Evaluating Effective Teaching and Learning within Complex Levels of Interaction

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Abstract: Through a survey of evaluation data and reports collected from studies of successful ICT use in schools across 50 countries, the contextual factors regarding how schools can effectively integrate ICT is examined. A model of a strategic evaluation design and key findings is discussed, and, the systemic factors associated with understanding classroom level change are presented. The paper will conclude with a brief discussion of how a dynamic and complex set of activities function within multiple levels of interaction ranging from Macro, policy level analysis, Meso, school level analysis, and Micro, classroom level of analysis are necessary to support education reform efforts.

Introduction

Across the globe, conversations are taking place about the challenges facing education systems in transforming the classroom into a teaching and learning environment that enables new ways to explore, learn, and share knowledge. These conversations are increasingly turning to the role of technology in education. Inevitably, these same conversations turn to questions regarding the effectiveness of technology integration and what impact technology plays in the quality of teaching and learning in today's classroom.

For those in the private sector who are involved in the many aspects of education technology, the questions frequently challenge both the motives for their involvement and the efforts associated with understanding the effectiveness of these efforts. There is rarely agreement on the roles and methods of such private sector involvement, but there is agreement that as the demand for high-level skills continues to grow, the tasks associated with transforming traditional models of schooling to meet these demands are often hidden within the complex political, social, and educational systems in which they are so deeply embedded. Often, those in the private sector are far enough outside the political system to observe the opportunities and challenges associated with the many education reform efforts. This distance may inform activities intent upon transforming learning environments in local and global ways. Identification of the activities that support a shift from traditional education systems to the desired innovative learning environment will require exploration beyond the classroom to include the wide-ranging systemic change of programs, practices, and policies based on a clear theory of change.

The goal of this paper is to discuss an effective strategic evaluation design and help audience participants address some of their own concerns in designing an evaluation strategy. Using a set of core protocols and key findings, the design of the Intel® Teach evaluation strategy will be presented. In addition, the larger, systemic factors associated with understanding classroom level change will be discussed. The paper will conclude with a brief discussion of how a dynamic and complex set of activities function within multiple levels of interaction to support education reform.

Background

For over a decade, Intel® Corporation has been helping K–12 teachers to become more effective educators by training them on how to integrate technology into their lessons, and to promote problem solving, critical thinking and collaboration skills among their students. Following the introduction of computers in US classrooms in the early 1990's, there were few teacher professional development programs available to help teachers use this new technology in their efforts to improve student learning, (West, 1990; Yost, et al. 2004). The critical issue at the time was if teachers understood how the technology contributed to classroom instruction. As a result, the type of

teacher professional development, meaning the methods of teacher-training, the length of that training, and the training content, began to shift beyond hardware and software use to emphasize the instructional purpose of the technology and the impact on education (Makrakis, 1991), as well as the need for an improved quality and nature of teacher-training, (Hannifan, et al.1987).

By the end of the decade, U.S. Secretary of Education Richard W. Riley stated in a speech at the National Conference on Education Technology, "Teaching and learning that uses technology effectively can lead to greater academic success and make a real difference in the lives of students." He also added that, [technology] "…is not a substitute for solid teaching and learning - but a tool to help teachers teach and help students learn at the highest levels and helps teachers teach more effectively. Technology is one part of a comprehensive quality learning experience that, at its very core, involves the concept of teaching people to think and to continue to learn throughout their lifetimes so that they can benefit from change", (Riley, 1999)

To address the need for teacher professional development that moves beyond applications, the Intel® Foundation contracted with the non-profit Institute of Computer Technology in March 1998 to collaborate on content development and to create a program designed to train classroom teachers how to integrate computers into their existing curriculum. In 2008 the program began to be recognized as the Intel® Teach Program, and had trained more than five million teachers in more than 40 countries. To date, the program has trained more than seven million teachers in more than 50 countries to be more effective educators by providing content and instruction in ways to effectively integrate technology into their lessons to promote problem solving, critical thinking and collaboration skills among their students, and is committed to reaching 13 million teachers by 2011, (Intel, 2008).

A key element of the Intel® Teach program is maintaining localized content and administration through a train-the-trainer model where local training agencies recruit and train master teachers who will each train additional classroom teachers. In addition, Intel® partners with governmental entities to address various components of the education system including: policies, professional development, pedagogy, curriculum, assessment, information and communications technology (ICT) use, school organization, and at the higher education level, the development of technical curricula and research programs. Intel's involvement is intended to help educational systems move from an approach that emphasizes the acquisition of knowledge, to one that emphasizes conceptual understanding and the application of concepts to real-world situations. All of the programs are designed to improve the effective use of technology to enhance the quality of education, to promote the development of 21st century skills, and to encourage excellence in mathematics, science, and engineering. (Light, et al., 2009)

In addition to program and infrastructure investments, Intel® has also invested in rigorous program evaluation to establish and sustain continuous improvement of these educational products and activities. The research and evaluation compiled for this purpose has not only enabled the improvements of the program development efforts, but now also comprises a comprehensive body of evidence that demonstrates program impact. (Michalchik, Light, Price, 2009) As a result of these efforts, critical evidence has emerged that may inform efforts to measure impact related to ICT in education, beyond student assessment to include complex systemic factors.

Evaluation Design

The Intel® Education programs worldwide are evaluated by local research teams which conduct studies within individual country and language contexts. To ensure a consistent approach across the international programs, these local teams are based upon a framework that begins with a conversation between the evaluators and the program managers to articulate clear goals and objectives, implementation strategies and local contextual dependencies of the project. From these conversations, the evaluator can begin to identify specifics around the intervention, the theory of change and the research questions that identify measureable indicators of success.

The evaluations vary depending on country context as well as program maturity. A look at the multiple dimensions of this comprehensive evaluation program considers a developmental approach to identify phases of evaluation in relation to program maturity. Evaluations of programs in early stages of development, or pilot efforts, focus on formative data collection within the areas of localization, adoption and comprehension. As program evaluation results were compared to the stated goals and objectives of the programs, a set of indicators have been identified that address relevant questions about program performance. Findings from independent evaluation resulting from the analysis of existing longitudinal end of training evaluation data indicate that after completing the teacher professional development program, teachers feel more prepared to address the challenges involved in making ICTs a part of everyday classroom activity and to feel more aware of good instructional practice regarding effective integration of technology in schools (Martin & Shulman, 2006).

Evaluation efforts that explore expanding program focus on continuous improvement processes and application or learner impact within the classroom environment follow. It is the findings from independent evaluation six months after training reveals that teachers: 1) Use technology much more for their own productivity and professional development, 2) Use technology in more varied ways with their students, and 3) Use different teaching approaches (e.g., project-based learning and formative assessment) than they did before the training. In addition, 91% of teachers report their students are more "motivated and involved" in their learning and 81% say student projects show "more in-depth understanding" (Lght, et al, 2006)

Upon maturity, long-term follow-up evaluations focus on sustained learner-centered teaching, technology use and activities. This strategy is designed to identify key outcomes through consistent evaluation standards and using effective quasi-experimental designs, including such tools and methods as participant surveys, site observations, interviews, case studies, focus groups, and reviews of student work when applicable. It is a result of these follow-up studies that the complexities that influence teacher changes in attitude, knowledge and behavior begin to emerge as peripheral environmental factors that must also be understood, in order to optimize teacher professional development efforts focused on classroom activities [Fig. 1].

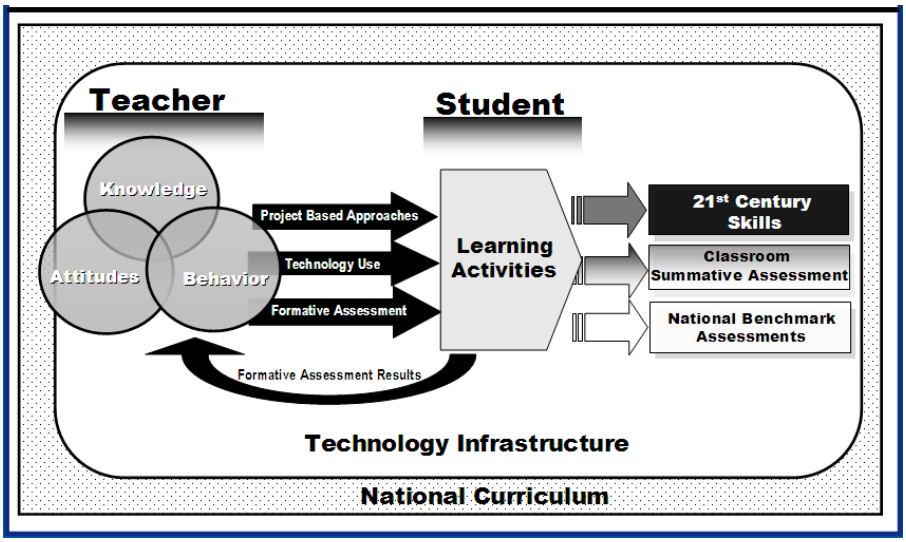

Figure 1. Logic Model of the Intel® Teach Essentials Course Influence on Teaching and Learning

Understanding the Complexity

Traditionally, analysis of instructional practice and classroom activity has been measured through student assessment systems. These traditional assessment practices have expanded beyond measuring student learning aligned to curriculum goals to also include monitoring and accountability of school improvement efforts. As noted by Douglas, (2009), "Progress in studying the complexity of classroom instruction on a large scale relies on our ability to pose research questions at the appropriate levels of analysis and to attempt to answer the questions using rigorous methods." Therefore, traditional means to measure the success of non-traditional education reform efforts using technology, present neither the appropriate questions, nor analysis at the appropriate level. As a result, there is an increasing need to understand the interactions between students change in activities, teachers change in practice, policy change in standards and curriculum, and process change in how students engage with content.

To identify an appropriate evaluation strategy for these various activities and levels of interaction, it is important to understand a comprehensive logic model that identifies the intervention, the context and the audience with valid cause and effect relationships that lead to the desired behaviors with relevant measures. In order to transform general project goals and objectives into observable and measurable phenomena, it is crucial to have a clear and realistic understanding of the project design and reasonable expectations. The evaluation design must consider that schools are full of complex political and social dynamics.

In their article titled "Equity and Excellence in America's Schools: The Case for 'Learning Equity' and a Proposed Model for Analyzing Statewide Education Reform Initiatives," Bobbett and Ellett (1997) describe a

framework of analysis for understanding large-scale education reform initiatives within multiple levels of interaction: 1) Microanalysis (policy level); Mesoanalysis (school level), and Microanalysis (classroom level).

Macroanalysis views education reform efforts from a perspective external from the school at the policy level. "Measurement and evaluation at this level attempts to understand such initiatives from the perspectives of policy makers, their constituents, resource allocation, power relationships, political costs/benefits, and so on" (Bobbett & Ellet, p. 15). Most reform initiatives have been and continue to be analyzed from this perspective. As a result, often data collected in evaluation activities focuses on quantifiable accountability measures such as: cost, duration, logistics, participant rates, and materials distributed or collected. Rarely do such measures clearly illustrate *how* a reform effort is affecting a change in attitudes, knowledge or behavior. Often, consequences of these measures are used in a punitive manner if outcomes fail to meet policy requirements.

A Mesoanalysis of reform efforts views implementation strategy from the school level. According to Bobbett & Ellett, this perspective, "appreciates what is known and understood about schools as complex social systems and organizations (p. 17)". *Site-based management* has been used to describe this approach. School administration and decision-making may affect how policies are implemented and enforced at this level, but more importantly, school leadership may influence the *school culture* and through their own actions that either support or prevent changes in activities. For example, a recent study by Martin and Shulman, (2006), indicated that teachers who hold student-centered or "constructivist" pedagogical beliefs tend to value technology integration more than those whose beliefs about teaching are more teacher-centered. Often the pedagogical beliefs of the chief administrator influence the beliefs of the teachers within a particular school. As a result, Mesoanalysis is a critical level to consider due to its impact on sustainability.

At the Microanalysis level, reform efforts are viewed at the classroom level. As the goal of any education reform effort must be to improve student learning, and most student learning in the formal education system is designed to take place in the classroom, "impacting the quality of teaching and learning at the classroom level should be a major goal of any policy-based reform initiative" (Bobbett & Ellet, p. 19). Therefore, considering such teacher characteristics as attitudes and instructional practices is critical. As Palardy and Rumberger, (2008) discovered, attitudes and instructional practices combined account for more variance in student learning than teacher background qualifications. In addition, evaluation efforts that consider the interactions between both students and teachers with school structures for the creation of productive learning environments are necessary. (Tobin & Kincheloe, p. 43)

Conclusion

The purpose of conducting research on education ICT is to further the understanding and advancement in teaching and learning through innovative uses of technology. Progress in understanding the factors and characteristics of effective integration of technology use in education relies on our ability to approach evaluation at the intersection of teachers, students, and policies within the surrounding classroom, school, and political environments. Education excellence is defined in terms of the quality of actual teaching and learning processes at the classroom level and at the individual school level. Historically, many reform efforts to improve education have been tied to policy-based initiatives that focus on student-centered assessments; as a result, maintaining these large-scale initiatives is often difficult due to a lack of understanding of the school as complex organizations. Often, failure of many reform initiatives results from the inability to understand issues related to useful, current and relevant educational change, and ill-defined concepts regarding implementation strategies and desired outcomes.

Effective, sustained policy-based education reform initiatives must be understood at the school level but designed at the classroom level. Providing analysis that recognizes intended accountability requirements, yet is flexible in its implementation while identifying specific and observable desired behaviors, is necessary to transform the traditional classroom. For example, it is unrealistic to expect a reform program to transform teacher practice if the design does not include professional development nor directly engage classroom teachers. Means, (2009), in her report to the US Department of Education states, "While technology has changed what is possible and how students can be supported and resourced in their learning, the principles of effective instruction never really change. The technology is not what drives learning but simply what mediates and supports the process; therefore, it is vital that professors, instructors and teachers remain focused on the overall process of learning and their own teaching strategies and methods throughout. What has significantly changed is the way in which these effective teaching strategies can be achieved at a higher level using new technology" (p. 12).

Progress in studying the complexity of classroom instruction on a large scale relies on our ability to pose a research approach with questions at the appropriate levels of analysis, and to attempt to answer the questions using

rigorous methods. For an evaluation to be useful, it needs to be built around an expected outcome, some prior concept of what that outcome would look like and a set of indicators of success. This stage of the evaluation entails transforming the general goals and objectives of the project into observable and measurable phenomena. Furthermore, the choice of outcomes should be closely linked to the level of analysis with the desired outcome corresponding to the level of analysis. Lastly, it is crucial that the definitions of success be realistically based on the context and alignment to the project design. As a result, we may not be able to predict specifically what will happen in such a complex system, but we can identify patterns or trends and then, incrementally, focus on improving individual components of that system.

Evaluation reports from the Intel® Education initiatives can be found at: http://www.intel.com/education/evidenceofimpact/EvaluationReports.htm

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