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Systems Thinking and Technology Integration as Catalysts for School Change in High Need Schools: IMPACT V and the Alignment of Organisational Ends and Means

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Abstract

As part of a grant project in the state of North Carolina in the United States, eleven schools participated in the IMPACT V project, designed to help infuse technology into middle and high schools across the state. Involvement in the program required the preparation of a detailed action plan identifying how each school would use grant funding, coaching, and graduate-level courses to integrate technology effectively. Faculty assigned to mentor and provide direct instruction to the principals of the participating schools soon determined that there was a high degree of variability in terms of how well prepared principals were to plan, develop, and implement their respective action plans in a systematic fashion. Each school was asked to prepare a logic model designed to help both their planning and implementation of IMPACT V funds through identification of clear goals, activities, outputs, and outcomes. Preliminary results of our study indicate that principals were initially disoriented and confused when introduced to the project, and their preliminary action plans were not grounded in a clear understanding and plan for technology integration. The cohort model provided a lot of necessary support, and the action plans changed over time with statistically significant differences found between pre and post action plans. In terms of participant attitudes, principals have moved from excited and frustrated at the beginning of the project to confident and satisfied as their technology integration action plans have evolved into living documents that have helped them utilize systems thinking in planning and implementing technology into their schools.

Keywords: Systems Thinking; Technology Integration; Logic Model; Artefact Analysis; IMPACT V.

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Introduction

An interdisciplinary research team collaborated to study the impact that using systems thinking and logic models had on the refinement and implementation of IMPACT V action plans by participating school level stakeholders who had received extensive funding for technology integration in their respective schools. The team comprised of three university faculty members representing three different departments within the School of Education at the University of North Carolina at Greensboro (UNCG) —information science, educational leadership, and educational measurement—two of whom are course instructors.

The IMPACT V Grant

The IMPACT V grant entitled, “Building 21st Century School Leadership” positions technology integration as a catalyst for school improvement through leadership and technology access to principals, teachers, and students (North Carolina Department of Public Instruction, 2005). The primary goal for IMPACT V is:

Based on valid research and reflecting the recommendations of the revised North Carolina Educational Technology Plan (2005–2009), the IMPACT model . . . assures that the media and technology resources and conditions necessary to support the teaching and learning process are present. (Hewitt, Lashley, Mullen, & Davis, 2012)

The project originally included 13 administrators from 12 high-need schools across a southeastern state in the United States that participated in an online [Specialist in Education \(EdS\) in Educational Leadership](#) program as part of the project. The instructional framework involved:

A three-pronged curricular perspective on curriculum that underscores this online leadership preparation initiative in order to reach our desired target of building 21st-Century leadership. Three overarching concepts or “target arrows” of this program innovation are (1) to engage in leadership development through coursework, institutes, and enrichment activities within a social justice framework (Normore, 2008); (2) to promote through the internship experience practice-based leadership coaching to increase school team/democratic decision making and empowerment in schools (Papa & Papa, 2010), and (3) to anchor these two major goals through school improvement specifically aimed at technology leadership at multiple levels. (Schrum & Levin, 2009, as cited in Hewitt, Lashley, Mullen, & Davis, 2012, p. 8)

Figure 1

IMPACT V Three-Prong Targeted Curricula Design (Hewitt et al., 2012)



- 1) *Leadership Development within a Social Justice Framework*
- 2) *Practice-based Leadership Coaching for Empowerment*
- 3) *Technology Leadership: School and Classroom Levels*

Participating schools were selected for the project based on two core factors—they served a high needs student population based on socioeconomic criteria and they did not have a technology facilitator.

Potential participants completed an extensive visioning and planning process over a four-month period. The IMPACT V model involves:

School teams comprised of the principal or assistant principal, four teacher leaders representing core curricular areas, and one media specialist. The district level media/technology director also constitutes the team. The core curricular teachers are currently participating in a fully online Masters of Instructional Technology program at another university in North Carolina while the practicing administrators are earning the EdS degree through our new online program, which functions informally as a cohort. These school teams are figuring out how to work collaboratively to develop a school improvement action plan and provide professional development for their schools while seeking support and resources from their district office. (Hewitt, Lashley, Mullen, & Davis, 2012, p. 8)

The IMPACT V grant provides participating schools with substantive funds for technology equipment/infrastructure, professional development, the school team's graduate school programs, and leadership coaching.

The problem among schools, however, was the absence of a guiding framework in which to implement technology integration in a systematic fashion that was both well aligned with the schools' existing goals and also within the existing capabilities of their teachers and respective school climates. School principals became frustrated when dissonance arose between what was being asked of them by the grant, and what they were learning in their coursework, and what they were experiencing in application—especially as it related to technology integration, assessment, and systems thinking. Two of their primary instructors are authors of this article, which reflects the action research involved in addressing this unexpected problem by introducing systems thinking and how it positively impacted these projects.

Literature Review

Systems Thinking

A system can be defined as a “set of elements that function as a whole to achieve a common purpose” (Betts, 1992, p. 38), and systems thinking emphasises the need to take into account how smaller parts interact and interconnect with one another to form an entire system. Senge (2012) uses the family as an example of how to understand systems thinking, and refers to individuality and the interaction effect it has on a family unit as navigating a “web of interdependence.” Each member's individual behaviour has an impact on the others and also influences others' behaviour and, ultimately, the entire system. Senge also believes there are three primary components of systems thinking: 1) A commitment to learning, 2) Being prepared to accept when you are wrong, and 3) The need to triangulate. In Video 1, Senge (2012) describes systems thinking as a web of interdependence.

Video 1

What is Systems Thinking? (Peter Senge, 2012)



One of the first examples of systems thinking and education was developed as part of the United States' preparation for WWII (Chow & Whitlock, 2010; Instructional Design Central Website, 2009; Reiser & Dempsey, 2002). Faced with the need to mobilize millions of troops in a very short period of time, President Roosevelt called on the nation's top psychologists to help develop a training system based on contemporary human performance and learning. Based largely on BF Skinner's work, the field of instructional systems design (ISD) was born. After the war, other businesses and governmental organisations began using this methodology to provide training to impact their employees' overall skills and performance. A primary issue, however, that was soon discovered was that there are many aspects of an organisational system, outside of a worker's knowledge, skills, and abilities, that influence human performance. In Video 2, Joe Harless (2009) describes his definition of what performance technology means.

Video 2

What is performance technology? (Joe Harless, 2009)



The discipline that then emerged was called human performance technology (HPT) and emphasised the application of systems thinking to human and organisational performance. The foundational process for both instructional systems and human performance technology is the ADDIE process, which calls for a systematic process involving Analysis, Design, Development, Implementation, and Evaluation (Chow & Whitlock, 2010). It represents a systematic process of discovery, identification of clear goals, and continuous evaluation and improvement. Joe Harless, considered one of the forefathers of HPT, ultimately added assessment to the ADDIE model. Because data and existing information about the organisation and

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its stakeholders must first be collected before the analysis stage can begin, the revised model is A-ADDIE (Chow, 2008).

Systems thinking is characterised by the concept of synergy where “the whole (system) is greater than the sum of its parts (elements)” (Betts, 1992, p. 38) and it can be differentiated into hard systems thinking and soft systems thinking (Checkland, 1981; Dawidowicz, 2012). Hard systems thinking is most often applied as systems or operational analysis to environments where both problems and solutions are well defined and controlled; soft systems thinking, better known as “holistic” or “reflective” thinking is applied to systems that are less precise and where the variables are less controlled (Dawidowicz, 2012). A recent study of 172 people in the United States found that systems thinking was important to approximately 79.7% of all decisions made yet the majority of respondents demonstrated limited or no understanding of what exactly systems thinking was or how to apply it (Dawidowicz, 2012).

Another way to view systems thinking is through open (complex) and closed (simple) systems (Bates, 2013). An open system is complex because there are many variables that are uncontrolled, dynamic, and unpredictable; such systems must be adaptable and collect feedback continuously because change is constant. Closed systems are controllable, with linear thinking and feedback loops in which cause and effect are well determined and understood (Bates, 2013; Betts, 1992).

According to Alhadeff-Jones (2008) two opposing views of systems thinking have emerged over the past 50 years—first order and second order systems thinking. First order systems thinking attempts to reduce and breakdown the inherent complexity of any system into its individual parts; this type of thinking emphasises a reductionistic, autonomous perspective where a sum can be understood and controlled through its individual parts, which promotes “command and control” type thinking and leadership. Second order systems thinking adds a constructivist layer to first order thinking but accepts that many of the parts of a system are unique, independent, and will develop their own meaning and perspectives, which therefore requires participatory management and communication approaches (Alhadeff-Jones, 2008; Bates, 2013).

Ends and Means Thinking

According to Kaufman (1988), “all individual accomplishments within an organization must combine to provide a useful organizational contribution; some results are ‘building blocks’ for larger, overall ones” (p. 80). The means, resources committed to attaining a goal, and ends, the goal to be accomplished, can be described by five organisational elements (see Figure 2).

Kaufman’s (1988) model recognizes the need for clearly established ends or outcomes, and the alignment of means necessary to attain them, and illustrates how interrelated the organisational elements are.

Figure 2**Organizational Elements Model (Kaufman, 1988)**

	Inputs	Processes	Products	Outputs	Outcomes
	(New Material)	(how-to-do-its)	(en-route results)	(the aggregated products of the system that are delivered or deliverable to society)	(the effects of outputs in and for society and the community)
Examples	Existing human resources; existing needs, goals, objectives, policies, regulations, laws, money, values, societal and community characteristics; current quality of life.	Means, methods, procedures; searching for "excellence," teaching; learning; human resource development, training, managing.	Course completed; competency test passed; competency acquired; learner accomplishments; instructor accomplishments; production quota met; the performance "building blocks."	Delivered automobiles, sold computer systems; program completed; job placements; certified licenses, etc.	Safety of outputs; profit; dividends declared; continued funding of agency; self-sufficient, self-reliant, productive individual; socially competent and effective, contributing to self and to others or to substances; financial independence.
Scope	Internal (Organization)				External (Societal)
Cluster	Organizational Efforts		Organizational Results		Societal Results/Impacts

When applied to educational environments, systems thinking is often referred to as systemic change, which reflects the need for holistic solutions to the complex problems associated with public education. Reigeluth (1992) noted that there are two types of change: piecemeal, and systemic—which is often referred to as paradigm shift. Piecemeal involves singular changes that do not take into account other aspects of the system that also need to be addressed for any effective or long-term change to occur. Systemic change involves looking at all aspects of the system to ensure that the change that takes place is aligned with, and resonates throughout and around, the organisation (Reigeluth, 1992). According to Banathy:

In education, it must pervade all levels of the system: classroom, building, district, community, state government, and federal government. And it must include the nature of the learning experiences, the instructional system that implements those learning experiences, the administrative system that supports the instructional system, and the governance system that governs the whole educational system. (Banathy, 1991 as cited in Reigeluth, 1992, p. 2)

The application of systems thinking to public education is a natural fit because educational systems represent complex organisations with a large variety of human performance. Kemp (2006) believes that education has not kept up with the changing world; that the information age requires our educational institutions teach new skills such as “the development of initiative, creativity and skills in critical thinking and problem-solving, mental and physical skills needed for productive work, using advanced technologies, engaging in group-processes and developing good habits for self-direction and personal growth” (p. 20). The ends have changed, and the means through which we prepare students must change also.

Bates' (2013) research on the use of systems thinking in United Kingdom public education suggests, however, that first order systems thinking on its own can be detrimental rather than the educational panacea many had hoped for. Referred to as the "self-improving" system of public service, the United Kingdom has adopted a model for public services reform predicated on four interrelated factors: "top down performance management, capability and capacity, market incentives, and users shaping the service from below" (Bates, 2013, p. 41). Applied to public education, however, this approach treats schools as closed systems and ignores the dynamic variables of pedagogy, children, local variability and needs, teachers, and so forth—which does not honour the unique contexts in which they take place, and which are not accounted for through systems thinking (Alhadeff-Jones, 2008; Bates, 2013). Ultimately, the United Kingdom example reflects the need for second order systems thinking:

Education as a public service needs to be recognised by policy-makers and school leaders as a complex phenomenon which cannot be reduced to abstract measures without diminishing the humanness of the children that it has a duty to serve . . . 'seeing like a state' can sever our connection to the real-life substance upon which ideas of improvement were based in the first place. (Bates, 2013, p. 52)

Alhadeff-Jones (2008) suggests a third order of systems thinking that entails a recognition that, in fact, complex systems are complex and often defy explanation, reduction, or specific definition. Harless (1998) would, more particularly shift focus from trying to predefine the system as a sum of its parts and rather focus on the outcomes—or what he refers to as "accomplishments."

Accomplishment-based Teaching and Learning

According to Harless (1998), the primary goal for education needs to be accomplishment (a high quality end) focused "to produce graduates who have the knowledge, skills, information, and attitudes relevant to becoming accomplished citizens" (p. 20). He holds that the ultimate goal of education is not to go to college or even find a well-paying job but rather to become an accomplished citizen of society who has the soft and hard skills necessary to be competent and productive in life. An accomplishment reflects the short-term and long-term result or outcome of behaviour, or an output of doing the right things. Harless (1998) believes that there are three fundamental problems with education. First, it needs to shift its focus to WHAT it is trying to teach students rather than HOW it is educating its students. The WHAT needs to shift from subject content to societal accomplishments required, such as a strong work ethic, engineering skills, technology skills, and other product based accomplishments. In other words, it is less of what you know, and more what you can do.

Second, is a general lack of skills and knowledge of teachers on how to produce such accomplishment-based learning in their students because they only know how to teach as they were taught as students; the process is still focused on subject-driven content rather than application. Lastly, is low student motivation, which is linked directly to the first two causes—not seeing the relevance of subject-based content. Harless (1998) believes that solving these three problems in education will represent the systemic paradigm shift called for by others: 1) Focus on learning goals that are accomplishment-based, 2) Improve teaching so that it focuses on attained ends rather than content, 3) Improve student motivation by improving on 1 and 2.

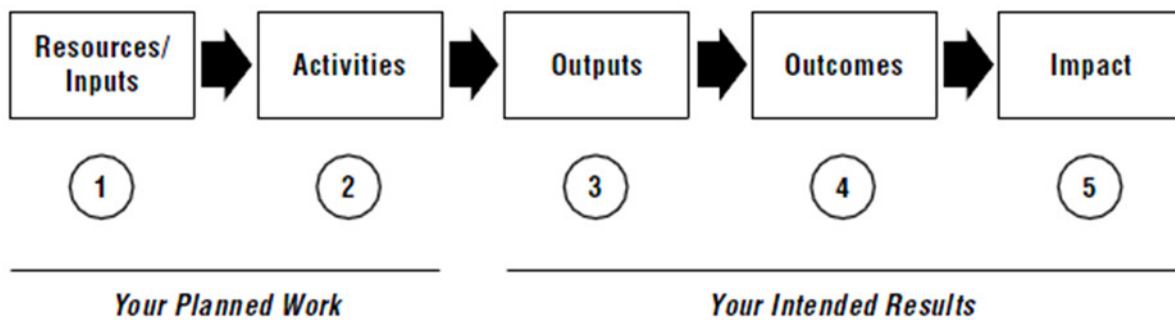
The Logic Model: A Framework for the Application of Systems Thinking in Education

The W. K. Kellogg Foundation (2004) defines a logic model as a "systematic and visual way to present and share your understanding of the relationships among the resources you have to operate your program, the activities you plan, and the changes or results you hope to achieve" (W. K. Kellogg Foundation, 2004, p. 1).

Logic models help defines, “a picture of how your organization does its work—the theory and assumptions underlying the program [that]. . . . links outcomes (both short- and long-term) with program activities/processes and the theoretical assumptions/principles of the program” (W. K. Kellogg Foundation, 2004, p. III). The five elements of a logic model are inputs, activities, outputs, short-term outcomes, and impact or long-term outcomes (see Figure 3).

Figure 3

A Logic Model (W. K. Kellogg Foundation, 2004)



Inputs reflect the resources that are allocated, *activities* are the actions taken (using the inputs) toward achieving the desired *outputs*, which are the direct results or products of the activities; *outcomes* are the specific changes in behaviour, and *impact* is the long term, fundamental change that has been achieved (W. K. Kellogg Foundation, 2004). The National Science Foundation (NSF) refined the logic model to reflect only four elements—inputs, activities, outputs, and outcomes (Westat, 2002).

The logic model has been derived from Kaufman’s Organizational Elements Model (OEM) and reflects an operational process for applying systems thinking to organisational performance. For the IMPACT V grant, each school was allocated state funds to infuse technology into their classrooms, and the logic model (see Figure 4) helped establish that technology and technology training represented inputs and activities rather than the actual ends of the project.

Figure 4

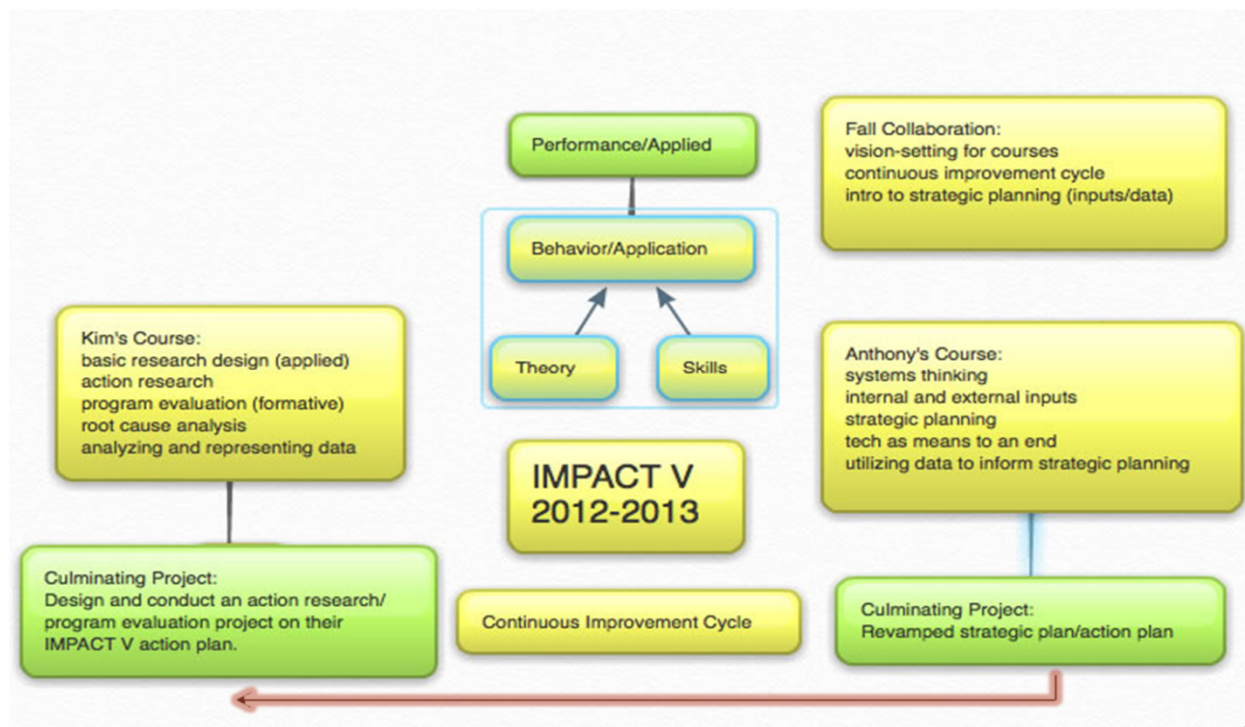
IMPACT V Logic Model

Goals (Ends)	Inputs	Activities	Outputs	Short-term Outcome	Long-term Outcome
	✓	✓	✓	✓	✓
Goal 1		T E C H N O L O G Y	P A R T I C I P A N T S	I M P A C T	
Goal 1 objectives					
Goal 2					
Goal 2 objectives					

Two courses in particular were co-designed around the educational administrators, in pursuit of their EdS degree as part of the grant, of each of the participating schools as part of their respective technology integration action plans: basic methodology, action research, and program evaluation in the first course; and the systems approach to planning, integrating technology, and utilizing research data, which involves strategic planning and utilizing data, in the second. The end goal for both courses would be for administrators to be able to take skills from both courses and apply them in their respective schools using the theory and skills taught to them (see Figure 5).

Figure 5

IMPACT V Courses for Principals



Research participants were introduced to the logic model after developing their initial action plans for technology integration. Our study examines the impact of using the logic model and the systems thinking that it reflects by seeking to answer three research questions:

- What are the barriers, strengths, and supports to implementation of the IMPACT V action plans?
- How do the participants' action plans change over time?
- How do principals' attitudes about action planning change over time?

Method

The results of our study have been collected and analyzed through participant interviews of the principals and artefact analysis of their initial and revised action plans.

Design: Pre–post design using artefacts and interviews

Interviews

Participant interviews to date have taken place with six of the 11 administrators (two have dropped out of the project). The interviews were comprised of 12 open-ended questions about the project (See Appendix A). All interviews were 60–90 minutes in duration and were transcribed and examined for major themes.

Interview data were examined holistically and then coded analytically for themes and patterns (Bogdan & Biklen, 2007; Cresswell, 2003). Using initial and focused coding (Lofland & Lofland, 1995), data were examined vis-à-vis the research questions using an iterative process of developing and clarifying data categories. Memoing (Cresswell, 2003) was instrumental in ascribing meaning to categories and refining them (Rossman & Rallis, 1998). Throughout the data analysis process, the authors were mindful of the “problematic and sometimes contradictory nature of data” (Fontana & Frey, 2005, p. 714). So, for example, as themes under *barriers* emerged, some interviews reflected barriers specific to implementing the specifics of the project while another reported barriers in implementing the project in general. Frequent mentions of the first, however, as opposed to a single mention of the second, helped further enrich the qualitative data presented in our findings.

Artefact Analysis: Action Plan Rubric Development and Scoring

Through this part of the study, the researchers sought to 1) derive instruments that explored data naturally occurring (required from the grant and class activities), and 2) develop tools for investigation of both qualitative and quantitative data that could be used repeatedly to gather longitudinal data—allowing the research team to look across time at the program artefacts.

First, data naturally occurring as a result of participation in the program were investigated. The team developed a rubric for scoring the action plans on seven categories (see Table 1) in order to probe the second research question. Rubrics are assessment rating scales that are commonly used in education (Allen & Knight, 2009; Hogan, 2005; Mertler, 2001; Moskal, 2000). For this task, an analytic rating (Mertler, 2001) scale scored on a 5-point scale, with 1 being defined as poor and 5 being defined as excellent, was developed to separate out the characteristics of the parts of the action plans that the participants were required to do in the ACTION V project. The parts of the action plan correspond directly with the seven categories on the rubric; the examples were required and delineated by the ACTION V grant, and definitions were developed by the research team to assist in defining common criteria for scoring the action plans.

Schools’ initial action plans and their revised action plans at the end of Year 1 were then scored using the scoring rubric. To ensure consistency and to adhere to the recommendations in the literature, definitions were set before the scoring commenced (Hogan, 2005), and the same person scored all.

Table 1**IMPACT V Action Plan Rubric Categories, Definitions, and Examples**

Rubric Category	Definition	Examples
Introduced Vision for the IMPACT model at the school	Degree of completeness and clarity of the goals (i.e., what the project hopes to change) as a result of participation in the overall program.	Goal: All faculty members will be 21st century professionals, using technology for teaching & learning, collaborating, and communicating. Goal: All students will be 21st century learners, using technology for thinking & learning, collaborating, and communicating.
Outlined Priorities and Objectives	Degree that the objectives (i.e., specific priorities that are measurable and lead to the overall goal of the program) are clear, accurate, and informative for the reader and are aligned with the overall goals of the program.	All teachers will be encouraged and supported to advance along the Technology Use in Classrooms continuum (from "productivity" to "instructional presentation and student productivity" to "student-centred learning" through the effective Implementation of the IMPACT Model
Identified Steps/Strategies	Degree that the steps are complete clear, understandable, and are consistent with the objectives of the program.	All teachers will have access to professional development and point-of-need coaching.
Delineated inputs/activities with Timeline and responsible persons	Degree that the inputs are complete, accurate, and provide an overview of the program scale and size with specific timelines and personnel (i.e., what people and resources are needed to achieve the objectives with concrete and realistic dates).	Needs Survey "IMPACT Workshops" August 2011 Needs Survey Aug. IMPACT V Professional Development
Explained Evaluation Questions	Degree that the evaluation questions reflect an understanding of what the program needs to ask that are observable, measurable, and realistic in giving an overview of the projects' implementation, value, and impact.	What type of support do teachers need? Are teachers using what they learn in professional development sessions in their classes? How so?
Identified Evaluation Data sources	Degree that the data sources, collection techniques, and corresponding indicators to monitor the progress toward achieving the objectives are outlined for the program and are realistic.	Needs Survey Data Anecdotal Evidence Overall conclusion.
Summary and Next Steps	Degree that the evaluative information above were used and summarized to discuss the implementation, value, and impact of the program of what actually happened and/or changed for the program constituents or community as a result of participating in the program and how this informs future directions.	Interpretation of Data and Action Steps: What do the results mean? What are you going to do now?

Note: All categories were scored based on the degree they met the criteria set in the definition. These were scored on a 5-point scale, with 1 being defined as poor and 5 being defined as excellent.

Sample, Setting, and Ethical Issues

All participants were educational administrators of each of the IMPACT V schools. Interviews were conducted at the University of North Carolina at Greensboro's School of Education. Each participant was provided with an informed consent form and interviewed by a research assistant so that both the anonymity and confidentiality of the interviewee was maintained and they were free to speak openly and candidly about the project.

Ethical considerations centred on the fact that two of the researchers were also instructors of record and responsible for the grades of each participant. The university institutional review board, however, found minimal risk was involved because the study's research questions and goals of the interview were not focused on the quality of instruction or the roles played by their instructors but rather the evolution of the

technology integration project. Furthermore, all participants were informed they had the right to refuse to participate, which half did, and research assistants were used to conduct the interviews to avoid biasing responses and so that each participant could speak freely and openly.

Data Analysis

Descriptive statistics on pre- and post-participation rubric scores were done. Next, the Wilcoxon test for non-parametric data and matched pairs was used to observe differences between the means for the pre- and post-participation, because this is the most appropriate analysis with this particular sample size and the available data.

Results

Interviews: Initial Findings

With little exception, each of the interview participants recounted consistent experiences with the grant and their action plans. While each participant's school context was unique, and while those unique elements certainly nuanced each school leader's perceptions of the grant, data were surprisingly consistent across participants. The following sections present findings for each of the three guiding research questions.

Barriers

To be considered for the IMPACT V grant, eligible schools had less than two weeks to submit a proposal, including an action plan, for how the grant would be used to promote substantive school change. For most participants, those initial plans were hurriedly constructed and were primarily designed to be attractive to the granting agency as opposed to serving as a guiding document for change. As one respondent recounted: "We had to say certain things. But to be honest, it was a document we did not refer to, we did not refer back to it the whole first year." Another respondent explained:

Well, the action plan, when we initially had to create this—it was just because, you know, this was something they said you had to do. It didn't really take on a whole lot of meaning until we took a class in which we started looking at it a little more closely and actually understood that we needed to make measurable goals . . .

Each of the participants discussed the action plans as being living documents that "evolved" over time. The most frequently and vociferously cited barrier to the development and implementation of their action plans was a lack of clarity regarding what was expected of the action plans by the granting agency. One participant confided, "The whole first year, I could not have defined what I thought that IMPACT grant was." One participant explained:

We didn't know what the IMPACT grant was all about. The whole first year, IMPACT was about like sticking Jell-O to the wall. It was one thing one month, it was a different definition the next, nobody could define it. I actually was told it's whatever you want it to be in your school. The first year it was very hard to write good goals and to write an action plan because you didn't know really what, I hate to use the term "what they were looking for" because I truly think it is what we want it to be, but within certain guidelines. At the end of this past—the second summer—we got clarity.

Each of the participants used the word “frustrating” to describe this lack of clarity. Participants described clarity developing over time and especially being a function of a “course correction” announced in the second summer of the grant by the head of the granting agency. The course correction included a focus on four expected outcomes of schools’ participation in the grant. These four outcomes would serve as the structure for grant reporting to the agency.

For some participants, there was a sense of “why didn’t they just tell us this stuff in the beginning,” while for others there was a sense that the granting agency was “building the plane in the air, with not having a clear understanding of what [sic] final product was expected . . . that’s always been kind of a moving target.” And another stated: “But as we got more direction, the requirements also have changed.”

Related to this was a lack of effective communication among the partners in the grant: state granting agency, the universities providing the EdS and MEd programming, the leadership coaches, and the state agency technical support consultants. Another participant explained:

I also think that maybe you need to get your ducks in a row to start with—that would be very, very helpful to the process, and I think it would have alleviated a lot of frustration and a lot of stress for a lot of people. And it just seems to me that there is a real lack of communication amongst the agencies that are responsible for all of us. The university, DPI [the state agency], it just seems like there’s a lack of communication. It’s interesting, the summer institute, one of the ladies that was leading that kept talking about us having to create a plan, and when we finally, it was my table we finally called her over. ‘Cus I kept telling my team, I think she is referring to the action plan that we’ve already written, and they kept saying, I think she wants something different. And she didn’t even know that we had action plans written . . . How does someone not tell you that?

Several participants noted attempts by the university to “bridge” or connect the state agency’s expectations from the grant to the university coursework.

Another barrier to planning and implementation of IMPACT action plans was the inundation of other initiatives and changes expected of schools. Statewide there was a shift to the Common Core State Standards and Essential Standards, requiring new curricula in almost all instructional content areas and new achievement testing aligned to the revised curricula. The first year of the IMPACT grant was also the first year of a new state educator evaluation system, which—for the first time ever—included a measure of educator effectiveness based on student test results. Additionally, each school had other initiatives that vied with the IMPACT initiative for time, energy, and attention. From one respondent:

When you’ve got to do the Common Core, and you’ve got to do PBIS [Positive Behavioral Interventions and Supports], and you’ve got to do AVID [program for encouraging students to seek and plan for higher education], and you’ve got to do all these other acronyms, then it just becomes consuming. So that affects the buy-in, when there’s so much on your plate. It’s like a family reunion: You might have the best pot of peas ever made, but you’ve got to taste a little bit of everything so you don’t offend Aunt Betsy. That’s the whole thing—being able to give [IMPACT] its just due.

Another respondent echoed this sentiment, emphasising that so much change was:

overwhelming for our staffs. It's just an overwhelming time. Is that stopping us from starting to implement IMPACT and doing good things with our teachers? No, it's not. But is it an impediment to effective implementation? Yes, it is. It's a lot to learn at one time.

Additionally, school leaders in the cohort felt overwhelmed by being administrators and graduate students simultaneously:

plus me being in school, plus having—we're still working full time jobs that are more than full time jobs. Sometimes things do get put on the back burner, and this is one of those things that's easy to put on the back burner.

Another barrier to planning and implementation of IMPACT was staff turnover. Three of the initial building leaders in the IMPACT cohort had left the program by the beginning of the second year because they left their positions as building leader of an IMPACT school (e.g., to accept another administrative position or because they were transferred). When this happened, the school was dropped from the IMPACT program. Other staff turnovers proved tumultuous and disruptive as well. In one IMPACT school, one of the assistant principals (AP) was going to serve as the IMPACT school leader; shortly before the first IMPACT event, the AP was transferred to another school, and another AP was assigned as the IMPACT school leader. The new AP overseeing the school's IMPACT program had not participated in developing the school's initial IMPACT plan, and she "literally read it the day before" her first IMPACT event. Within the same school, the media specialist suffered an injury and:

was out for almost the whole first semester, and it was her last year before retirement, so she had kind of disengaged from everything. So, we spent the first year really focused on ... nothing related to media, which is really the foundation of this whole thing.

Luckily, though, the IMPACT team at this school was instrumental in the selection process of the new media specialist, who was quickly on-boarded and gelled well with the IMPACT team.

Several of the building leaders in the IMPACT cohort were assistant principals, as opposed to principals. This created some tensions and challenges. As one participant explained, even though she was given "free reign" by her principal to lead IMPACT:

It has been awkward trying to fit my vision for IMPACT into someone else's larger school vision. And the communication has been good. It's not that it hasn't happened, but it's two separate people trying to work toward a goal coming at it from two directions. And him not being the person who was going to the meetings. For me, it's my life right now. For him, it's just another thing going on in our school.

Strengths and Supports

Overwhelmingly, participants noted various people as their most important supports for planning and implementing their action plans. Most commonly, they noted their building IMPACT teams (comprised of four core content teachers and the media specialist), the leadership coaches assigned to them, fellow students in the cohort, and their university instructors. Some participants also mentioned district leadership, especially technology personnel. Each of the participants felt that there were people

instrumental in bringing the plan together and then breathing life into it; these people also nudged the leaders when needed:

The IMPACT team . . . Just by being willing to do the work, by being willing to ask questions, by being willing to be open, by kicking me in the rear end when needed to be kicked, and by listening to my thoughts. Again, my technology department—technology coordinator—has been instrumental in what we’ve been able to do . . . And UNCG faculty, and the leadership training has been very, very helpful. And the coaching, the coaching aspect of it. I get frustrated because every time they come, they leave with me being half ticked-off because of, they ask the questions they need to ask, so I wish we had more time with them.

Participants also noted their university coursework as being instrumental in planning and implementing their action plans:

Working with Dr. Hollis [pseudonym used] now, for the first time, Dr. Hollis is starting to put together the pieces of ok, this is how we monitor what we’re doing to make sure we’re getting the impact that we should out of IMPACT. How we monitor our professional development (PD)? Is the PD being successful? Do we need to change something we’re doing based on what our data says? Is our student data aligned with the professional development that we’re providing? Are we doing the right things for children? You’ve got to monitor that for data and that part of our plan is still evolving. We’re still learning as practitioners how to do that now in our graduate courses. . . . That is an important part of implementation and monitoring as a leader and teaching our teachers how to look at data to see if what we’re doing is either effective or ineffective. And it’s okay to fail; it’s just not okay to keep doing it.

Without exception, participants lauded their fellow cohort members as being invaluable supports:

Oh my God, we talk all the time. The cohort has been an extraordinarily close cohort. We talk all the time about how our plans are set up, what are you doing with this, maybe that’s something I need to be looking at . . . We have looked at each other’s plan and we coach each other along and it’s been not only a coaching thing but a cheering each other along as well. It’s an arduous process doing these things . . . We don’t have anybody better to call than our peers in this game. We talk to each other more than we talk to our professors or our coaches.

In addition to people as supports, participants named several components of the grant that served as strengths for the project, including the emphasis on professional development (50% of grant funds had to be allocated to professional development), an emphasis on sustainability, and the relevance of the IMPACT project to other required initiatives (e.g., Common Core).

Changes in Action Plans

Each of the participants’ action plans changed substantially over time. Respondents referred to their plans as being a “living document” that “evolves” over time. All eventually saw their plans as guiding change in their schools, as opposed to—as many originally did—considering them artefacts “on a shelf”:

So we all wrote this action plan in the beginning when we wrote the grant, and I can tell you I don’t think any of us are using that iteration of our plan. And that iteration of the plan is pretty much defunct for us.

Some participants wrote their original action plans by themselves or with limited collaboration; over time, further iterations of the action plan were “much more of a collaborative effort” with the school’s IMPACT team.

Participants also talked about their plans becoming more narrowed and focused over time, and not so “pie in the sky.” The biggest change to the substance of the plans was to align goals with data for the purposes of monitoring and evaluation:

One of the things we said we wanted to do was raise test scores. Well, that’s a horrible measure, looking at it now. Yes, the score may have gone up. Was it related to technology? So through the process of the clarification . . . we’ve learned how to do some measurement . . . and to write a good goal that’s measurable. Those things have changed; it’s created better leaders.

Changes in Attitude toward Action Planning

Initially, most participants saw the required action plan as a pro forma step to accessing sizable grant funds. Over time, they came to see their revised action plans as authentic, guiding documents and to see the value of action planning: “It’s a living document that we [IMPACT team] review weekly in my office. Where are we? What’s on the calendar? What did we say we were going to do?” Further, as leaders, they gained the ability to apply their learning to other leadership endeavours:

When I first started, I had no idea how to even begin planning, setting the goals and how to measure it, and all of those things. Over the course of this time, I feel like I have a much better idea now of how to do this if I had to do it again with a different project.

Participants moved from the frustration of amorphous and possibly shifting expectations to a place of empowerment and energy:

In regard to IMPACT V, for about a full year, was pretty negative. We whined, we complained, and that was pretty much to [the state agency’s] face. I was pretty astounded at some of the, I don’t think venom is the right word, some of the angst . . . [now] I feel very comfortable that we’re going to do what we set out to do. I feel comfortable that we’re making the strides.

Increasing clarity regarding the IMPACT model and expectations, as well as coursework and instruction on topics such as data and evaluation, and the impact of early stages of implementation led to excitement and hopefulness:

We’ve moved so far ahead of where we were so I’m really proud of my whole school and all my teachers because there’s definitely that effort there. We’re not perfect and again, we’re not where we want to be, but gosh darn we’re a lot further than we were. So I’m really proud of them.

Participants also recognized the long-term benefits of the implementation of their action plans:

It has been a growing experience for me, and I think it’s becoming a growing experience for my staff, which is as I would expect it. It’s hard to lead something you don’t understand yet. I’m getting to a place now where I understand it, I understand what it should look like, and it’s

changed my vision for where I'd like to see my school two or three years from now. But I also understand that these changes don't happen overnight necessarily. I'm starting to learn now a lot more than I understood last year.

Overall, participants believed that their work with IMPACT made them better leaders:

I'm at a different place now in my leadership capability than I was a year ago . . . In short, the grant, I think, in the end is going to be an extraordinarily powerful grant . . . And I think it will be extraordinary in my school. It's just going to take a couple of years. And I mean a couple more years.

Artefact Analysis

Artefact analysis supports the qualitative findings that the project action plans significantly changed and evolved since the introduction of the logic model into the project. Evident from Table 2 below, the participants' action plan artefacts garnered between a 0 and a 1.78 mean on the pre-participation rubric, and between a 1.44 and a 3.89 mean on the post-participation rubric. A Wilcoxon test was conducted to evaluate whether the post-participation rubric scores were statistically significantly higher. The results indicated significant differences on six of the seven rubric categories with the post-participation means being higher. The rubric categories with the highest gains were evaluation-related items, including explained evaluation questions (with mean differences of 2.64 from 0.92 to 3.56) and identified evaluation data sources (with a mean difference of 2.39 from 1.50 to 3.89).

Table 2

Analysis of Rubric Categories from Pre to Post Participation in the Class (Wilcoxon matched pairs test)

Rubric Category	Pre-Participation		Post-Participation		Difference	Significance of Difference*
Introduced Vision for the IMPACT model at the school	1.92	0.97	3.11	1.36	1.19	0.062
Outlined Priorities/Objectives	1.33	0.83	3.22	1.09	1.89	0.011
Identified Steps/Strategies	1.42	0.83	3.22	0.83	1.81	0.011
Delineated inputs/activities with Timeline & responsible persons	1.58	1.13	3.22	0.83	1.64	0.017
Explained Evaluation Questions	0.92	1.30	3.56	0.88	2.64	0.007
Identified Evaluation Data sources	1.50	1.24	3.89	1.05	2.39	0.007
Summary and Next Steps	0.08	0.00	1.44	1.74	1.36	0.041
Totals	1.21	0.44	3.10	0.33	1.89	0.008

*Calculated using the Wilcoxon matched pairs test at $p < .05$.

Discussion

Our study is not complete at this time with four months remaining until the conclusion of the project. Our preliminary findings, however, allow us to suggest tentative answers to each of the study's research questions:

RQ1: What are the barriers, strengths, and supports to implementation of the IMPACT V action plans?

In terms of barriers, two major themes arose. First, was the sense that there was no initial direction, consistency, or continuity. This involved everything from everyone's plans looking very different from one another, inconsistent feedback, and even changing requirements of the project itself. The second theme was that because of the changing requirements, the results "did not make a lot of sense" and represented documents to just be "put on a shelf." Strengths of the process included the plans making more sense, and serving as a working document in which to evaluate progress of the project with measurable goals. Primary supports included the IMPACT V coaches, their fellow principals, project teachers, and the action research course they were taking at the same time.

RQ2: How did the participants' action plans change over time?

Through artefact analysis, it was clear that participant action plans were significantly different pre and post the introduction of the logic model. One high school action plan, for example, initially began with ten objectives focused on activities centred around technology integration. The central problem, however, was that this encouraged an emphasis on means or integrating technology in the absence of pathways towards specific and measurable goal attainment. Using a logic model framework which involved six elements—goals, inputs, activities, outputs, short-term outcomes, and long-term outcomes—the plan was rewritten into six specific goals followed by appropriate resources necessary to attain them, and with measurement strategies. Most importantly, outside of becoming more of a working document, use of the logic model allowed principals to prioritize technology integration activities based on goals and available resources.

RQ3: How do principals' attitudes about action planning change over time?

Their action plans, in fact, did change substantially over time to both their great frustration and ultimate satisfaction. According to one principal, he/she knew it was going to be a working document and it was "worded beautifully but couldn't be evaluated and measured . . . nobody told me that until just this past August." Frustration ensued because they had "put a lot of hours into this document, it (has) been to the entire school improvement team, the IMPACT team, central services, —thought it was good . . . but feedback needed, we are finally getting now." As participants were nearing the end of the project, one respondent remarked, "while it (has) been a frustrating process and we wish that we could have . . . inserted some of this at the beginning part of it, it is what it is."

Limitations and Implications

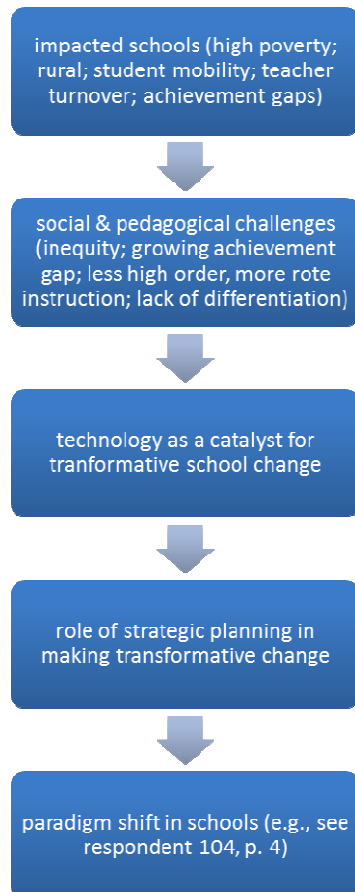
Limitations

The study has two primary limitations. First, only 11 principals and schools were involved, which reflects a low sample size and therefore limited generalisability. Second, the two-year grant project is still in process. As such, data is not yet available on the ultimate impact of the grant and action planning process on student learning and school culture.

Despite these limitations, the use of participant interviews and artefact analysis allowed us to triangulate data to identify emerging implications. The lessons learned may be useful in implementations with similar conditions. Figure 6 illustrates the theory of action underlying the IMPACT V approach to social change created by the authors. By pairing technology as a catalyst for substantive school change with systemic planning, pedagogical changes (e.g., increased expectations; higher order instruction) can influence social change (decrease in achievement gaps and increase in equity). The true impact and outcomes of the IMPACT V project in participating schools, however, remains to be seen in the future.

Figure 6

IMPACT V and Social Change



Implications

The use and integration of technology is intuitively a necessary and positive move in ensuring children are educated with the knowledge and skills they will need to be successful in a rapidly changing future. Systems thinking provides a logical framework from which to plan, implement, measure, and continuously improve technology integration projects that ultimately effect social change. This calls for the application of all three orders of system thinking: understanding the sum of the whole and its respective parts; adding constructivist meaning and perspectives to the natural order of complex systems (especially those involving human variables); and recognising that, in fact, complex systems are indeed complex and should often remain open and undefined and unreduced to a common denominator (Alhadeff-Jones, 2008). Harless (1998) operationalised all three through his accomplishment-based curriculum development (ABCD) process that emphasised end outcomes as opposed to rigid process or assessment benchmarks.

Conclusion

The preliminary results of our study suggest that principals, their action plans, and respective school implementations underwent a journey of discovery in how best to practice technology integration in a systemic fashion. As one respondent put it, their original plan was “beautiful” and vetted by the school stakeholders but was completely immeasurable and therefore difficult to achieve. Artefact analysis suggests that the original plans did a good job of articulating how schools were going to integrate technology but were done in a vacuum without clear pathways toward attaining specific short-term and long-term goals. The use of action planning must be situated within clear expectations and professional development and coursework related to systemic planning, logic models, and measurement. Additionally, participants need to know that action planning is an iterative process and that action plans are living documents that will necessarily evolve over time. Professional development, coursework, and experience with action plans significantly improve the quality of action plans. Finally, principals leading for substantive change need support systems that include coaches or instructors, and peers.

Additional trends and more comprehensive answers to the study’s research questions will take place after the study concludes in spring, 2013. The long-term implication of the study’s results is that it may serve as a playbook for future technology integration projects that will allow those that follow a clearer, more advanced pathway towards success. This should allow for others who follow a more precise process in which to frame the context of technology integration within the larger window of higher-level school outcomes and teacher-student accomplishments rather than as a goal and end in itself. Technology by itself is not directly correlated to higher student achievement; rather the goal is to appropriately integrate technology in such a way as to help facilitate and enhance the teaching and learning process towards achievement of clearly identified and negotiated student accomplishments.

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Appendix A

Interview Questions

1. Describe your school and its role with IMPACT V and how you came to participate.
2. Talk about how you designed and refined your action plans over time and what had the greatest impact on them?
3. To what degree, and in what ways, have the action plans been implemented at your school?
4. What are the barriers to planning and development of the IMPACT V action plans?
5. What went well in the planning and development of the IMPACT V action plans?
6. What are the barriers to implementation of the IMPACT V action plans?
7. What went well in implementation of the IMPACT V action plans?
8. Describe who has supported you through the IMPACT V action plan planning process. How?
9. Describe your general perspective towards the IMPACT V project in general and the planning process.
10. How has your perspective towards the project and action planning changed from when you first started?
11. Talk about the general perspectives of your principal peers toward IMPACT V action planning.
12. Is there anything else you would like to share (anything they would like to say)?

Appendix B

Action Plan Analytic Rubric

NAME _____ SCHOOL _____

Total Score _____/35

Action Plan Category	Definition and Examples	Excellent				Poor	Non-existent
		5	4	3	2	1	0
Introduced Vision for the IMPACT model at the school	Degree of completeness and clarity of the goals (i.e., what the project hopes to change) as a result of participation in the overall program. Examples: Goal: All faculty members will be 21st century professionals, using technology for teaching & learning, collaborating, and communicating. All students will be 21st century learners, using technology for thinking & learning, collaborating, and communicating.						
Outlined Priorities/ Objectives	Degree that the objectives (i.e., specific priorities that are measurable and lead to the overall goal of the program) are clear, accurate, and informative for the reader and are aligned with the overall goals of the program. Examples: All teachers will be encouraged and supported to advance along the Technology Use in Classrooms continuum (from "productivity" to "instructional presentation and student productivity" to "student-centred learning" through the effective Implementation of the IMPACT Model.						
Identified Steps/ Strategies	Degree that the steps are complete, clear, understandable, and consistent with the objectives of the program. Example: All teachers will have access to professional development and point-of-need coaching.						
Delineated inputs/ activities with Timeline and person	Degree that the inputs are complete, accurate, and provide an overview of the program scale and size with specific timelines and personnel (i.e., what people and resources are needed to achieve the objectives with concrete and realistic dates). Example: August 2011 - Needs Survey on Professional Development						
Explained Evaluation Questions	Degree that the evaluation questions reflect an understanding of what the program needs to ask that are observable, measurable, and realistic in giving an overview of the projects' implementation, value, and impact. Example: What type of support do teachers need? Are teachers using what they learn in professional development sessions in their classes? How so?						
Identified Evaluation Data sources	Degree that the data sources, collection techniques, and corresponding indicators to monitor the progress toward achieving the objectives are outlined for the program and realistic. Examples: Needs Survey Data; Anecdotal Evidence.						
Summary and Next Steps	Degree that the evaluative information above were used and summarized to discuss the implementation, value, and impact of the program of what actually happened and/or changed for the program constituents or community as a result of participating in the program and how this informs future directions. Interpretation of Data and Action Steps: What do the results mean? What are you going to do now?						