI initiative is the idea that at the first sign of student struggles, educators can intervene and implement evidence based strategies to help get students back on track. Greenwood, et al. (2011) discussed why educational leaders might implement RTI:

> The potential benefit of RTI in early education is the ability to provide key social-emotional and early literacy experiences for those children who lack these experiences and the key skills to prevent the need for special education services for language, literacy, and behavior disorders, particularly for this population of children with experiential deficits. (p. 2)

Through data analysis, educational leaders can judge which RTI strategies are most effective and appropriate for their educational setting.

The fourth type of data identified by Bernhardt is perception data. Simply put, perception data can be described as the mental models stakeholders have about the educational environment. Bernhardt (2004) wrote that you must understand how a group thinks to change what they believe (p. 26). Perception data, like other forms of data are quite a broad term that can lead to multiple decisions being made by educational leaders. If used correctly, perception data give a voice to all stakeholders within the organization. Whether leaders choose to utilize surveys, interviews, or other forms of formal and informal methods, perception data can be a powerful tool for instilling change within the organization.

In the study conducted by Danhauer, et al. (2012) researchers were able to measure students' perceptions of their well-being in relation to listening devices. Previous studies had shown that devices such as iPods were causing hearing loss in high school students. The researchers hypothesized that most high school students perceived the listening devices to be safe, and certainly no danger to their hearing. Through a survey administered to students, the researchers concluded that "most of the students needed education about hearing health, the warning signs of hearing loss, and how to prevent hearing loss" (p. 14). Using the same survey, they also concluded that the perceptions did not match the reality about safe iPod use. They cited the following statistics that students were unaware of:

(a) people who have preexisting hearing loss still need to worry about future hazardous noise levels (29%)

(b) hearing loss caused by noise can be prevented (11%)

(c) using cotton in the ears does not protect people from hearing loss due to loud noises (60%)

(d) ringing in the ears is a warning sign for over-exposure to potentially hazardous sounds (32%) (p. 17).

This survey and its' results serve as one example of how perception data can be used to make decisions as it relates to what is taught in the classroom.

Perception data are not strictly tied to curriculum however. Take the safety of students for example. Research has shown that school climate is directly tied to the feelings and perceptions of students as they relate to safety. Raskauskas (as cited in Sbarbaro & Smith, 2011) argued that "students who bully reported feeling less and less comfortable at school, revealing a correlation between connectedness to school and bullying. A teacher's stance on bullying

attributes to school climate, as well if they are against bullying" (p. 141). By using student perception data, one can determine the level of safety that students feel at school, and can use this data in conjunction with other data to drive toward decisions.

It is important to not that often times, the end result after determining perceptions, is to initiate changes to alter perceptions. Hong and Eamon (2011) conducted a study showing a correlation between student perceptions of dangerous neighborhoods and dangerous schools. To counter these perceptions, they wrote, "Our study suggests that intervening at the family, school, and neighborhood levels can increase students' perceptions of safer school environments. Enhancing these perceptions in turn will likely promote students' psychological, social, and academic well-being" (p. 436). Perception data are perhaps the most important type of data because perception impacts actions. For example, if educational leaders want parents more involved, they must do something to make sure the perception of the parents' is one that would lend itself to parental involvement. Perhaps student effort is driven by their perception of teachers' expectations or opinions. The possibilities are endless, but the implications are enormous. One cannot fully express the importance perception plays in the classroom. Teachers oftentimes center their instruction on how they perceive learning to take place. Brophy and Good (as cited in Hardre, Davis, & Sullivan, 2007) wrote that "teachers can promote or reduce students' motivation, both in their design of classroom learning environments and in their direct interactions with students" (p. 157).

Research has shown that student perception is directly and indirectly linked with motivation. In a study conducted by Sungar and Senler (2010), they concluded the following:

> If they are experiencing threatening learning environments, which focus on behavioral management and competition rather than individual progress and competence, their basic

needs will be less likely to be satisfied effectively, resulting in controlled motivation. Indeed, in the present study, perceived threat was found to be positively linked to controlled motivation and negatively linked to autonomous motivation. (p. 321)

Friedel et al. (2012) showed the interconnectedness between perception and production between students when they wrote:

> Studies have shown more specifically that when teachers are perceived as focusing on performance, their students' sense of self-efficacy and orientations toward mastering content decline. But when students perceive that their teachers emphasize mastery, their perceptions of self-efficacy increase, which, in turn, increases the students' mastery goal orientation as cited in Mesa. (p. 48)

If aspects of learning, such as curriculum and instruction are driven by perception, it is certainly worth trying to understand ways to gather and make sense of perception data. No type of data can stand alone. Bernhardt (2004) wrote,

> A rich, complex picture of a school emerges from the intersection of all four categories of data, such as a comparison of state test scores-disaggregated by program, gender, and grade level. These intersections allow you to answer questions such as: Are there differences in achievement scores for eighth-grade girls and boys who report that they like school, by the type of program and grade level which they enrolled" (p. 29).

Intersecting the data gives a more complete picture to the educational leader of what he or she is working with. Bernhardt further wrote:

> When student-learning measures are the only focus of a school's data analysis efforts, school personnel end up using their time figuring out how to look better on the student-learning measures. This narrow approach has limited results. By contrast, looking at

> student achievement results in conjunction with the context of the school and the processes that create the results gives teachers and administrators important information about what they need to do to improve learning for all students (p. 30)

While data bases are perhaps by their very definition evidence, evidence based decision making is more than one person making decisions from a set of scores or responses. Evidence based decision making is communal in nature, and therefore a democratic environment is needed to maximize data usage. Enter the concept of the data room. Kensler, Reames, Murray, and Patrick (2011) described the data room in this way:

> The data room may be a designated space or physical location within a school where much of the thinking and interaction occurs. The work in the data room is intended to move beyond the room and influence teaching practices throughout the high schools, thus expanding the community of practice beyond the leadership team and physical space. (p. 33)

Data rooms allow for educators to have an area in which they can share their voices in the decision making process. In the data room, educational leadership teams ask and try to answer questions while being guided by the data. If utilized correctly, the data room provides for educators to become involved in the decision making process as engaged, learning stakeholders. One is reminded of Costa and Marzano (1987) who wrote that "by asking questions, selecting terms, clarifying ideas and processes, providing data, and withholding value judgments, teachers can stimulate and enhance the thinking of their students" (p. 33). Data rooms provide a way for educators to reengage in the learning and decision making process, and become involved in true learning communities where evidence based practice can occur. It is important to note that the mere establishment of data systems is inadequate. Wayman and Cho (2009) wrote that support

systems must also be in place for the studying of data to pay off (p. 103). With an understanding of learning communities, or communities of practice, it is appropriate to consider what constitutes evidence based practice.

Shared Decision Making

A study conducted by Park and Datnow (2009) showed that the most obvious quality educational leaders who practiced data driven decision making possessed was a shared activity. They wrote:

> Our findings indicate that data-driven decision-making is co-constructed by multiple actors at both the school and district level. First, leaders at all levels constructed the vision and implementation of productive data-driven decision-making. Leaders, both informal and formal, played a pivotal role by helping to positively frame the purpose of using data. They did so by focusing on creating an ethos of learning and continuous improvement rather than blame. Second, in order to give data relevancy, leaders also distributed decision-making authority in a manner that empowered different staff members to utilize their expertise. (p. 491)

The findings of Park and Datnow resembled principles of the learning community, and brought up questions dealing with leadership style. If we marry the two issues, the question becomes this: What type of leadership style best lends itself to fostering a learning community where evidence based decision-making can take place?

Park and Datnow suggested that a distributive leadership style best lends itself toward a world where data-driven decisions are to be made. Zepke (2007) found distributive leadership, in which responsibilities are shared by many stakeholders to be appropriate, but cautions that we must question the concept of accountability if it is to really work (p. 313). Other researchers

have written on the importance of instructional leaders adopting a distributive leadership style as well. Helterbran (2010) wrote, "The principal, to be fully effective, must understand the importance and benefit of sharing leadership for without this understanding to support and foster teacher leadership, little good will come" (p. 346). This idea that an educational leader cannot be effective alone is a recurring theme throughout literature.

Similar to distributive leadership is the concept of inclusive leadership, a style advocated by Dorzak (2011). He stated that inclusive leadership "is seen as a process of development of distributed power (not empowerment seen as the result of action controlled by the leader but developed by empowerment) (p. 48). Inclusive leadership results in a democratic community. Kensler, Caskie, Barber, and White (2009) defined democratic community as "a school community where democratic principles operate at the personal, interpersonal, and organizational levels" (p. 701). This concept of distributed power for school improvement can be found in other empirical studies as well. Hofman, Hofman, and Guldemond (2001) wrote, "Findings show that secondary schools in which school staff and other school parties exert a relatively great influence on school board policy are more effective than other schools" (p. 133). Zachary (2004) wrote, "Leaders who demonstrate personal commitment rally others around the commitment. Leaders must encourage and invite participation by inspiring a shared vision of what is possible through mentoring" (p. 183). Instilling leadership in teachers requires deliberate motivational techniques on the part of the principal. Helterbran (2010) wrote,

> Teacher leadership is typically not compensated leadership and certainly generates more work for a teacher…Therefore, teacher leadership capacity in any school building as a melding of support and encouragement by the principal and the willingness of teachers to impact their own professional vocation. (p. 366)

It is the responsibility of the educational leader to provide the teacher with intrinsic motivation to assist in leading.

Evidence-based practice has not been universally accepted by educators and administrators. Kowalski (2009) wrote that many critics of the No Child Left Behind Act of 2001 have cited unrealistic expectations and demands associated with the results of data analysis (p. 1). It is possible that state mandates such as No Child Left Behind take away the ability of teachers to make judgments about best practices for their students in the name of data. Cooper, Sureau, and Coffin (2009) wrote, "The key role of data is not to end discussion or debate, but is a force to foster new ideas and provide information for reaching decisions" (p. 389). Shared decision-making will not just take place naturally. It requires diligent effort, and practical methods that foster learning communities. Systems thinking tools are a practical way to help increase evidence based decision-making in the learning community.

Establishing Learning Communities: The Introduction and Implementation of Systems Thinking Tools

Author Peter Senge identified what he called the five disciplines, which he identified to be at the core of his learning organization model. These five disciplines include personal mastery, mental models, shared vision, team learning and systems thinking. Senge (1994) described personal mastery as "learning to expand our personal capacity to create the results we most desire, and creating an organizational environment which encourages all members to develop themselves towards the goals and purposes they choose" (p. 6). Personal mastery simply means to become experts at our chosen field.

Applying personal mastery is an ongoing task. Raines (2004) wrote,

> Applying personal mastery in a holistic way means approaching one's life as a creative work, living from a creative and generative viewpoint. It involves an ongoing dual process of clarifying what's important, and continually learning how to assess current reality in relation to progressing toward that vision. (p. 5)

Personal mastery is assessed through continuous communication between educational leaders and teachers; and utilizing systems thinking tools provides a forum for these discussions. Raines (2004) offered the following questions to effectively gage personal mastery:

- How can you increase your value to the organization?
- What are your short-term and long-term goals?
- What will prevent you from accomplishing these goals?
- What qualifies you to accomplish these goals?
- How can you help us better service our stakeholders?
- As your leader, what can I do to help you?
- In what ways can I identify you need help?
- How can we best deliver feedback to you?

Any interactive dialogue that causes self-reflection will help to stimulate personal mastery (p. 5).

The second discipline is mental models. Senge defined mental models as "reflecting upon, continually clarifying, and improving our internal pictures of the world, and seeing how they shape our actions and decisions" (p. 6). Mental models are how we view the world and each other. These models, which everyone possesses, are constantly evolving, and can be greatly influenced by outside forces such as systems thinking. Raines (2004) wrote, "the discipline of mental models involves discerning the actual data that supports or doesn't the many generalizations we have about the world. If our mental models are not based on real data, then

those assumptions limit our ability to read the environment accurately" (p. 3). Using data to shape our mental models makes us smarter thinkers. The implications of this are huge.

The third discipline identified by Senge to create a learning organization is shared vision. He described shared vision as "building a sense of commitment in a group, by developing shared images of the future we seek to create, and the principles and guiding practices by which we hope to get there" (p. 6). Exercises that stimulate active listening are critical if we are to establish a shared vision. Educational leaders can utilize data rooms to open the eyes of teachers, and help change preconceived notions that faculty may have about the students they serve. Raines (2004) wrote, "The careful deconstruction of those assumptions will allow dialogue and learning to continue, and lessons about safety to be reinforced. It is a slower process, but one that leads to a deeper understanding and alignment between people" (p. 3). By putting data out in front of teachers, and talking about the implications of the data, we experience a paradigm shift, and our mental models come in to focus, and the end result is a shared vision. Raines (2004) suggested that once the vision is established, it is important for the organization to cherish that vision, and pass it on to future stakeholders if it is to be maintained (p. 3).

The fourth discipline identified by Senge is team learning. Senge defined this as "transforming conversational and collective thinking skills, so that groups of people can reliably develop intelligence and ability greater than the sum of individual members' talents" (p. 6). Everyone has unique perspectives to offer, and members of a learning organization can learn from each other. Research has shown that leaders are far more likely to reach appropriate solutions to problems through a team approach, because groups are made up of individuals with unique mental models that have been shaped by their world experiences. Simply put, no one

person has experienced everything, so teamwork is clearly a critical aspect of developing learning communities.

The fifth discipline, and the heart of this study, is systems thinking. Systems thinking was defined by Senge as "a way of thinking about, and a language for describing and understanding, the forces and interrelationships that shape the behavior of systems. This discipline helps us to see how to change systems more effectively, and to act more in tune with the larger processes of the natural and economic world" (p. 7). Systems thinking is so unique that it is like a different language. It is a mental language that impacts our understanding of the world around us. If valued, systems thinking will change the way you view every part of your life, and thus the organizations to which you belong.

Senge (1994) provided a few warning in regards to expectations to learning organizations wishing to implement systems thinking. They include the following: There are no right answers. Systems thinking involves asking multiple questions, with the results often being confusing answers with multiple ramifications. Systems thinkers must be able to make the best choice, and be continuously aware of the consequences. The second expectation he addressed is that learning organizations cannot be divided in half. He wrote "as you put together a team, make sure all necessary functions are represented, and gain clearance from top management to propose cross-functional solutions, regardless of sensitivities and politics. No area of the organization can be off-limits or protected" (p. 92). Organizational leaders must thrive to involve all stakeholders in different processes that the organization goes through.

It is quite surprising that there is a lack of research on systems thinking tools given that these concepts are not new. Lazanski (2010) credited the Mayans with being a systems thinking civilization due to the complexity of their calendar (p. 295). This reflects the idea that the

Mayans might have been what Blockley (2010) referred to as "loopy thinkers" (p. 190). He wrote, "Systems thinkers look for connections and feedback and feed forward. Many people tend to think in straight lines-moving from cause to effect" (p. 190).

Prominent systems thinkers have continuously made contributions to the field throughout history. Leon (2008) recognized Edward Deming, Jay Forrester, and Peter Senge as leading systems thinkers. He wrote, "as an expert in statistical control of quality, Dr. Deming found that the variation in the data collected depended mainly on the interdependence between resources and persons through specific processes" (p. 15). Forrester also championed systems thinking. Leon (2008) described Forrester as "the father of Systems Dynamics, which seeks to simulate organizational and social systems with models that are full of complex variables" (p. 15). The current leader and researcher in the area of systems thinking is Peter Senge. Leon (2008) wrote that Senge "promotes systems thinking as the main capability to attain fundamental solutions to the problems of all kinds of organizations, as well as to design strategies that facilitate the creation of the futures desired by a group of people" (p. 15).

Senge (2010) warned against time delays when implementing systems thinking practices as well. Time delays can be balanced with continuous monitoring and assessment of the learning organization. He cautioned against taking the easy way out in regards to providing solutions to problem. He wrote the following:

> Most people prefer to intervene in a system at the level of rules, physical structure, work processes, material and information flows, reward systems, and control mechanisms-where the elements are more visible and it requires less skill to work with them. But as you move toward the more intangible elements, such as people's deep-seated attitudes and beliefs, your leverage for effective change increases. You come

closer to looking at the underlying reasons why the rules, physical structure, and work processes take their current form. (p. 93)

There might be a tendency to stay away from sensitive issues, but if educational leaders are willing to tackle the things people care about head on, the potential for effective change is influenced in a positive way. Senge (1994) also warned of a performance dip that occurs almost without fail when implementing new processes that come about as a result of systems thinking tools. People are generally resistant to change, and the leadership team must remain aware of the challenges they will face along the way in regards to resistance (p. 93–94). The implication is that learning communities must be patient, and believe in the decisions they make while actions work themselves out.

Specific Learning Tools

Perhaps the most popular learning tool is Peter Senge's iceberg model. Senge (2009) wrote that the purpose of the iceberg model is to "consider a serious problem and thus introduce yourself to the practice of systems thinking" (p. 80). There are four steps in Senge's iceberg model. The first step is to identify the event, which the learning organization wants to address. Step two is to look at patterns and trends that happened around the time the event occurred. Senge wrote that "looking at patterns of behavior is often depressing; they make it seem as if fate is inexorable. No matter what you do, you'll fall into that pattern. But that is based on the false assumption that history will repeat itself" (p. 82).

To dig deeper and make sure problems do not continue to repeat themselves, one must next look at the systematic structure. Senge defined systematic structure in the following way:

A set of unrelated factors that interact, even though they might be widely separated in time and place, and even though their relationships may be difficult to recognize. When

> studied, these structures reveal the points of greatest leverage…These are not necessarily the points of highest authority; they are the places where the ingrained channels of cause and effect are most susceptible to influence. (p. 82)

Step four is to examine the mental models of those within the system. If the iceberg is to be a successful systems tool, learning organizations must be able to identify mental models and bring them up for discussion. Senge stated that systems thinking is not an idea that comes naturally, and he attributes this to the human tendency to think and act in linear ways. The problem with this way of thinking is that learning organizations are circular organizations, and factors within that organization directly and indirectly impact one another.

Meadows (2008) would likely add in a fifth step to the iceberg model. Concerning mental models, she wrote that it is important to "Expose your mental models to the light of day" (p. 172). She explained this in the following way:

> Get your model out where it can be viewed. Invite others to challenge your assumptions and add their own. Instead of becoming a champion for one possible explanation or hypothesis or model, collect as many as possible. Consider all for them to be plausible until you find some evidence that causes you to rule one out. That way you will be emotionally able to see the evidence that rules out an assumption that may become entangled with your own identity. Getting models out into the light of day, making them as rigorous as possible, testing them against evidence, and being willing to scuttle them if they are no longer supported is nothing more than practicing the scientific method. (p. 172)

Figure 3. Senge's Iceberg Model modified from Senge, et al. (2000a, 2000b, p. 80).

One systems tool that shows interworking relationships between factors within an organization is a causal loop diagram. Like the iceberg model, Senge suggested some general steps for creating causal loop diagrams. Step one involves starting with a variable. Senge (2009) wrote that this is "a noun describing some element that you know is involved in the system. Then ask: What are the other elements that affect that variable?" (p. 87). After the loops are created, they can be used as a starting point to talk about problems within the learning organization.

Although causal loop diagrams are effective, they are in and of themselves insufficient. Senge (2009) wrote,

> A causal loop that shows student population growth might show that investment in school activities leads to more students moving in. But how much investment is necessary

> before the school system crosses a threshold of attractiveness?... To predict or anticipate a system's behavior in the future, you must look at the situation with more precision" (p. 89).

A system learning tool hat helps to accomplish this task is a stock-and-flow chart. Senge wrote:

> A stock-and-flow diagram translates any sort of situation–even the most qualitative, immeasurable situation–into five different kinds of mathematical entities. These include: stock, which is the quantity, flow, the rates in which numbers flow into or out of our stock, a converter, which are outside forces that impact stocks and flows, a connector, which are connectors that define interrelationships within a sock flow chart, and a cloud, which represent outside forces and the origin of the flow. Developing a stock-and-flow diagram creates a model of the situation at hand–a model that can be programmed on a computer and tested against experience until you feel it is robust" (p. 90).

Another useful systems thinking tool is the behavior-over-time graph. Meadows (2009) wrote, about the importance of using behavior over time graphs to chart significant events over a period of time (p. 20). Charting events on behavior-over-time graphs provides a visual element and makes patterns clear. The ideal result is conversation within the learning organization as to the factors that cause the trends that are clearly visible.

Perhaps the greatest attribute of systems thinking tools is the fact that many of the tools are used to determine causation. Causation, as mentioned earlier, can be directly tied to perception. Consider the causal loop diagram (see Figure 3). A professional learning organization utilizes systems thinking tools. If utilized properly, systems thinking tools can be used to identify appropriate causation, and the result will then be appropriate perception of the

learning organization. Perception in turn will drive the action of stakeholders within the organization (Grazer, Sampson, Pennington, & Prusak 2011). From here, the old adage of success breeding success takes over, as stakeholders within the learning organization see problems addressed. A culture of systems thinking within the learning organization develops.

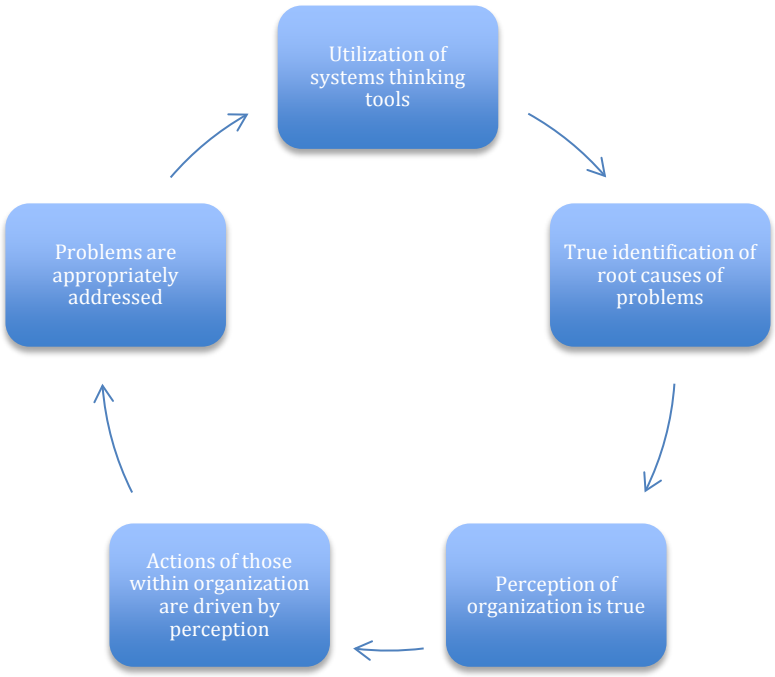

Figure 4. Causal Loop Diagram Showing Potential Impact of Utilizing Systems Thinking Tools

So far, it is evident that systems thinking can be used within learning organizations, so the focus then has to be defining schools as learning organizations. Senge (as cited in O'neil, 2005) described schools as learning organizations in the following way:

> I've seen really significant innovations that have endured; they've usually grown out of people from these multiple constituencies working together. It's been a few committed teachers with some bright ideas, in concert with a principal who has a particular view of her or his job, in concert with a superintendent who is in line with that principal, and in

concert with people in the community who are very much part of the innovation process. (p. 21)

Even in defining the school as a learning organization, it is clear that the order or hierarchy is very process-oriented, each stakeholder depended on the other for success. To this end, it is important to consider the interconnectedness of systems. Meadows (2008) wrote, "Systems happen all at once. They are connected not just in one direction, but many directions simultaneously. To discuss them properly, it is necessary somehow to use a language that shares some of the same properties as the phenomena under discussion" (p. 5). While it is important to understand individual systems, it is foolish, if not impossible altogether to try to separate them from other systems.

In conclusion, it is important to consider that children are at the core of education initiatives. As Senge (as cited in Oneil, 1995) wrote, it is crucial that we introduce students to these systems tools and ideas:

> One of the commonalities in our work is a recognition of the deep fragmentation of the educational process, and the belief that too often we fail to capture the imagination and commitment of the learner in a way any real learning process must. We see an enormous need to integrate systems thinking as a foundation for education for kids. So, many of the changes in curriculum and pedagogy involve bringing the systems perspective into the mainstream of education, because people today must be able to make sense of systems, to learn how to use knowledge in ways that cross disciplinary boundaries…Schools need to focus on thinking skills and learning skills, because those are what will prepare kids for a world of increased interdependency and increased change. (p. 22)

Systems thinking tools, evidence based decision making, and professional learning communities are not simply fads in the realm of education. Leaders in multiple disciplines are considering these concepts. These leaders wish to initiate change through organizations, and do so with a culture that cultivates teamwork and values evidence based decision making. Systems thinking tools provide a catalyst for which the goals of professional learning communities can be accomplished. The combination of being able to determine true causation along with the ability to allow data to drive the decision making process is quite powerful. Being able to wrap one's mind around these ideas can lead to ownership within the organization, pride among stakeholders, and achievement of the organizational goals.

Conclusion

Empirical research on systems thinking is not vast. Luckily, principles of systems thinking are grounded in empirical research that is widely explored. These principles include team learning, evidence based decision-making, and professional development among others. Because we know what we know about the principles of systems thinking, systems thinking in and of itself warrants exploration. Systems thinking lends itself to put aspects we know are critical to school improvement to practical use. This study attempted to examine just how that was done.

CHAPTER III. METHODS

Introduction

School improvement is a term that has become the battle cry for school systems across the country. It is a large undertaking, and a few individuals cannot achieve it within the confines of the school building. Leaders at Cornfield High School realized this when they hired Mr. Bluth to move across the county to take a job in their district.

Mr. Bluth, the assistant superintendent over curriculum in the Cornfield School District, introduced systems thinking tools to administrators and teachers at Cornfield High School. Other leaders at Central Office recruited Mr. Bluth to come to Cornfield based on his expertise in systems thinking theory. Leaders told Mr. Bluth that he would be allowed to implement systems thinking throughout the district with no strings attached. The difficult decision to move across the country was an opportunity Mr. Bluth could not pass up. He had seen systems thinking tools work in school, and certainly in businesses, and he knew the value they would provide this new organization.

Systems thinking tools provide a practical and concrete way to involve all stakeholders in taking ownership of an organization, and achieving a team approach. There is not much research that supports how leaders are using systems thinking tools for school improvement. I know there is a link between evidence-based decision-making and school improvement so the question I had to ask was this: How can leaders utilize systems thinking tools for school improvement? This study attempted to answer this question. By conducting a case study in a high school that utilizes

systems thinking tools, I was able to begin to understand the answers to my questions. I addressed the following research questions in this study:

1. How did members of the Cornfield High School leadership team (administrators) report using systems thinking tools?
2. How did teachers of Cornfield High School report using systems thinking tools?
3. What successes did the leadership team relate to the use of systems thinking tools?
4. What successes did the teachers of Cornfield High School relate to the use of systems thinking tools?
5. What possibilities did the leadership team see for future use of system thinking tools?
6. What possibilities did the teachers of Cornfield High School see for future use of systems thinking tools?

It is important to note that this study focused on decisions that impacted school improvement at the school level, as opposed to instructional strategies in the classroom.

Why This Study is Suited to a Qualitative Design

This study clearly focused on an issue in a specific system in that it focused on high school teachers and administrators who were utilizing systems thinking tools. There is very little empirical research on the implementation of systems tools into learning organizations. The school system being study had immersed itself in systems thinking theory. Berg and Lune (2012) wrote "Qualitative researchers, then, are most interested in how humans arrange themselves and their setting and how inhabitants of these setting make sense of their surroundings through symbols, rituals, social structures, social roles" (p. 8). This study allowed

me to examine how individual experiences with systems thinking tools have influenced school improvement within the learning organization. I wanted to design a research project that allowed me to hear what my participants had to say, but also examine the surroundings to empower the data further.

Certainly, I could have conducted a quantitative study to examine how systems thinking tools have impacted a certain aspect of school improvement, such as test scores. However, this does not describe a wide picture of multiple aspects of school improvement. I wanted to know how individuals have experienced school improvement through the utilization of systems thinking tools. As Bernard and Ryan (2010) wrote, "When we reduce people's thoughts, behaviors, emotions, artifacts, and environments to sounds, words, or pictures, the result is qualitative data" (p. 5). Therefore, I decided to conduct a qualitative study that allowed participants to express their thoughts through interviews, observation, and documents. I did not solely take in to account what participants said, but I made notes of participants' attitudes regarding systems thinking. I took pictures that provided visual evidence of stakeholders within Cornfield High School implementing systems thinking theory.

The Specific Methodology Employed

I conducted research within a bounded case of a school where leaders were using distinct techniques for the purpose of school improvement. Creswell (2007) described case study research as "a qualitative approach in which the investigator explores a bounded system or multiple bounded systems over time, through detailed, in-depth data collection involving multiple sources of information, and reports a case description and case-based themes" (p. 73). In this study, the case was a high school located in Missouri. I utilized multiple sources of data including documents, observation, and interviews. Yin (2003) wrote that evidence in a case

study can come from "six sources: documentation, archival records, interviews, direct observations, participant observation, and physical artifacts" (p. 83). This case study included all of these features under categories of documents, interviews, and observation. Stake (1995) wrote "What one does in the field, from gaining access to triangulating data, needs to be guided by the research questions" (p. 50). Every aspect of the method design was guided by my research questions. To help establish credibility, and establish triangulation of data, I also included member checks in this study.

Creswell (2007) identified several procedures for conducting a case study. The first step is to "determine if a case study approach is appropriate to the research problem" (p. 74). I made the decision to use a case study design because it was most conducive to helping to answer the research questions. One of my goals was to understand on a deeper level how systems thinking tools were being used in Cornfield School. I gained this understanding from open-ended questions designed in interviews as opposed to limited survey questions.

Uniqueness of this Study

I designed this study with an understanding of principles of leadership style, change theory, and organizational theory. I did not design the study with one theory in mind. The goal of this study was to expand our understanding of how a specific organization is utilizing these relatively new ideas of systems thinking tools. A second goal was simply to understand the uniqueness of the methods employed by this particular school system. Stake (1995) wrote, "There is an emphasis on uniqueness, and that implies knowledge of others that the case is different from, but the first emphasis is on understanding the case itself" (p. 8). This case was unique in that there were not many schools that intentionally implemented systems thinking tools. This case was purposeful in doing so.

Applying Creswell and Yin's definitions to this project, the study was qualitative in nature, in which I studied a bounded system (Cornfield High School) over a period of four days on site. During this time, interviews with teachers, as well as the high school leadership team took place. I also used documents and reports for analysis purposes, as well as observation in the form of field notes.

Tasks of the Researcher

In case study research, the researcher performs many tasks. The first task completed by the researcher is that of an observer. Berg and Lune (2012) identified four roles played by the researcher: complete participant, participant as an observer, observer as a participant, and complete observer (p. 84). Though I wanted to be as non-disruptive as possible during my visit, my role was more than that of a complete observer. I was conducting and recording interviews, which required interaction with the participants. At the same time, I was not a complete participant, as there was no secret as to my purpose. My role as a researcher in this case was that of an observer who was also a participant. This study involved much more than observation. It involved interviewing, as well as the ability to secure appropriate documents. To play the role of the researcher in this study, I also had to be efficient at data analysis. In case study research, this process began before data collection even took place, so I had to be prepared to make judgments about data as it was obtained. I also had to be knowledgeable about the details of systems thinking tools, which I was. I needed to be able to recognize and understand systems thinking language and application when I witnessed it. I had taken classes, read books, attended conferences, and applied my knowledge of systems thinking into my personal, professional, and scholarly pursuits. Though this case was unique for me in that I had never seen an organization

utilizing systems thinking in a fully immersed way such as this, I certainly understood what I was seeing. I was also able to collect quality data and analyze it because of this understanding.

Disclosure Statement

Systems thinking meant a great deal to me on a personal level. Had it not been for systems thinking, and the ideas of examining one's mental models, my family as I know it would not exist. A few years ago, my wife and I decided to adopt a baby. My mental model of what constituted a successful adoption was a newborn that looked like us. I remember vividly sitting with our social worker and stating that I wanted a baby that looked like us. I used a rationale that growing up adopted would be difficult enough on a child, and that he or she should at least look like his or her parents. That night, my wife and I talked about it. She did not know a great deal about systems thinking, but understood the concept of mental models. She asked me to explain to her what exactly would be wrong with adopting a baby of another race. I gave several excuses that I tried to mask as good intentions. Reality hit me like a ton of bricks, and I realized that my views on adoption did not mesh with my core values of humanity. My mental model of adoption was flawed, and had we never talked about it, I would not be the father of the incredible sixteen-month old boy that is now my son. This was what systems thinking is was all about to me. I found systems thinking to be both life changing on a personal and professional level. My hope was that this study would lead to further examples of how a change in mental models could improve not a single person, but an entire learning organization.

In the classroom, systems thinking helped to make me a better teacher. It allowed me to connect with my students in a way that I had not previously done so. Systems thinking caused me to see the individuality and unique backgrounds my students were coming from, and helped me to understand that I was dealing with different adolescents who were at various stages of

biological, psychological, and social development. Because of this awareness, I was a much more effective teacher in the classroom, and I hope other teachers will be able to say the same thing because of systems thinking.

Since completing the first draft of this dissertation, I have started a new job in educational leadership. This new position has reinforced the value of systems thinking that I hold dear. I work in a very complex organization filled with wonderful and complex individuals, all who have a different perspective. My background with systems thinking has helped me to stay aware of my surroundings, and allowed me to adapt and grow quickly and professionally.

Sampling

Cornfield High School was a public school, grades 9 through 12, serving just under 2,000 students in St. Louis, Missouri. The school had a student to teacher ratio of 21 students per teacher. The school employed 170 faculty and staff, 80 of whom were classroom teachers. Grade 10 had the highest enrollment, while grade 12 had the lowest. Participants in this study included the leadership team made up of four participants, as well as five high school teachers from Cornfield High School. I recruited participants for the interviews through an email forwarded to teachers and members of the leadership team from the principal and assistant superintendent of curriculum and instruction (see Appendix A).

Creswell (2007) wrote that "purposeful sampling is used in qualitative research. This means that the inquirer selects individuals and sites for study because they can purposefully inform an understanding of the research problem and central phenomenon in the study" (p. 125). I used purposeful sampling, with the goal of understanding multiple perspectives on how stakeholders at Cornfield High School were using systems thinking tools. I interviewed each individual in private. Stake (1995) wrote "each interviewee is expected to have unique

experiences, special stories to tell" (p. 65). Because the sample consisted of different teachers and administrators with unique backgrounds, I constructed interviews in a way that allowed for conversations to center around unique experiences.

Site Visit

There were two days built into the trip to St. Louis between the two days of data gathering. I dedicated this time to synthesizing field notes, and interview transcription, and adjusting interview techniques as needed. I also scheduled two days immediately following conclusion of the trip to manage the remainder data while it was fresh. I spaced out time for a couple of reasons. I based the first reason solely on personal preference. Secondly, I created a schedule that allowed me to examine whether or not I adequately addressed during the interviews. Berg and Lune (2012) wrote "The reflexive ethnographer does not merely report findings as facts but actively constructs interpretations of experiences in the field and then asks questions" (p. 205). Recording field notes immediately after observations allowed me to accurately report what I was feeling. Time for recording these field notes was also necessary so that interpretation of what I observed could take place.

Data Collection Methods

Data collection for this study came from three primary methods. These included observation with field notes, interviews, and documents. Regarding observation, Stake (1995) wrote "All researchers have great privilege and obligation: the privilege to pay attention to what they consider worthy of attention and the obligation to make conclusions drawn from those choices meaningful to colleagues and clients" (p. 49). For this reason, I began observation immediately when I entered the campus, and ended observations after I left. I collected data in the form of unstructured and structured observations, and recorded field notes after the

observations were complete. Structured observations focused on evidence of systems thinking tools in the learning organization.

The second form of data collection involved interviewing participants. I arranged interviews with the teachers and leadership team through Mr. Bluth, assistant superintendent of curriculum in the Cornfield High School District, and Mr. Ritter, principal of Cornfield High School. Participation in the study was voluntary, and I informed participants of their rights to opt out at any time (see Appendix B). Berg and Lune (2012) wrote, "One of the most effective ways to learn about the circumstances of people's lives is to ask them…the nature of the case determines the topics that the interview must cover. Within those boundaries, the data are whatever the subjects have to say on the topic" (p. 331). For this reason, I conducted semi-structure interviews, where I covered major theme, but the interviewer and interviewee controlled the flow and direction of the content covered.

Though the interviews were semi-structured, I carried a list of several themes in each interview, and checked off as the interview took place. I selected these themes based on the conceptual framework created from the chapter two review of literature. Themes for interviews included uses and understanding of systems thinking tools (Senge, 1994), school improvement (Bernhardt, 2005), personal experiences (Burckman, 2008), professional development (Dufour & Dufour, 2006), professional learning communities (Wegner, 1998), change theory (Marsick and Watkins, 1999), and leadership style (Park & Datnow, 2009). I recorded the interviews with an iPad, and later transcribed the data. Once I transcribed the interviews, I summarized key points from each interview into paragraph form. Though geographic barriers limited the extent of member checking possibilities, I emailed interview summaries to participants for their review and input. I provided participants with contact information in case they wished to clarify any

point they made. Seven of the participants responded to the member check summaries, and none had concerns about what they had reported. Documents were the third type of data that I collected. Berg and Lune (2012) wrote,

> It is the very fact that these documents do reflect the subjective views and perceptions of their creators that make them useful as data in a case study. It is precisely through this subjectivity that these documents provide information…that may not be captured through some other more pedestrian data-collection technique. (p. 335)

Documents for this study came in the form of a professional development notebook used to educate administrators and teachers on how to utilize systems thinking tools for school improvement. Leaders in the Cornfield School District distributed these documents to teachers and administrators during a weeklong conference, which included professional development activities, as well as presentations from several systems thinking professionals. During this study, I also collected other documents that illustrated how systems thinking tools were being utilized by leaders at Cornfield High School for the purpose of school improvement.

Data Analysis

Data analysis and data collection are interactive/overlapping in qualitative research. Bernard and Ryan (2010) wrote "Looking for regularities is analysis. It's the quintessential qualitative act, and it's common to all traditions of scholarship across the humanities" (p. 3). Therefore, as I conducted observations and interviews, and collected documents, I conducted analysis in the form of seeking out regularities.

After I transcribed interviews, and recorded my observations on paper, I was left with a large amount of text to analyze. Analyses of these texts involved five steps identified by Bernard and Ryan (2010). These included "(1) discovering themes and subthemes; (2) describing the

core and peripheral elements of themes; (3) building hierarchies of themes or codebooks; (4) applying themes – that is, attaching them to chunks of actual text; and (5) linking themes into theoretical models" (p. 54).

Bernard and Ryan (2010) recommend eight techniques to physically handle data in order to look for themes and subthemes. These include looking for repetitions, indigenous typologies, metaphors and analogies, transitions, similarities and differences, linguistic connectors, missing data, and theory-related material. For this study, looking for repetitions and metaphors and analogies were the most appropriate techniques to use. I chose repetition not only because it was a practical place to begin coding, but as Bernard and Ryan (2010) pointed out, "The more the same concept occurs in a text, the more likely it is a theme" (p. 57). I also decided that metaphors and analogies were to be used because "People often represent their thoughts, behaviors, and experiences with metaphors and analogies" (p. 57). With interviews being the largest portion of data, it was important that a real emphasis be put on understanding what participants were saying. In addition to these techniques, I also coded data using a priori codes using the conceptual framework created from the review of literature. By using multiple techniques, I was able to see patterns, and reduce data into distinct categories.

After I discovered themes, I created codebooks to include a list of codes, identification of codes, operational definitions, and data exemplars (see Appendix C). These themes allowed anyone looking at my data to code my data using the same criteria as me, and thus helped establish credibility with the study. Because I built codebooks through an inductive approach, I welcomed the evolution of the codebook. Bernard and Ryan (2010) wrote "We find that codebooks are often a work in progress right up until a project is almost over. As coders find

more and more examples of themes, their reliability in marking themes–the actual process of coding–goes up" (p. 79).

After I created codebooks, and applied themes to text, I sought out patterns throughout the data. From here, I created warrants and assertions, and began the pre-writing process. I attempted to break my findings down by warrants or claims, and list several assertions for each warrant. I also sought disconfirming evidence for each warrant as well.

Verification of Interpretation

It is possible to transfer some findings to other school systems that utilize systems thinking tools for the purpose of school improvement. This was a bounded system, and it would have been difficult to replicate this study in the same school district. It was possible more interviews from this school could be conducted, more observations made, and more documents analyzed. For data critical to answering the research question, I used what Stake (1995) referred to as investigator triangulation. He wrote "For investigator triangulation, we have other researchers take a look at the same scene or phenomenon" (p.113). To help accomplish this, I had a fellow researcher interested in systems thinking tools code several pieces of data using my code book to help identify new patterns, and verify old ones (Lincoln & Guba, 1985). Although I was able to conduct limited member checks (Lincoln & Guba, 1985) for this study due to geographic barriers between the participants and me, I was able to implement several member-checking techniques. I was able to follow-up with the assistant superintendent of curriculum, and I sent interview summaries to participants for review. Two coders were used for sections of data from observation, interview transcripts, and documents to help establish intercoder reliability (Bernard & Ryan, 2010).

Conclusions

Opponents of qualitative research can argue that qualitative research poses a greater risk of subjectivity than quantitative research. Others would argue subjectivity is unavoidable, and not a risk at all. Because of this, I carefully planned the methods of this study. I made all decisions regarding method with the research questions in mind. The result was an appropriate methodology for this case where I could report results with as much credibility and trustworthiness as possible.

CHAPTER IV. RESULTS

The purpose of this study was to determine how high school teachers and administrators at Cornfield High School have used systems thinking tools for the purpose of school improvement. Research questions addressed during the study included the following:

1. How do members of the Cornfield High School leadership team report using systems thinking tools?
2. How do teachers of Cornfield High School report using systems thinking tools?
3. What successes does the leadership team relate to the use of systems thinking tools?
4. What successes do the teachers of Cornfield High School relate to the use of systems thinking tools?
5. What possibilities does the leadership team see for future use of system thinking tools?
6. What possibilities do the teachers of Cornfield High School see for future use of systems thinking tools?

While at Cornfield High school, I interviewed teachers, and took field notes. I transcribed interviews, and sent member check summaries to participants for clarification. I initially coded all of the data myself. A colleague who is familiar with systems thinking tools and education coded some portions a second time. In addition to interview transcripts and my field notes, a third piece of data was coded, and used for triangulation purposes. This piece of

data was a 179 page document provided to administrators and teachers who attended systems thinking training in the Cornfield School District. For the purpose of this study, I refer to it as CSN, or the Cornfield Systems Notebook.

This chapter summarizes the findings of this study. Because responses to the research questions were so similar, content of this chapter has been condensed to report by theme rather than research questions. This chapter will discuss the major themes that emerged from this study including systems thinking as a voluntary process, the influence of training of those who utilize systems thinking tools, committee uses of systems thinking tools for improvements and problem solving, and the utilization of systems thinking tools in the classroom. It should be noted that the reader will see two types of quotes, actual quotes from interviews, and other quotes that were put in from my field notes to enrich the tales.

Participant Name	Mr. Flair	Mrs. Rock	Mrs. Savage	Mrs. Kaepernick	Mrs. Petty	Mr. Ritter	Mr. Bluth	Mrs. Funke	Mr. Fandango
Role: T = Teacher A = Administrator	T	T	T	T	T	A	A	A	A
Systems Training Level	High	Med	High	Medium	Low	High	High	High	High

Figure 5. A Chart of Participants

Systems Thinking as a Voluntary Process

Central office administrator Mr. Bluth took one last look in his office. He smiled as he reflected on his past six years at Cornfield High School. To him, it had seemed like only yesterday when he agreed to travel across the country to accept the administrative position at Cornfield High School. It had not always been an easy six years. When he first started, only a

few select people in the system had even heard of systems thinking, much less accepted it. Six years later, Mr. Bluth hoped he was leaving behind a culture that centered on group decision-making and deeper level thinking. He thought about the arguments he had with reluctant administrators, and even got a little teary eyed thinking about the turnaround in attitude some others had after giving systems thinking a shot. He had been told so many times by so many teachers that they appreciated the fact that this was something he never shoved down their throats. Secretly, he thought systems thinking needed to be shoved down their throats. It needed to be a non-negotiable that administrators and teacher alike put in to practice. He knew this would not be the case though. Perhaps it was too idealistic to assume everyone would be on board with this thing, and perhaps this is why Mr. Bluth was anxious to get a fresh start.

On his way to the car, Mr. Bluth passed Mr. Fandango, an administrator who happened to be at Central office that day. "I understand you are leaving us. I am very sad to see you go. I want to tell you something before you do," Mr. Fandango said. Mr. Bluth nodded as Mr. Fandango (Interview, January, 2013) stated:

> I know there are skeptics to systems thinking theory, but I appreciate what you have done here at Cornfield High School. When you think about the high levels of rigor in learning, you think about the ability to make tie old connections with new concepts. And that's what systems thinking tools have done for me, and everyone else here who has chosen to use it. I think if we really bought in 100%, our outcomes would be unlike anything we have ever seen. Anyways, I just wanted to say thanks for all you have done. Mr. Bluth thanked Mr. Fandango. The two shook hands, and departed.

General Discussions

This study focused on two groups, teachers, and members of the Cornfield leadership team. The data revealed that these two groups were in sync on almost all the research questions related to systems thinking. One major theme stood out between the two groups though, and it was the idea of whether systems thinking should be voluntary or mandated. Most of the teachers interviewed referenced how nice it was to have this program that was available to them, but not mandated. Members of the leadership team on the other hand, were frustrated with the lack of participation by their faculty, and were ready to crack down on those who chose to ignore systems thinking.

Systems thinking being a voluntary process at Cornfield High School has impacted participation among teachers. One participant, Mrs. Petty (Interview) stated, "No one's forced me to use it. I'm not going to trainings because I don't see a need for it. It's not how I choose to spend my time."

Members of the leadership team are not blind to the views of teachers like Mrs. Petty. Because of this, the most prominent idea that members of the leadership team identified as to future uses of systems thinking tools was this idea that the mandated use of systems thinking tools had to be widespread among everyone within the Cornfield School district. All four members of the leadership team, and several teachers made mention to the fact that the use of systems thinking tools has been a voluntary process at Cornfield High School. Three out of the four administrators interviewed indicated that the process needed to become more mandated if they were to see systems thinking have a maximum impact. Mr. Bluth (Interview), an administrator at the Cornfield Central Office stated,

I think we still have people who think it's a program you can choose to adopt or not adopt. Maybe the next step's thing is that, it should be non-negotiable. If you're an administrator and you're not looking long term, and attend to consequences of everything you put in place, that's a problem. If you're not figuring out what mental models are going to be necessary in order to deliver this new science curriculum, that's just wrong. We're not going to get the results that we could get if we don't start thinking that way.

The CSN offers a unique perspective of this theme of volunteerism. Though the CNS does not directly address voluntary themes, it does address the idea of getting stakeholders actively involved. However, the CSN discusses the importance of those who utilize systems thinking tools to adapt habits of systems thinkers, so that they might anticipate resistance, and have an appropriate plan in place to address the resistance. One who reads and analyzes the CNS would not be likely to come away with the idea that systems thinking should be mandatory. Rather, systems thinking is a process that will take time that if done correctly, will win over the hearts and minds of all stakeholders. In my field notes, I recorded that this was the impression I got from the teachers as well. I think members of the leadership team know that making this a mandatory process would be met with resistance, but are forgetting that a root idea of systems thinking is that it takes a great deal of time to become the culture of an organization.

Administrators felt that the process must become more mandated in order to solve problems. Administrators introduced systems thinking to the faculty at Cornfield High School six years ago, and there is not enough participation six years later. Though all participants agreed that systems thinking tools could be used to solve problems, all participants indicated in their responses that they could be tackled on a deeper level, something they agreed can be done in the future at Cornfield High School. All administrators made mention to the fact that even

though they have been using systems tools for several years, they have a ways to go in how they are using them to solve problems. One member of the leadership team, Mr. Fandango (Interview) stated:

> It takes a high functioning team to impact changing growth at other levels. We have a number of teachers that continue to show improvements. We are working on teachers developing additional tools that would be considered culturally responsive teaching and learning. We're having some successes from that. It's just taken so long to get going, and we have to find a way to keep building momentum to lead to bigger improvements.

Every participant acknowledged that only some teachers were utilizing systems thinking tools. All the participants interviewed identified systems thinking training at Cornfield High School as a voluntary process in which they signed up for training based on their interests and needs. For some teachers, this means more pressing issues like instructional techniques have taken precedence. One teacher I interviewed had no training in dealing with systems thinking beyond basic information that had been shared in faculty meetings.

Contents of the CNS offer opposition to teachers who feel it does not apply to their curriculum. One of the main goals presented in the CNS was that participants would begin to understand that systems thinking could be utilized in any curriculum. The CNS contained several examples of tools that could be integrated into multiple subject areas.

Teachers who have chosen to explore systems thinking have reported an increase in their effectiveness in the classroom. Four out of five teachers addressed this point in their interviews. The fifth teacher did not refute it, but stated she was unsure how systems thinking impacted the overall effectiveness of those who used it. One teacher, Mrs. Savage credits the emphasis systems thinking places on mental models with creating a more positive climate, which in turn

has impacted the effectiveness of all teachers at Cornfield High School. Mrs. Savage (Interview) stated:

> The culture when I got here was really negative. It was negative with the students. It was negative with teachers. It was negative. It was really kind of shocking to me actually. Student morale was low, and their self-esteem suffered. Because of systems thinking, I think that's become much more positive.

Another teacher, Mrs. Kaepernick, described how systems thinking benefited her organizational persona, in turn making her more effective. Mrs. Kaepernick (Interview) stated, "I write things down all the time and I'm fairly organized and I'm a very detailed person. And so, all those Icebergs and all those different things helped me with all that." By being more organizes, Mrs. Kaepernick felt as if systems thinking had made her a more effective teacher. The CNS is also filled with organizational themes, allowing the user to go about systems thinking through deliberate action steps to be thorough in an organized manner.

With these successes in mind, one would think that it would only make sense to mandate systems thinking tools to all faculty. The issue is not that simple though. All five teachers indicated they appreciated the fact that systems thinking was not mandatory, and that this feature was attractive to them. Mr. Flair (Interview) stated, "It hasn't been forced on us. That's what made me so curious about it. I wanted to know what was going on." Another teacher, Mrs. Savage (Interview) described the value in allowing teachers to organically discover systems thinking tools:

> Here's a good example of someone who here who was completely resistant to it. They tried it and then completely bought it. She was very argumentative. I don't even know how she ended up on the learning team because all she did was argue with me in the first

session about how this wouldn't work for her, or this would not work in her classroom. Then she came to me one time and brought a behavior over time graph with her. She tried it, and she had so many kids that grasp it that hadn't grasp it before, she kept going with it. She just kept adding and adding and adding and finding that she was having more and more success with kids through it. So I think it's those teachers that are actually tried in the classroom that stick with it. She consistently tried to apply it in the classroom, and she bought into it because she saw the difference that it makes with their students.

The Influence of Training on Those Who Utilize Systems Thinking Tools

Mr. Ritter, the principal of Cornfield High School, walked into his building for the first day of pre-planning. He was eagerly anticipating starting his third year at Cornfield High School. His summer had been spent as much off campus as on. His system had just finished putting on a large systems thinking conference for administrators and teacher leaders in the Cornfield School District. He had no knowledge of systems thinking before beginning his work at Cornfield, but quickly bought in to the idea through conversations and workshops with Mr. Bluth, who had recently been hired to serve as an Assistant Superintendent of Curriculum for schools within the Cornfield School District. It was not long before Mr. Ritter began to think about how tools such as the Iceberg could be used for planning and problem solving at Cornfield High School.

The end of the previous school year brought an opportunity for Mr. Ritter to put what he had learned about systems thinking into practice. Money issues were forcing administrators throughout the Cornfield School District to look at their current schedule, and come up with an alternative one that would allow them to cut units, while at the same time not compromising academics. Mr. Cornfield knew teachers would be resistant to the change, but believed that if he

could somehow give them some input, then resistance would be kept to a minimum. He sent out an email detailing the change, and attached several proposed schedules for teachers to consider. He invited them to bring comments and concerns about each schedule to the meeting.

An hour before the meeting, Mr. Ritter prepared in the media center. He had large printouts of each schedule, as well as corresponding Iceberg models for each schedule. Teachers and other administrators filed in, and sat at pre-assigned tables. Mr. Ritter charged each table with the task of summarizing their thoughts on each of the schedules, and each table had a leader who reported out. The group shared many of the common concerns. They felt that moving from a block to a traditional seven-periods model would cause a loss of overall quality in instruction. Some teachers voiced the opinion that having the same trouble students all year long was unfair. Others liked the idea of shortened classes, citing students' inattention during blocks as a reason to change. Mr. Ritter (Interview) stated

> I understand all of your concerns, and they are valid. We are here because I want you to have input in what we do, and I want us to come to a decision that is best for all of us. To do so will require us move beyond our concerns, and go deeper to understand our mental models as it relates to what a school schedule should be.

Last year, Mr. Ritter had introduced all of his teachers to the Iceberg Model. Some had gone through more training, but none of the math teachers had. They were forced to take a professional development on relating algebraic concepts to real world issues while other members of the faculty went more in depth with systems thinking. Mrs. Petty, the math department head, rolled her eyes when Mr. Ritter informed them of the Iceberg model. Mrs. Petty (Interview) stated, "Great, more of this systems thinking garbage. Let's get this dog and pony show over with." Other teachers, like Mr. Flair, were legitimately excited to have a voice

in the process. Mr. Flair (Interview) stated, "He's right. We have to understand our deeper definition of what a school schedule should be if we are to come up with the best alternative." Mr. Ritter knew that some teachers were engaged while others were not. He began the exercise, taking his faculty and administrators through the Iceberg. Mr. Ritter assigned each group a schedule to complete an Iceberg on, and each group had at least one leader who was well versed in the Iceberg model. After working through the model, each group reported out. In the end, Mr. Ritter suggested that their mental model of an ideal schedule should be one that would help them in fulfilling their core value of maintaining a learning environment that affirms abilities and interests. Mr. Ritter thanked the teachers for their time, and promised to take their input with him to meetings with leaders at central office. Mr. Flair nodded in agreement, while Mrs. Petty rolled her eyes.

General Discussions

The level of training was a major theme that emerged from this study. It is quite evident that professional development greatly influenced their perceptions of how teachers and administrators utilized systems thinking tools. While all the participants were able to talk to some degree about how they are using systems thinking tools, those who had received more training were able to go in to more detail about the extent to which systems thinking was being utilized. The five teachers I talked to all indicated they had received anywhere from zero to a great deal of professional development in the area of systems thinking tools. The extent to which participants had been professionally developed related largely to their individual needs and preferences. Activities ranged from basic presentations in faculty meetings, to opportunities to attend major conferences on systems thinking like Camp Snowball. One participant, Mr. Flair (Interview) stated:

> I started doing research myself. I pestered and pestered enough that they sent me to Tucson this past summer. So I got to go to Camp Snowball, which is fantastic. So, then it became my mission to introduce it to my department. I only wanted people who were interested to participate.

The gap in training among teachers at Cornfield High School is not coincidental. Some participants felt that systems thinking was discipline specific, and did not really have a place in their curriculum. Mrs. Petty, a math teacher, explained why she had not pursued professional development in systems thinking. Mrs. Petty stated,

> Some of it is after school and some of it is during our regular professional development day. It was second on my choice list this time for the PD. I would have made it my first choice if I saw value in it. I don't think it's relevant to math, or at least I don't know how it's relevant to math. Nobody around here has yet to show me different.

Mrs. Petty did indicate she believed systems thinking had a role in other areas, and that some teachers are effectively using it in the classroom in other disciplines. The CNS also addressed this theme. The CNS described and provided examples of how systems could be applied to specific disciplines. Teachers who had received moderate to heavy training identified usefulness of systems thinking tools both in and outside their own classroom. One teacher, Mrs. Savage brought several examples of student work showing how students were using systems thinking tools in her classroom. Mrs. Savage stated "I had them working in class and I had them paired up, kids that understood Icebergs and kids that didn't so they could help each other. There was much deeper thinking going on." Systems thinking is not limited to content at Cornfield High School. Systems thinking tools are also being used in committees for the purposes of school improvement.

Committee Uses of Systems Thinking Tools for Improvements and Problem Solving

Mrs. Funke, an administrator at Cornfield, took a seat at the round table. The assistant principal Mr. Fandango, and teachers Mrs. Kaepernick and Mrs. Savage joined him. They were part of the school improvement team, and were meeting to draft a new bell schedule to present to the teachers at the next faculty meeting. Mrs. Funke began the meeting by recapping how they had gotten to this point. Mrs. Kaepernick stated,

> We have used several types of systems thinking tools to get to where we are. We have used connection circles, and Icebergs to break things down. We've done a couple stock and flow kind of charts, and social models and things like that. We now understand problems that we have faced, and are likely to face in the future.

Mr. Fandango then stated, "Mrs. Kaepernick and Mrs. Savage, you two are here to represent the teachers, and discuss any barriers, or unintended consequences that you see before we roll this schedule out to the rest of the teachers." The teachers welcomed what might be considered by some to be an overwhelming sense of responsibility. Mrs. Kaepernick, a young teacher who had received light training on systems thinking, understood enough to know that the core of systems thinking was the user being able to see things from a broader perspective. Mrs. Kaepernick (Interview) stated, "My main concern is that we educate the faculty on the process of how we reach our outcome. We don't always do a great job of that." All three administrators nodded in agreement. Mrs. Savage (Interview) stated,

> It's important that we emphasize the ability of our teachers to have a voice in the decision making process. I am worried that we are moving a bit too fast on this schedule, and we need more input from more teachers. Through the Iceberg model, we identified the mere language of tardies presents a problem. All of our teachers define tardies differently. So

everybody's mental model about what a tardy was, was different. In turn, that's causing problems, you know, with students.

Mrs. Funke responded, "Let's schedule one more meeting. We will provide subs for whoever is interested. They can bring their ideas, comments, or concerns, and we will come to a mutual understanding of some things before we move forward with the schedule." All attendees nodded in agreement, and Mr. Fandango went about getting an announcement made for a meeting the next day.

General Discussions

All participants interviewed indicated that systems thinking tools were heavily used by committees consisting of various people to solve problems. It is in these committees that participants cite much of the practice of using systems thinking tools takes place. Even teachers who do not serve on the committees state that systems thinking tools are being used by these committee meetings to solve problems. One participant, Mr. Rock, who has little experience with systems thinking and who does not serve on committees, stated "I know policies and procedures is a committee that does and drives a lot of those things with systems thinking. I know that the administration have addressed a lot of policies and procedures through systems thinking."

Every participant interviewed indicated that systems thinking tools, such as the Iceberg and connection circle, were being used in committee meetings to help solve problems. Mrs. Petty, a teacher who did not use systems thinking tools or serve on committees herself, stated, "They're probably using some of those same systems tools to address those issues."

Using systems thinking in committees has led to some successes identified by teachers. One of these successes is that it has led to a more effective decision making process. Four out of

five teachers interviewed discussed how administrators were using systems tools to drive decisions at Cornfield High School. One teacher, Mrs. Rock (Interview), discussed a school improvement committee meeting she had sat in on.

> Sometimes it will be a problem that the administration will make a top down decision, but they tend to work as a team. I've been in their meetings and they sit around and use a lot of systems thinking tools and approaches to address the problems when they're going to make a decision.

Other participants chose to highlight how they themselves were involved in the decision making process through committee meetings. One teacher, Mrs. Kaepernick, stated:

> We looked at parent involvement. We found a correlation between student involvement and parent involvement. In turn, we found a correlation between involvement and academic achievement. We found the same to be true with discipline issues as well. We looked at the data there. We looked at the grade 1 data. We've looked at all that data as far as, and much of it was within the systems thinking format.

The use of systems thinking in committees has allowed for more collaboration among faculty members. The CNS discusses how stakeholders should collaboratively understand system structure to identify possible leverage actions. Even participants who do not utilize systems thinking themselves recognize that collaboration is taking place between those who do, and every participant interview acknowledged collaboration. One teacher and department head, Mr. Flair, discussed how he has spread practical uses of systems thinking to his colleagues.

> I had a friend who had been here for several years who was stuck in her ways. I showed her some things. She was our Advanced Placement English teacher at that time. She was amazed to realize she was already doing some of those things, and I explained to her

there were steps she could take to reach her regular students as well. She fell in love, and started using systems thinking on a regular basis.

Administrators in Cornfield High School see these committees as a catalyst for using systems thinking tools in conjunction with data to drive decisions in the future. All administrators agreed that though it had not been up to this point at a deep level, it certainly could and should be. One administrator, Mr. Ritter (Interview), noted, "When it comes to using it to examine graduation rate or what we're doing on those pieces we haven't taken that next step. That's the next step."

Teachers and administrators alike feel as if problems can be tackled at a deeper level at Cornfield High School. Four out of five teachers gave practical examples of how they were solving problems, and they all suggested they could and needed to tackle deeper level problems. The fifth participant was unaware as to what value systems thinking had, only that she believed it had value. One teacher, Mrs. Savage, stressed the need to use systems thinking techniques to solve complex problems.

> I think we can address problems on a deeper level. For example, we have low ACT scores. We do okay on our state assessment, but not quite well enough. I think that's one problem that we can address with systems thinking. We need to start involving the students though. It's not just us wanting the students' achievement, but they need to want the students' achievement also. It will not happen without their involvement. We could also certainly tackle the attendance problem. Why aren't kids coming to school? We need to begin looking deeper at that.

Both teachers and administrators agree, an increase in use of systems thinking tools would lead to an overall effectiveness of both parties. Four out of five teachers interviewed

provided data indicating a direct link between continued use of systems thinking tools and professional growth. One teacher, Mr. Flair, lamented the fact that one of his administrators simply would not use basic systems theory to examine his own weaknesses:

> We have very smart people here who are very stubborn. Systems thinking to them I think looks babyish, and elementary. They have trouble because they think they are experts already. I love to learn and realize systems thinking isn't going anywhere. I really think the administrator over my department will have less trouble if he would embrace systems thinking, and could identify where he was weak.

A common benefit of systems thinking is that it allows members of a learning organization that might not have a voice in a traditional setting to be heard. While members of the leadership team do not attribute systems thinking to increasing the number of stakeholders involved in the decision making process, they do credit systems thinking with providing a more practical way of contributing in a meaningful way. All leadership team members cited in their interviews examples of practical uses of systems thinking tools in committees. One administrator, Mr. Ritter (Interview) stated:

> I don't think it got more people involved, because many have been involved. My school improvement team uses the Iceberg to evaluate each different schedule we're looking at. So you got students, you got parents and you got teachers and administrators all looking at you know how these different schedules could possibly impact us so, we can impact the schedule.

Through practical uses of systems thinking tools, administrators did not necessarily see an increase in stakeholder involvement, but saw more effective stakeholder involvement. This

theme of practical use was a major theme found in the CNS. Six pages of the CNS document were dedicated to practical uses of systems thinking tools.

The Utilization of Systems Thinking Tools in the Classroom

Mrs. Savage anxiously awaited her meeting with Mr. Fandango. Mr. Fandango had just been in Mrs. Savage's room a couple of hours earlier to conduct a routine observation. Mrs. Savage was particularly excited, as the lesson that day included student presentations of Iceberg models, a type of systems tool used to examine root causes of problems. Administrators at Cornfield High School had recently been emphasizing to teachers to try to implement systems thinking into their classrooms. Many of the teachers had taken part in using the tools to solve every day problems such as tardy students, and schedule conflicts in recent meetings. Mrs. Savage was one of these teachers, and knew right away that the Iceberg model would fit well in to her plans for her English Literature class.

Mr. Fandango arrived for the meeting, and warmly greeted Mrs. Savage. He stated, "First of all let me say, I was so excited to see you implementing the Iceberg into your classroom. You seem to have some really good outcomes with the kids. Tell me a little more about what is going on with your students, and what you think about systems thinking." Mrs. Savage thought for a minute and decided to explain what was going on in the class. Mrs. Savage (Interview) stated,

> Here is the background of what you saw today. They've read an excerpt from Sherman Alexie's book, *The Lone Ranger and Tonto Fistfight in Heaven*. It's Indian education, so it goes through his life in school. I had the students complete an Iceberg on it. We're working on inferences. We did this whole Iceberg to get inferences. More than half of the class already knew how to do it. It's nice when students already understand how to

> do it. I spent about probably a day and a half working together through an iceberg to get all the students caught up, and then we had already done something with on inferences. So we worked through, and did iceberg together on that, and then they started working on this. I had them working in class and, I had them paired up, kids that understood Icebergs and kids that didn't so they could help each other. They get to these as much deeper thinking that they wouldn't even have ever scratched.

Mrs. Savage's explanation impressed Mr. Fandango. "I'm really excited to see what is going on in your classes. You are really teaching students in a way that is rarely done," he said. "There is something else you should know," stated Mrs. Savage. "Go on," stated Mr. Fandango. Mrs. Savage pulled out a poster-sized, incredibly detailed Iceberg, complete with behavior-over-time graphs. It was obvious that much thought and effort had gone in to the creation of it. Mrs. Savage (Interview) said,

> You know I teach an English 11 class and that most of the kids in it have failed, the pretty remedial kids. Tools like systems thinking have worked wonders you know for me with getting kids to think at deeper levels. A student who failed my class last year created this Iceberg. This year, he gets it.

Mr. Fandango was blown away by the work, and asked Mrs. Savage if he could keep it as an example to show the rest of the faculty. Mrs. Savage gladly complied.

A success identified by teachers and administrators at Cornfield High School was that systems thinking tools have led to successful instruction in the classroom. Every participant interviewed made mention of the fact that teachers used it in the classroom, though some participants themselves did not do so. One teacher, Mrs. Savage, explained why certain teachers had bought in to using systems in the classroom:

> I think the most effective teachers are those who are willing to try to apply what they are learning. I'm not talking about just trying the behavior-over-time graphs one day, but consistently trying to apply it in the classroom. Those teachers buy into it because they, they've seen the difference that it makes with their students.

Teachers at Cornfield High School agree that systems thinking tools can be used to further increase student achievement in the classroom. All five participants agreed that teachers were using systems thinking tools in classrooms at Cornfield High School, and that it could be an effective instructional technique. Some participants made mention of the idea that students need to be challenged to achieve more, a theme that Mr. Ritter, the principal also made mention of. Mr. Flair described a moment in one of his classes where systems thinking tools were used by teachers to level the playing field with his advanced classes. Mr. Flair (interview, January) stated,

> I teach an honors class for a local university. Getting those students to use the Iceberg and to slow down and rethink is difficult because they refuse to believe that their thinking is wrong because they are advanced. My regular education students like it because it gave them a chance to think slowly and take it step by step. And then they're excited when they see oh I did that? Yes you did, and this is thinking that's on par with your advanced counterparts but you've never given yourselves the opportunity.

Systems Thinking Tools in the Classroom

Members of the administrative team at Cornfield High School have also seen successes resulting from utilization of systems thinking tools in the classroom. All administrators interviewed indicated that the systems thinking tools have provided an effective instructional technique for teachers who had been trained. The CNS provided multiple examples of how

systems thinking tools could be utilized in the classroom as well. All participants on the leadership team spoke about examples in the classroom they had seen and appreciated. One administrator, Mr. Fandango (Interview), stated,

> I think there are lots of people trying to use systems thinking tools for all the right reasons. We have teachers using them very effectively with students in getting some really, really neat outcomes. We have students that are very involved with the systems thinking group with administrators at Central Office, who are demonstrating their ability to really analyze complex systems using systems tools. We have people that are presenting in conferences on a regular basis about using systems thinking tools. Mr. Ritter also spoke about taking pride in the fact that teachers took his suggestions on how to implement systems thinking into their instruction.

Another success identified by members of the leadership team was the idea that systems thinking tools have led to teachers tapping into higher order thinking skills among students who use it at Cornfield High School. Two out of the four administrators spoke to this directly, while others made mention of related themes. Mr. Fandango spoke to this when talking about students possessing this type of intelligence not being tapped into. Mr. Fandango (Interview) stated, "We have kids that naturally have an ability to look at systems globally, and they get cause and effect. I think that's a sign of like a certain type of intelligence."

Mr. Ritter (Interview) also reinforced this idea when he stated "We have students that are higher achieving academically, but not probably as naturally smart. Maybe it's not smarter or it's not global". Mr. Bluth, an administrator at the central office level of Cornfield High School, spoke of evidence of higher order thinking as well in his interview. Mr. Bluth (Interview) stated,

> Our teachers brought examples of student work to a workshop we had. We looked at the examples of student work and talked about what they do in the classroom. I was so happy with what I saw. I wanted to hire some of those kids right now. It's that whole college and career ready thing you know. Again, I don't care how you get them there, but every one of our students deserves to be prepared for life after high school, and this gets them there.

Conclusions

The findings of this study are predictable and eye opening at the same time. Of course participants who had more professional development utilized systems thinking tools more, and thus were able to expound more on school improvements that had been made as a result of systems thinking. It also is not really surprising that those who valued systems thinking were able to identify successes inside the classroom as well as outside. There were several themes that emerged that did surprise. These themes were volunteerism versus mandated use of systems thinking tools, the ability to tap into higher order thinking through uses of the tools, and the use of committees to facilitate the use of systems thinking tools. Such surprises open the door wide to multiple areas of research as it relates to the uses systems tools for school improvement.

CHAPTER V. FINDINGS

Introduction

The purpose of this study was to determine how high school teachers and administrators at Cornfield High School have used systems thinking tools within the setting of a professional learning community. This chapter summarizes the study, discusses findings as they relate to literature, and presents surprises and conclusions.

Summary of the Study

For as long as schools have existed, educational leaders have faced the ever-daunting task of improving their learning organizations. Some school leaders have discovered that this is not something that can be accomplished alone, and that it takes a learning community to solve problems. This study examined how one school is utilizing a specific idea known as systems thinking to solve problems through a learning community.

The purpose of this study was to determine how high school teachers and administrators in Cornfield High School are using systems thinking tools within the setting of a professional learning community for school improvement. Research questions addressed in this study include the following:

1. How do members of the Cornfield High School leadership team report using systems thinking tools?
2. How do teachers of Cornfield High School report using systems thinking tools?

3. What successes does the leadership team relate to the use of systems thinking tools?

4. What successes do the teachers of Cornfield High School relate to the use of systems thinking tools?

5. What possibilities does the leadership team see for future use of system thinking tools?

6. What possibilities do the teachers of Cornfield High School see for future use of systems thinking tools?

Review of the Methodology

This research study was situated within a bounded case of a school using distinct techniques for the purpose of school improvement. Cornfield High School is a public school, grades 9 through 12, serving just under 2,000 students in St. Louis, Missouri. The school has a student-to-teacher ratio of 21 students per teacher, and the school employs 170 faculty and staff, 80 of whom are classroom teachers. Grade 10 has the highest enrollment, while grade 12 has the lowest. Participants in this study will include the leadership team made up of 4 participants, as well as 5 high school teachers from Cornfield High School. Participants for the interview were recruited through an email forwarded to teachers and members of the leadership team from the principal and Assistant Superintendent of Curriculum and Instruction. Data were collected through observation recorded in field note form, interviews with participants, and a document provided to teachers who had received training in uses of systems thinking tools.

Data were initially coded using themes recommended by Bernard and Ryan (2010). A codebook of themes was created, and used by a colleague performing a similar study to code select parts of my data. As codes were applied to texts, I sought out patterns and created

warrants and assertions in response to my research questions. Findings were then reorganized by themes as opposed to research questions to more adequately address major themes.

Major Findings

As data were collected and analyzed, it became apparent that aside from the debate as to whether or not systems thinking should be voluntary in nature, the opinions of teachers and members of the leadership team in regards to systems thinking were quite similar. For this reason, findings from each group can be reported together.

Uses of Systems Thinking Tools

Attitudes of administrators at Cornfield High School regarding the role of systems thinking tools varied from participant to participant. Interviews revealed that while all members of the leadership team that participated in the study valued systems thinking tools, their reports on the implementation of the tools differed. Some administrators at Cornfield saw systems thinking tools as a way to get people involved who might not otherwise be given a voice in the decision making process.

Teachers reported using systems thinking tools in a variety of ways. It is quite evident that professional development greatly influenced their perceptions of how systems thinking tools were being utilized. While all the participants were able to talk to some degree about how they are using systems thinking tools, those who had received more training were able to go in to more detail about the extent to which systems thinking was being utilized. The extent to which participants had been professionally developed was dependent largely on their individual needs and preferences.

Successes of Using Systems Thinking Tools

Members of the leadership team reported a variety of successes that they attribute to the implementation of systems thinking at Cornfield High School. The most common successes cited by members of the leadership team included practical uses that allowed for more involvement among all stakeholders, classroom utilization, and higher order thinking skills among students who used it.

A common benefit of systems thinking is that it allows members of a learning organization that might not have a voice in a traditional setting to be heard. While members of the leadership team did not attribute systems thinking to increasing the number of stakeholders involved in the decision making process, they did credit systems thinking with providing a more practical way of contributing through the use of systems thinking tools. A second success identified by members of the leadership team at Cornfield High School was that it provided an effective instructional technique for teachers who had been trained in systems thinking. All participants on the leadership team spoke about examples in the classroom they had seen and appreciated. Though this study was not designed to understand how systems thinking was being utilized in the classrooms, teachers' use of systems thinking reflects their values and an understanding of systems thinking theory. A third success identified by members of the leadership team was the idea that systems thinking tools have led to teachers tapping into higher order thinking skills among students who to use it at Cornfield High School.

Teachers at Cornfield High School related several successes to the use of systems thinking tools. The most common successes identified by teachers include a more effective decision making processes, instruction in the classroom, increased collaboration among faculty members, and professional growth of teachers who us systems thinking tools.

Future Possibilities of Systems Thinking Tools

The leadership team identified several possibilities for future uses of systems thinking tools. The most common possibilities of future uses of systems thinking tools identified by the leadership team were more mandated widespread usage of systems thinking tools, use of tools in conjunction with data, and a school wide deeper level of problem solving. Teachers at Cornfield High School identified several possibilities for the future use of systems thinking tools. The most common possibilities teachers identified for future uses of systems thinking tools included continued increase in administrator and teacher effectiveness, an ability to tackle deeper level problems, and using systems tools to further increase student achievement.

Findings Related to Literature

Findings of this study corresponded to several themes found in the review of literature. In regards to uses of systems thinking tools, it was revealed that some administrators at Cornfield see systems thinking tools as a way to get people involved who might not otherwise be given a voice in the decision making process. Wenger (1998) described communities of practice in which multiple stakeholders within the learning organization acted in concert to create a learning community (p. 45). Administrators at Cornfield high school recognized the benefits of learning communities consisting of more than a select few, just as Marsick and Watkins (1999) wrote about.

Teacher uses of systems thinking tools varied, but one commonality was that professional development greatly influenced their use of the tools. This professional development has to be offered to teachers by administration to activate teacher intrinsic motivation (Helterbran, 2006, p. 366). By providing professional development opportunities to teachers, administrators at Cornfield High School have created a form of inclusive leadership (Dorzak, 2011).

The most common successes cited by members of the leadership team included practical uses that allowed for more involvement among all stakeholders, classroom utilization, and higher order thinking skills. Involvement is a theme that researchers attribute to being a feature of professional learning communities. Levine and Shapiro (1999) stated that learning communities in schools all share the following characteristics: being organized into smaller groups within organization, integration of curriculum, establishment of support networks, bringing people together in meaningful ways, focusing on learning outcomes, community based involvement, and continuous self-assessment (p. 3).

The result of higher order thinking skills that was cited as a result of classroom utilization is particularly interesting and deserves more attention in future studies. It certainly backs up ideas of Raines (2004) and Senge (2004) that systems thinking results in self-reflection, which then results in personal mastery (p. 5). While this idea of higher order thinking skills is fascinating, Senge would define it simply as learning. Senge (2004) defined learning as "transforming conversational and collective thinking skills, so that groups of people can reliably develop intelligence and ability greater than the sum of individual members' talents" (p. 6).

Successes identified by teachers at Cornfield High School included effective decision making processes, classroom instructional techniques, increased collaboration among faculty members, and professional growth of teachers utilizing the tools. One of the key tenants of evidence-based decision-making is that it is done through collaboration (McMillan and Pollio, 2003). It should come as no surprise then that teachers cited both effective decision-making and increased collaboration as successes at Cornfield High School. Learning communities require collaboration. Earl (2009) described this collaboration as "collaboration where relationships are challenging, focus on substantive issues, problem identification and problem solving that goes

beyond what is known" (p. 50). It is also no surprise that teachers identified professional growth as a success that has come about as a result of the implementation of systems thinking tools. Like students in a classroom, participants who are involved in learning communities often experience growth through team learning.

The most common possibilities of future uses of systems thinking tools identified by the leadership team were more mandated widespread usage of systems thinking tools, use of tools in conjunction with data, and a school wide deeper level of problem solving. The argument of whether or not systems thinking tools should be mandated at Cornfield High School can be debated by both sides at Cornfield High School. Teachers appreciated the fact that utilizing systems thinking was not something that was forced on them. At the same time, administrators feel the time is right to make the integration of systems thinking a non-negotiable at Cornfield High School. Bruckman (2008) would argue that change will not simply happen (p. 213). At the same time, administrators must be aware of the potential consequences of their actions. Organizational change can often lead to disengagement from the learning organization (Baltzer, Westerlund, Backhans, & Melinder, 2011). Organizational leaders must therefore be aware of potential consequences of change, and prepared to help employees deal with them. Open lines of communication will likely be necessary if administrators at Cornfield High School do move toward mandated use of systems thinking tools.

It would certainly be in the best interest of administrators at Cornfield to begin focusing on using systems thinking tools in conjunction with data. Slocum, Spencer, and Detrich (2012) as well as Wendt and Miller (2012), and Bernhard (2004) all wrote about the importance of data in the decision-making processes. Doing so will allow administrators to address the third future use of systems thinking tools in Cornfield High school, which is solving problems on a deeper

level. As Senge's (2004) iceberg model illustrates, that is what systems thinking is really all about.

The most common possibilities teachers identified for future uses of systems thinking tools included continued increase in administrator and teacher effectiveness, an ability to tackle deeper level problems, and using systems tools to further increase student achievement. The idea that those who utilize systems thinking tools would be more effective within their organization is supported by literature. Helterbran (2010) wrote, "The principal, to be fully effective, must understand the importance and benefit of sharing leadership for without this understanding to support and foster teacher leadership, little good will come" (p. 346). Like administrators, teachers also agree that deeper problems can be tackled, specifically student achievement.

Surprises

There were several surprises that I did not anticipate coming in to this study. These surprises included select participation in utilization of systems thinking tools, a disconnect in the value of volunteerism between teachers and members of the leadership team, and the incredible successes of teachers who have fully bought in to systems thinking theory.

The first surprise that stood out was that participation in the utilization of systems thinking tools varied greatly from teacher to teacher. Coming in to the study, I knew that one administrator in particular had been employed by the Cornfield School District because of her expertise in systems thinking. Because of this, I assumed there would be some level of systems thinking use by all teachers. Though the majority of the teachers reported utilizing systems thinking tools in some way, I anticipated there would be some minimal baseline under systems thinking that all teachers would operate.

The second surprise relates directly to the first surprise. Not only was I surprised that the use of systems thinking in Cornfield High School was voluntary, but I was surprised that there was a disconnect in the way teachers and administrators felt about this. Teachers reported appreciating the fact that systems-thinking was not something that was forced on them, and administrators discussed the fact that it needed to be more mandatory. It is probably not a stretch to say that mandating systems thinking on the teachers at Cornfield High School might have unintended consequences. It would appear that teachers view volunteerism as a central theme of systems thinking. If administrators take away this volunteerism, it is possible teachers will question the usefulness of what leaders at Cornfield High School have been working to implement. At the same time, mandated use will possibly cause more stakeholders to use the tools, and successes of Cornfield High School could increase.

It is also quite possible that administrators who felt that systems thinking tools need be a non-negotiable felt an internal struggle due to the fact that mandating systems thinking might very well be a contradiction in and of itself. Advocates of systems thinking typically are looking to shift away from principles of a factory model of education, and value contributions of multiple individuals. To label systems thinking a non-negotiable means to practice mandates that many systems thinkers detest. At the same time, they felt conflicted because they know the value of systems thinking. It is a difficult situation that really does not have a clear and easy answer to the problem.

The third surprise is possibly the most important surprise as it relates to this study. I was thoroughly surprised by the successes of teachers who had fully embraced systems thinking, and utilized it regularly in their classrooms. The teachers who most bought in to systems thinking were able to tell remarkable stories of student success and school improvement. I came in to the

study believing systems thinking could result in these things, but hearing and seeing it surprised me nonetheless. Probably the most surprising thing that was shared was an Iceberg model created by a student in a remediation class. It was incredibly detailed, and rich in content (see Appendix D). It was clear that the student had put much thought and effort in to the assignment, and the product resonated with the teacher as well.

Implications for Practice

Because of this study, there are several implications for practice to consider for any educational leader wishing to utilize systems thinking for school improvement. After interviewing teachers and members of the leadership team, there are several lessons I learned from Cornfield High School that would drive my actions in regards to using systems thinking for school improvement.

The first step would be to analyze the culture of your school. Are the stakeholders used to having a voice in the organization? If not, practical professional development sessions will be necessary to develop that culture. Are structures in place to allow multiple stakeholders to contribute? If not, leaders must think about what that these structures will look like. For Cornfield High School, this meant the establishment of committees to allow for problems to be addressed. Understanding one's culture is the first step in implementing systems thinking tools.

The second step would be to professionally develop the stakeholders who will be utilizing systems thinking tools. Even if a culture exists where everyone is given a voice, these tools are distinct. They serve a particular focus, and people will need to be taught how to use them. Leaders must also decide who will participate in this professional development. In the case of Cornfield High School, participation was optional. Interviews with members of the leadership team reveal this might not be ideal though. If change is likely to be met with

resistance, leaders must have a plan in action to deal with this resistance. Likewise, leaders must be prepared to deal with teachers who do not really want to implement systems thinking tools, even if it is mandated.

The third implication for action would be to have an plan for implementation of systems thinking tools, as well as structures that assess the successes and failures of systems thinking tools utilization. Will leaders offer and or mandate professional development opportunities to systems thinking novices? All teachers and leadership team members discussed successes and failures, but there was some inconsistency in what they cited. What goals do leaders want to accomplish with systems thinking tools? There should be a clear focus on how systems thinking tools are being utilized, and an ability to success how successful everyone is in doing so.

Recommendations for Further Research

There are several possibilities I see for future research as it relates to this study. This first possibility would be to replicate this study in other school systems in which systems thinking tools are being utilized. The second recommendation I would make would be a study on how organizational leaders establish norms within the learning organization. The third recommendation I would make would be to study professional development techniques as they relate to systems thinking training.

The first recommendation for future research would be to replicate the study as much as possible with similar participants. As mentioned in the limitations section, this was a bounded case, which certainly had unique features that other cases simply would not have. It would be most interesting to examine similarities and differences of other schools in comparison to Cornfield High School. My assumption is that despite clear differences, many of the results would be replicated.

The second recommendation for future research deals with how educational leaders establish norms within the organization. This relates directly to volunteerism versus mandated adaptation of systems thinking tools. It would be interesting for an educational leader wishing to implement systems thinking tools to be able to predict how methods of implementation will be received by his or her staff, and how leaders plan on dealing with resistance to change (Bruckman, 2008.) It would also be interesting to conduct studies that deal with how educational leaders can impact the perceptions of the stakeholders. Since systems thinking is really about understanding mental models, studies that prove how mental models are shaped would be most significant.

The third and final recommendation I see for future research deals with what kinds of professional development are most appropriate for an educational leader who wishes for his or her staff to implement systems thinking tools for the purpose of school improvement. It would be particularly interesting to use action research in conjunction with systems thinking to professionally develop stakeholders (West, 2011.) Though this study showed that those with professional development in systems thinking were more likely to use the tools, it did not lend itself to really exploring what types of professional development would be most helpful to educational stakeholders.

With Cornfield High School relying so much on committee use, it would be interesting to look at a committee through the team learning framework identified my Marsick and Watkins. Marsick and Watkins discuss the benefits of having individuals with different ideas linking and working through their ideas for the purpose of improvement and professional growth. Since Cornfield High School has made an effort to establish these committees, it might be beneficial to

analyze the processes of framing, reframing, integrating perspectives, experimenting, and crossing boundaries (p. 96).

Concluding Remarks

This study provided several lessons for those who value systems thinking tools. The idea of volunteerism versus mandated implementation was easily the most surprising theme, and one that really deserves further exploration. What is certainly clear is that systems thinking tools are being used by some teachers and members of the leadership to make improvements. Those who have taken advantage of professional development opportunities have been able to identify multiple improvements that have taken place in Cornfield High School.

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APPENDIX A

E-MAIL INVITATION FOR EXPERIMENT

I am a graduate student in the Department of Educational Foundations of Leadership and Technology at Auburn University. I would like to invite you to participate in my research study to assess how systems thinking tools are being utilized for school improvement. You may participate if you are a member of the faculty or staff in the Ritenour School District.

As a participant, you will be asked to participate in a semi-structured interview, lasting approximately 40 minutes. If you agree to participate, you may withdraw at any time.

If you would like to participate in this research study, please respond to the email from your principal, letting him know. Participation is strictly voluntary. If you have questions, please contact me at prestjw@auburn.edu or you may contact my advisor, Dr. Kensler at lak0008@auburn.edu.

Thank you for your consideration,
John Prestridge

APPENDIX B

AUBURN UNIVERSITY INSTITUTIONAL REVIEW BOARD (IRB) CONSENT AND APPROVAL

AUBURN UNIVERSITY INSTITUTIONAL REVIEW BOARD for RESEARCH INVOLVING HUMAN SUBJECTS

RESEARCH PROTOCOL REVIEW FORM

For Information or help contact **THE OFFICE OF RESEARCH COMPLIANCE**, 115 Ramsay Hall, Auburn University
Phone: 334-844-5966 **e-mail:** hsubjec@auburn.edu **Web Address:** http://www.auburn.edu/research/vpr/ohs/

Revised 03.26.11 – DO NOT STAPLE, CLIP TOGETHER ONLY.

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1. **PROPOSED START DATE of STUDY:** Jan 7, 2013

PROPOSED REVIEW CATEGORY (Check one): ✓ **FULL BOARD** **EXPEDITED** **EXEMPT**

2. **PROJECT TITLE:** Dissertation: The Use of Systems Thinking Tools in Ritenour Schools

3. John Prestridge	Student	Educ. Leadership	256 783 3094	prestjw@auburn.edu
PRINCIPAL INVESTIGATOR	**TITLE**	**DEPT**	**PHONE**	**AU E-MAIL**
2905 Edgemont Street, Opelika AL, 36804		NA		prestridge.john@lee.k12.al.us
MAILING ADDRESS			**FAX**	**ALTERNATE E-MAIL**

4. **SOURCE OF FUNDING SUPPORT:** ✓ Not Applicable Internal External Agency:_____ Pending Received

5. **LIST ANY CONTRACTORS, SUB-CONTRACTORS, OTHER ENTITIES OR IRBs ASSOCIATED WITH THIS PROJECT:**
NA

6. **GENERAL RESEARCH PROJECT CHARACTERISTICS**

6A. Mandatory CITI Training

Names of key personnel who have completed CITI:
John Prestridge ✓

CITI group completed for this study:
✓ Social/Behavioral Biomedical

PLEASE ATTACH TO HARD COPY *ALL* CITI CERTIFICATES FOR *EACH* KEY PERSONNEL

6B. Research Methodology

Please check all descriptors that best apply to the research methodology.

Data Source(s): ✓ New Data Existing Data
Will recorded data directly or indirectly identify participants? Yes ✓ No
Data collection will involve the use of:
Educational Tests (cognitive diagnostic, aptitude, etc.)
✓ Interview / Observation
Physical / Physiological Measures or Specimens (see Section
Surveys / Questionnaires
Internet / Electronic
✓ Audio / Video / Photos
Private records or files

The Auburn University Institutional Review Board has approved this document for use from 11/12/12 to 11/11/13
Protocol # 12-362 EX 1211

6C. Participant Information

Please check all descriptors that apply to the participant population.
✓ Males ✓ Females AU students
Vulnerable Populations
Pregnant Women/Fetuses Prisoners
Children and/or Adolescents (under age 19 in AL)
Persons with:
Economic Disadvantages Physical Disabilities
Educational Disadvantages Intellectual Disabilities
Do you plan to compensate your participants? Yes ✓ No

6D. Risks to Participants

Please identify all risks that participants might encounter in this research.
✓ Breach of Confidentiality* Coercion
Deception Physical
Psychological Social
None Other:

Received
OCT 30 2012
Research Compliance

*Note that if the investigator is using or accessing confidential or identifiable data, breach of confidentiality is always a risk.

Do you need IBC Approval for this study? ✓ No Yes – BUA #_____ **Expiration date** _____

FOR OHSR OFFICE USE ONLY

DATE RECEIVED IN OHSR:	10/30/12 by GB	**PROTOCOL #**	12.362 EX 1211
DATE OF IRB REVIEW:	11/12/12 by CC	**APPROVAL CATEGORY:**	45CFR46.101(b)(2)
DATE OF IRB APPROVAL:	11/12/12 by CC	**INTERVAL FOR CONTINUING REVIEW:**	3years

COMMENTS: reprinted consent received 1/15/13

7. **PROJECT ASSURANCES**

PROJECT TITLE: Dissertation: The Use of Systems Thinking Tools in Ritenour Schools

A. PRINCIPAL INVESTIGATOR'S ASSSURANCES

1. I certify that all information provided in this application is complete and correct.
2. I understand that, as Principal Investigator, I have ultimate responsibility for the conduct of this study, the ethical performance this project, the protection of the rights and welfare of human subjects, and strict adherence to any stipulations imposed by the Auburn University IRB.
3. I certify that all individuals involved with the conduct of this project are qualified to carry out their specified roles and responsibilities and are in compliance with Auburn University policies regarding the collection and analysis of the research data.
4. I agree to comply with all Auburn policies and procedures, as well as with all applicable federal, state, and local laws regarding the protection of human subjects, including, but not limited to the following:
   a. Conducting the project by qualified personnel according to the approved protocol
   b. Implementing no changes in the approved protocol or consent form without prior approval from the Office of Human Subjects Research
   c. Obtaining the legally effective informed consent from each participant or their legally responsible representative prior to their participation in this project using only the currently approved, stamped consent form
   d. Promptly reporting significant adverse events and/or effects to the Office of Human Subjects Research in writing within 5 working days of the occurrence.
5. If I will be unavailable to direct this research personally, I will arrange for a co-investigator to assume direct responsibility in my absence. This person has been named as co-investigator in this application, or I will advise OHSR, by letter, in advance of such arrangements.
6. I agree to conduct this study only during the period approved by the Auburn University IRB.
7. I will prepare and submit a renewal request and supply all supporting documents to the Office of Human Subjects Research before the approval period has expired if it is necessary to continue the research project beyond the time period approved by the Auburn University IRB.
8. I will prepare and submit a final report upon completion of this research project.

My signature indicates that I have read, understand and agree to conduct this research project in accordance with the assurances listed above.

John Prestridge		Oct 8, 2012
Printed name of Principal Investigator	**Principal Investigator's Signature (SIGN IN BLUE INK ONLY)**	**Date**

B. FACULTY ADVISOR/SPONSOR'S ASSURANCES

1. By my signature as faculty advisor/sponsor on this research application, I certify that the student or guest investigator is knowledgeable about the regulations and policies governing research with human subjects and has sufficient training and experience to conduct this particular study in accord with the approved protocol.
2. I certify that the project will be performed by qualified personnel according to the approved protocol using conventional or experimental methodology.
3. I agree to meet with the investigator on a regular basis to monitor study progress.
4. Should problems arise during the course of the study, I agree to be available, personally, to supervise the investigator in solving them.
5. I assure that the investigator will promptly report significant adverse events and/or effects to the OHSR in writing within 5 working days of the occurrence.
6. If I will be unavailable, I will arrange for an alternate faculty sponsor to assume responsibility during my absence, and I will advise the OHSR by letter of such arrangements. If the investigator is unable to fulfill requirements for submission of renewals, modifications or the final report, I will assume that responsibility.
7. I have read the protocol submitted for this project for content, clarity, and methodology

Lisa Kensler		Oct 22, 2012
Printed name of Faculty Advisor / Sponsor	**Signature (SIGN IN BLUE INK ONLY)**	**Date**

C. DEPARTMENT HEAD'S ASSSURANCE

By my signature as department head, I certify that I will cooperate with the administration in the application and enforcement of all Auburn University policies and procedures, as well as all applicable federal, state, and local laws regarding the protection and ethical treatment of human participants by researchers in my department.

Sherida Downer		10/23/12
Printed name of Department Head	**Signature (SIGN IN BLUE INK ONLY)**	**Date**

8. **PROJECT OVERVIEW: Prepare an abstract that includes:**
(400 word maximum, in language understandable to someone who is not familiar with your area of study):

I.) A summary of relevant research findings leading to this research proposal:
(Cite sources; include a "Reference List" as Appendix A.)
II.) A brief description of the methodology,
III.) Expected and/or possible outcomes, and,
IV.) A statement regarding the potential significance of this research project.

I.) Perhaps today more than ever, a greater emphasis is being placed on how educational leaders initiate change within an organization for school improvement. Many scholars agree that school improvement takes place and is sustained through a team like approach. Meirinka, Imants, Meijer, and Verloop (2010) stated as much when they wrote "fostering teams which exchange ideas, discuss their experiences and their underlying assumptions and which aim to solve shared problems may be regarded as a promising direction for initiatives aimed at teacher professional development with respect to educational innovation" (p.177). Systems thinking tools provide a catalyst for which the goals of professional learning communities can be accomplished. The combination of being able to determine true causation along with the ability to allow data to drive the decision making process is quite powerful.

II.) The site came about as a result of a connection between the Chair of my study, Dr. Lisa Kensler, and the Assistant Superintendent of Curriculum for Ritenour Schools, Mary Scheetz. Mary also serves as a representative for the Waters Foundation, a leading organization in systems thinking theory and application. Mary arranged for the study to take place with teachers and administrators during a four-day span in January of 2013. Throughout the process, I will keep correspondence with Mary via email, face-to-face meetings, and phone conversations. After several conversations, Mary understands the type of sampling that is needed, and has arranged for me to interview teachers and the leadership team in Ritenour Schools. Participants will complete consent forms. The interviews will consist of open-ended and closed-ended interview questions over a four-day period. Interviews will be tape recorded, and later transcribed using a USB foot pedal, which allows me to control the speed of the audio when playing the tape back. Interviews will be transcribed for coding purposes. Copies of the tapes will be kept locked in a safe, and files of the transcribed data will be kept on my laptop, as well as an external hard drive.

III.) I expect participants to report on the different ways that systems thinking tools can be used for school improvement. I also expect that any participant that does not see systems thinking tools as an asset to school improvement will describe why this is so.

IV.) The purpose of this study is to look at how systems thinking tools could be utilized for the purpose of school improvement. In doing so, the study helps to begin to fill a massive gap in the lack of research tying systems thinking tools to evidence based decision making for the purpose of school improvement. At the same time, this study will test ideas and research already in place, which emphasizes the importance of using evidence-based decision-making techniques. It is a study based on topics, which are grounded in research, but yet to have really been explored. The implications of this study and other future studies related to systems thinking and concepts can have a profound impact on the policies and procedures practiced in schools. It is also important to note that this study examined the ways that teachers implement systems thinking tools into their instruction as well. For this reason, the door is open for future research in to ways that information is transmitted to students of teachers who utilize systems thinking tools in the classroom.

9. **PURPOSE.**
a. Clearly state all of the objectives, goals, or aims of this project.
The purpose of this study is to identify ways in which systems thinking tools are being utilized for the purpose of school improvement in Ritenour Schools.

b. How will the results of this project be used? (e.g., Presentation? Publication? Thesis? Dissertation?)
Dissertation
publications
professional presentations

10a. KEY PERSONNEL. Describe responsibilities. Include information on research training or certifications related to this project. **CITI is required.** Be as specific as possible. (Attach extra page if needed.) *All non AU-affiliated key personnel must attach **CITI certificates of completion.***

Principle Investigator John Prestridge ✓ Title: Student E-mail address prestjw@auburn.edu
Dept / Affiliation: EFLT

Roles / Responsibilities:
Design Study, Conduct Interviews, Transcribe and Analyze Data, Report Results

Individual: Lisa Kensler ✓ Title: Chair E-mail address lak0008@auburn.edu
Dept / Affiliation: EFLT

Roles / Responsibilities:
The faculty advisor will oversee the advising of the project, assistance with data collection, analysis, and reporting of findings

Individual: Todd Haynie ✓ Title: Student E-mail address gth003@auburn.edu
Dept / Affiliation: EFLT

Roles / Responsibilities:
Design Study, Conduct Interviews, Transcribe and analyze data, report results

Individual: Carey Andrzejewski ✓ Title: Comm. member E-mail address cea0011@auburn.edu
Dept / Affiliation: EFLT

Roles / Responsibilities:
Advising of the project, assistance with data collection, analysis, and reporting of findings

Individual: Lynne Patrick ✓ Title: Comm. member E-mail address rlp0004@auburn.edu
Dept / Affiliation: EFLT

Roles / Responsibilities:
Advising of the project, assistance with data collection, analysis, and reporting of findings

Individual: _____ Title: _____ E-mail address _____
Dept / Affiliation: _____

Roles / Responsibilities:

11. **LOCATION OF RESEARCH. List all locations where data collection will take place.** (School systems, organizations, businesses, buildings and room numbers, servers for web surveys, etc.) **Be as specific as possible. Attach permission letters in Appendix E.**
(See sample letters at http://www.auburn.edu/research/vpr/ohs/sample.html)
Ritenour School District, Spring 2013. Mary Scheetz, Assistant Superintendent, Ritenour School District has been contacted and has given permission for the research to be conducted with school personnel.

12. PARTICIPANTS.

a. Describe the participant population you have chosen for this project.
Check here if there is existing data; describe the population from whom data was collected & include the # of data files.
Teachers and members of the leadership team within the Ritenour School district

b. Describe why is this participant population is appropriate for inclusion in this research project. (Include criteria for selection.)
All participants will have had experience in utilizing systems thinking tools for the purpose of school improvement.

c. Describe, step-by-step, all procedures you will use to recruit participants. *Include in Appendix B a copy of all e-mails, flyers, advertisements, recruiting scripts, invitations, etc., that will be used to invite people to participate.*
(See sample documents at http://www.auburn.edu/research/vpr/ohs/sample.htm.)
I have spoken with Mary Scheetz, Assistant Superintendent of Curriculum for the Ritenour School district.
Mary contacted the principals to obtain permission for me to interview teachers and members of the leadership team.
The principal will be forwarding an email (attached in appendix B) from me as an invitation to participate.
Consent letters will be delivered to those who agree to participate. They will be informed that they can withdraw from the process at any time.

What is the minimum number of participants you need to validate the study? 1

Is there a limit on the number of participants you will recruit? ☑ No ☐ Yes – the number is _____

Is there a limit on the number of participants you will include in the study? ☐ No ☑ Yes – the number is 100

d. Describe the type, amount and method of compensation and/or incentives for participants.
(If no compensation will be given, check here ✓.)

Select the type of compensation: — Monetary — Incentives
— Raffle or Drawing incentive (Include the chances of winning.)
— Extra Credit (State the value)
— Other

Description:

13. PROJECT DESIGN & METHODS.

a. Describe, step-by-step, all procedures and methods that will be used to consent participants.
(___ Check here if this is "not applicable"; you are using existing data.)

1). An email will be sent inviting participants to interview. The cover letter will explain the purpose of the study and the fact that participants and will identify that all information gathered confidentially.
2). Interviews will respond, and those that respond yes will be provided with a consent to participate form. Consent forms will inform participants of their ability to withdraw from the project at any time.
3.) Before interviews begin, I will describe to participants how their identity will be protected. They will be reminded that they may withdraw from participating at any time.

b. Describe the procedures you will use in order to address your purpose. Provide a step-by-step description of how you will carry out this research project. Include specific information about the participants' time and effort commitment. (*NOTE: Use language that would be understandable to someone who is not familiar with your area of study. Without a complete description of all procedures, the Auburn University IRB will not be able to review this protocol. If additional space is needed for this section, save the information as a .PDF file and insert after page 6 of this form.*)

Semi-structured interviews will be conducted and recorded with participants and will last no more than 2 hours per interview. Interviews will then be transcribed, and coded using with a computer software. Data will then be analyzed, and reported.
Archival data and observational data will be coded and analyzed as available.

13c. List all data collection instruments used in this project, in the order they appear in Appendix C.
(e.g., surveys and questionnaires in the format that will be presented to participants, educational tests, data collection sheets, interview questions, audio/video taping methods etc.)
✓Interview Questions See Appendix C.
Audio Recorder

d. Data analysis: Explain how the data will be analyzed.
Interviews will be analyzed using computer software.

14. RISKS & DISCOMFORTS: List and describe all of the risks that participants might encounter in this research. ***If you are using deception in this study, please justify the use of deception and be sure to attach a copy of the debriefing form you plan to use in Appendix D.*** *(Examples of possible risks are in section #6D on page 1.)*

There should be no discomforts encountered by participants because they can withdraw at any time.

15. **PRECAUTIONS.** Identify and describe all precautions you have taken to eliminate or reduce risks as listed in #14. If the participants can be classified as a "vulnerable" population, please describe additional safeguards that you will use to assure the ethical treatment of these individuals. ***Provide a copy of any emergency plans/procedures and medical referral lists in Appendix D.***

Directions from the principal will include a statement reassuring participants that participation is strictly voluntary. Participants are not vulnerable populations. Pseudonyms will be used, so no real names of teachers or the school district will be identified.

If using the Internet to collect data, what confidentiality or security precautions are in place to protect (or not collect) identifiable data? Include protections used during both the collection and transfer of data.
(These are likely listed on the server's website.)

Files will be secured on one computer and password protected compression software.

16. **BENEFITS.**

a. **List all realistic direct benefits participants can expect by participating in this specific study.**
(Do not include "compensation" listed in #12d.) Check here if there are no direct benefits to participants.

Reflection on practice, as well as a greater understanding of the learning organization's vision and mission.

b. **List all realistic benefits for the general population that may be generated from this study.**

Results might indicate that the utilization of systems thinking tools results in a more cohesive work environment; and thus an increase in productivity.

17. PROTECTION OF DATA.

a. **Will data be collected as anonymous?** ☐ Yes ☑ No *If "YES", skip to part "g"*
("Anonymous" means that you will not collect any identifiable data.)

b. **Will data be collected as confidential?** ☑ Yes ☐ No
("Confidential" means that you will collect and protect identifiable data.)

c. **If data are collected as confidential, will the participants' data be coded or linked to identifying information?**
■ Yes (If so, describe how linked.) No ■
We will not code participants. All data will be confidential.

d. **Justify your need to code participants' data or link the data with identifying information.**
Not Applicable

e. **Where will code lists be stored?** (Building, room number?)
Not Applicable

f. **Will data collected as "confidential" be recorded and analyzed as "anonymous"?** ☑ Yes ☐ No
(If you will maintain identifiable data, protections should have been described in #15.)

g. **Describe how and where the data will be stored** (e.g., hard copy, audio cassette, electronic data, etc.), **and how the location where data is stored will be secured in your absence. For electronic data, describe security. If applicable, state specifically where any IRB-approved and participant-signed consent documents will be kept on campus for 3 years after the study ends.**

Data will be saved as an mp3 file, on a password protected computer, in a locked room. Hard copies of data will be kept in a locked filing cabinet, in a locked room. The computer will always be kept in a locked house with alarm system. All files will be deleted no later than May, 2014.

h. **Who will have access to participants' data?**
(The faculty advisor should have full access and be able to produce the data in the case of a federal or institutional audit.)
Investigators and the faculty advisor

i. **When is the latest date that confidential data will be retained?** (Check here if only anonymous data will be retained. ✓)
May, 2014

j. **How will the confidential data be destroyed?** *(NOTE: Data recorded and analyzed as "anonymous" may be retained indefinitely.)*
Files will be deleted

EDUCATIONAL
FOUNDATIONS,
LEADERSHIP
AND TECHNOLOGY

AUBURN UNIVERSITY
COLLEGE OF EDUCATION

INFORMATION LETTER
FOR A RESEARCH STUDY ENTITLED
The use of Systems Thinking Tools for the Purpose of School Improvement

(NOTE: DO NOT AGREE TO PARTICIPATE UNLESS AN IRB APPROVAL STAMP WITH CURRENT DATES HAS BEEN APPLIED TO THIS DOCUMENT.)

You are invited to participate in research study about how systems thinking tools can be utilized for the purpose of school improvement. John Prestridge and Gregory Haynie are conducting this study, under the direction of Dr. Lisa Kensler, Professor in the Auburn University Department of Educational Foundations, Leadership, and Technology. You were selected as a possible participant because of your role and experience with systems thinking tools.

What will be involved if you participate? If you decide to participate in this research study, you will be interviewed. The interview will not last longer than one hour and will be audio taped. No names of participants or locations will be identified in the recordings. The audio recording will be kept on a secure, password protected computer. All audio files will be deleted no later than May 1, 2015.

There will be no risk or discomforts associated with this research. If you participate in this study, you can expect to identify the possible role systems thinking may play in school improvement.

There will be no cost or expenses if you choose to participate in this research.
If you change your mind about participating, you can withdraw at any time during the study. Your participation is completely voluntary. If you choose to withdraw, your data can be withdrawn as long as it is identifiable. Your decision about whether or not to participate or to stop participating will not jeopardize your future relations with Auburn University, or your respective institution, school, or department.

Any data obtained in connection with this study will remain confidential. Information collected through your participation may be used to fulfill an educational requirement, published in a professional journal, and/or presented at a professional meeting.

4036 Haley Center Auburn, AL 36849-5221; Telephone: 334-844-4460; Fax: 334-844-3072
www.auburn.edu

If you have questions about this study, please email me at prestjw@auburn.edu. You may also contact my advisor, Dr. Lisa Kensler at lak0008@auburn.edu.

If you have questions about rights as a research participant, you can contact the Auburn University Office of Human Subjects Research or the Institutional Review Board by phone (334) 844-5966 or email at hsubjec@auburn.edu or IRBChair@auburn.edu.

HAVING READ THE INFORMATION PROVIDED, YOU MUST DECIDE IF YOU WANT TO PARTICIPATE IN THIS RESEARCH PROJECT. YOUR SIGNATURE INDICATES YOUR WILLINGNESS TO PARTICIPATE. A COPY OF THIS LETTER IS YOURS TO KEEP FOR YOUR RECORDS.

_____

Participant Name Date

_____

Print Name

_____

Investigator's signature Date

_____

Printed Name

APPENDIX C

DISSERTATION CODEBOOK

Category	Code	Operational Definition	Data Exemplar
Admin Uses of STT	ASTT	Reports of Administrative Uses of STT	We use the iceberg to evaluate each schedule
Teacher Uses of STT	TSTT	Reports of Teacher Administrative Uses of STT	Tools like systems thinking have worked wonders you know for me with getting kids to think at deeper levels
Collaborative Uses of STT	CSTT	Collaboration between administrators ant teachers using STT	We use, well on the school improvement team, I'm facilitator for that, too. We have parents as part of that team
Barriers	B	Reasons given for STT not being used	People not understanding the connection
Specific Improvements	SI	Specific Improvements Identified by Participants	Increased achievement on many state assessments
Personal Use of STT	PU	Examples of Systems Thinking Tools being Used outside classroom	Saying in my head time delay, time delay, when talking to my husband
STT background	SB	Training received on the uses of STT	I go to Camp snowball which was fantastic
Admin Future Uses of STT	AFU	Examples of how STT will be used in the future from Admin POV	The next step is that it should be non-negotiable
Teacher Future Uses of STT	TFU	Examples of how teachers see STT being used in the future	I think we could take the data. We could really put, I mean especially attendance and things we could do behavior over time graphs.
Volunteerism	V	STT as a voluntary process	I appreciate the fact that it wasn't something we were forced to do
Mandatory Use	M	STT as a mandatory process	This needs to become a non-negotiable

Category	Code	Operational Definition	Data Exemplar
Systems Thinking in the classroom	CU	examples of systems thinking being used in the classroom	The students completed an iceberg
Higher Intelligence	HI	Ability to think differently	Students who were repeaters, something clicked
Negative Views of STT	NV	Statements which reflected a negative view STT	We do this dog and pony show

APPENDIX D

STUDENT ICEBERG MODEL

Indian Education
Events
Patterns of Behavior
Underlying Structures
Mental Models