Critical Factors to Developing Successful and Sustainable Educational Technology Systems

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Abstract

This paper highlights the lack of deep and targeted research in the area of sustainable educational technology systems. Unlike private corporations, K-12 institutions have not significantly studied and quantified the impact, failed technology systems have on education. Current research and studies do not directly identify factors that improve return on investment and implementation, as it relates to meeting budget, timeline, cost and other pre-implementation factors. To identify critical factors necessary to developing successful and sustainable educational technology system, a research study employing a mixed-method design with a pragmatic approach is proposed.

Keywords: Sustainable, Educational Technology, Pragmatic, K-12 Education, Mixed-Method

The Problem

As the world our students live in continue to modernize and evolve, we tend to find a revolving door of new educational technology programs and initiatives implemented to improve K-12 education. As a K-12 educator, for almost a decade, I have experienced countless school, state and national technology systems that came and went without evident positive impact or success of its intended purpose. Oftentimes, these technology programs and initiatives were considered necessary for various reasons to improve education or solve a problem. However, many of these systems likely failed to mature to expectation and created a great cost to the educational environment.

As highlighted in Anthony Picciano's study on K-12 Online Learning programs, several major States such as Michigan, Alabama and others, continue to pass State-level policies that require greater use of online learning tools to improve K-12 Education. (Picciano, 2008) Additionally, the education sector continues to realize significant institutional interest in the use of mobile technologies to teach students in new and innovative ways. (Cavus, Nadire & Dogan, 2009) Furthermore, for over three decades significant research and implementation continue to be carried out to reduce the digital divide between students having access to technology and those who do not have such access. (Van & Hacker, 2003) Although the aforementioned initiatives, interests and research may differ in purpose and cause, they are all factors that fuel a continued influx of technology projects and systems, designed to improve education.

The major problem is that unlike private corporations, K-12 institutions have not significantly studied and quantified the impact, failed technology systems have on education. Nor has K-12 institutions identified key factors that contribute to sustainable educational Information Technology (IT) systems. In 1994, the Standish Group began collecting survey data from over 365 executives of small, medium and large companies across major industries. With

over 8,380 IT projects represented in the survey, the Standish Group was able to identify that a staggering 84% of IT projects were relatively unsuccessful. (The Standish Group, 1994) This 1994 report sparked greater conversations about the impact of IT systems and the importance of understanding factors that improve the success of IT projects.

Understanding Success Factors is Important

The impact that failed IT projects and initiative have on aspects of a school is not always evident or quantifiable. However, the financial impact and opportunity cost of failed IT projects are great and should be studied in K-12 education. To put this into perspective, the United States spent an estimated $6.9 billion in 1999 on desktops, servers, routers, wiring and Internet through Federal, State and local initiatives. (Kleiman, 2000) Since 1999, annual educational IT expense has increased dramatically, as educational IT expenses reached an estimated $56 billion in 2012. (Johnson, 2011) The increase between 1999 and 2012, equates to a $3.8 billions annual increase over the thirteen-year period. Using this trend, educational IT expenditure projects to be approximately $71 billion in 2016. Schools have continued to spend an extraordinary amount on educational technology. With already shrinking budget, each dollar that is spent on technology is one less dollar that is spent to reduce class size, hire additional teachers, purchase classroom supplies and support other instructional areas to improve educational outcomes.

United States' lacking knowledge of educational IT failure rate and factors that improve IT success will continue to equate to millions of dollars lost. It is both illogical and economically unethical to spend on projects without knowledge of the key factors to success. Likewise, the inability to calculate the return on investment (ROI) of education IT projects preclude the ability to accurately assess the effective use of taxpayers' dollars in K-12 education. ROI is the estimate or actual value realized from monetary investments over a period of time. The calculation ROI requires calculation of monetary and opportunity costs, benefits, and time scale. (Summing It

Up, 2003) Success and sustainability of educational IT systems directly relate to the calculation of ROI. Sustainable and successful IT systems ultimately mean that financial and non-financial investment were logical to some degree because there is a tangible, successful and sustainable product. Further ROI analysis using actual cost, timing and intended benefit would be needed to calculate a more accurate ROI. However, it is feasible to conclude that educational IT systems that are delivered late, fail, remain unused or discontinued within a short timeline, produce very low or no ROI.

Current Research

There has been extensive research carried out and articles written that list factors of software and IT projects in specific countries. (Nasir, 2011) However, research shows that there is a lack of concrete and aligned content specific to sustainable educational technology systems. Research on factors that lead to sustainable educational technology systems also lacks deep or targeted research. Alexander J. Romiszowski carried out the most closely aligned study, which focused on factors leading to successful or failed educational technology innovation. However, in his study, Romiszowski found that, many lists of critical factors were opinions with little supporting evidence composed by non-practitioners. (Romiszowski, 2004) Throughout the research process, there are a number of indirectly related studies and literature that connect to sustainable educational technology systems and factors that builds a foundation for future research.

In relation to sustainable educational technology, Beborah Lowther and a team researchers, investigated the effectiveness of Tennessee EdTech Launch (TnETL), which was a technology program development and implemented to meet the technology standards set by the No Child Left Behind Act (2008). The goal of the TnETL was to use trained full-time technology coaches to help teachers develop dynamic lesson that increased students' a

technology skills. **(**Lowther, Inan, Strahl & Ross, 2008) To evaluate TnETL, Lowther and her team, used a combination of surveys, observations, interviews, student performance data and focus groups. Their research concluded that the TnETL was successful in improving student engagement and achieving higher student results when comparing data from sample and control groups. However, most importantly, the study concluded that sustainability of the program was a major concern to continue the TnETL program. The studied identified sustainability as a key area that required future research. **(**Lowther, et al., 2008)

In 2009, Lu Ruiling and Richard Overbaugh conducted a research study that examines teachers' perception of their work environment and the factors that enhance or prohibited their use of instructional technology. Ruiling and Overbaugh used both quantitative and qualitative data to derive results that showed that the most crucial problem to technology success was timing, ability to solve problem quickly, equipment, teacher training and technical support. Lu and Overbaugh suggest that although expenditure on technology have increased and systems have been in place for over five years, use and integration have been low. (Ruiling & Overbaugh, 2009) Ultimately, the systems were ineffective.

Similar to Ruiling and Overbaugh's study, Yong Zhao and a group of researchers carried of study in 2002 that also investigated the factors that improve technology use in the classroom. This study found 11 salient factors that significantly impacted the success of current classroom technology innovation. These factors aligned to the teacher, nature of the classroom, access to and ease of technology. (Zhao, Pugh, Sheldon & Byers, 2002)

Although the three studies, previously mentioned, touched on effectiveness or identified critical factors to successful educational technology, they centrally focused on current technology use in the classroom. The studies did not directly identify factors that improve implementation, as it relates to meeting budget, timeline, cost and other pre-implementation

factors - which limits the scope of the studies. Due to this limited scope, the three aforementioned studies and other bodies of research are not directly aligned to identifying a complete picture of the factors that create successful and sustainable educational systems.

Future Research

Current literature teaming with the rapidly changing nature of educational technology, suggests that further research is needed specific to sustainable educational technology. Steven Ross, Gary Morrison and Deborah Lowther, discussed the exponential growth of educational technology and use with the lagging growth of deep research and study in the field. The researcher's investigation cites that educational technology in schools is growing at a rapid pace and is one of the most important problems for future researchers. (Ross, Morrison and Lowther, 2010) The highlight of this study suggested that although the field of educational technology is increasingly diverse, significant research methods, framework and evaluation have not been developed to measure educational technology's effectiveness or sustainability.

Research Design, Approach and Methods

Research Design

To identify factors that most contribute to successful and sustainable educational technology systems, this research study will employ a mixed-method design with a pragmatic approach. Due to the dynamic and broad nature of this topic, as seen within current research, both quantitative and qualitative data will be used. Generally, using a mixed-method approach provides a more complete understanding of a research problem than a qualitative or quantitative approach. (Creswell, 2013)

Research Approach and Philosophy

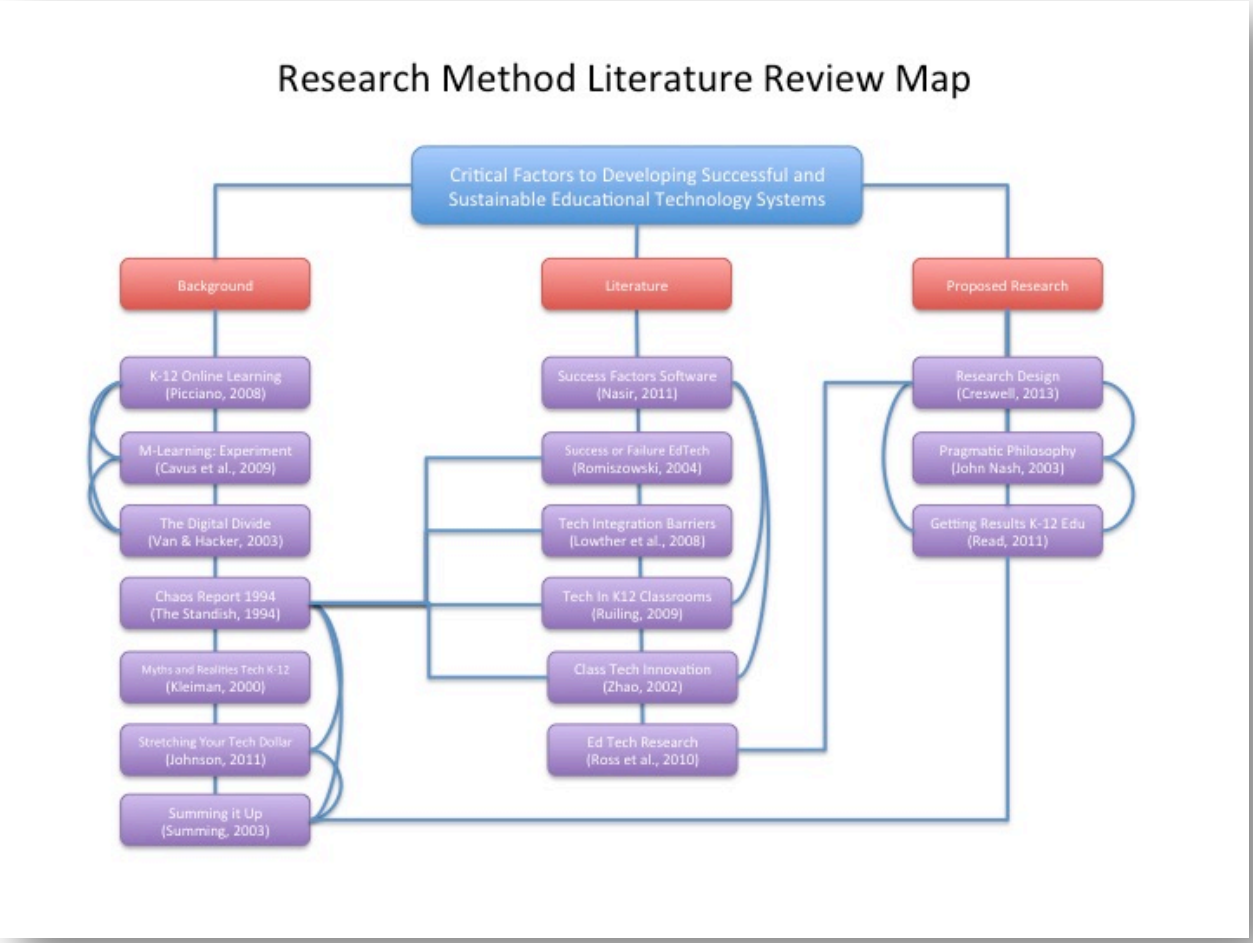
It is likely that during the research process, either quantitative or qualitative tools my dominate the means of data collection. Additionally, assumptions will not be made prior to

analysis to allow for a no-bias pragmatic approach. Pragmatic philosophy assumes that the decision-maker (researcher in this study), is always seeking the realization of intention, and is rarely indifferent to any situation. (John Nash, 2003) Having a pragmatic approach allows the data collection to take this research study in the most beneficial direction to derive a meaningful conclusion.

Research Methods

The proposed research method to be used in this study will include the use of opened-ended questions that target, teachers, administrators and students. A qualitative series of open-ended questions will be generated from quantitative data collected from target groups group. Similar to the study carried out by (Ruiling, 2009) and (Zoah, 2002), a technology survey, using a similar 5-point scale, that focuses on identifying factors that are critical to implementing successful and sustainable educational technology systems, will be given to participates. The results of the surveys will then be evaluated and used to develop in-person interview questions to capture qualitative data. Qualitative information helps bring the numbers found in quantitative data to life and develop deeper meaning. (Read, 2011) Therefore, qualitative data will be employed to identify trends or connection in the data collected from the surveys. Data collected from both methods will be analyzed by expert third parties and used to determine common factors that contribute to implementing successful and sustainable educational technology systems.

Appendix I: Literature Map



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