Research Article

Factors Affecting Teachers' Use of ICTs in the Classroom: A Systematic Review of the Literature

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Abstract

ICT for education heralded much promise for improving learning outcomes, but results have not lived up to expectations. To understand why, researchers are increasingly exploring the factors that affect teachers' acceptance and use of ICT in the classroom. This study adopts the systematic review approach used in clinical research to systematically search, screen, assess, and synthesize the literature on ICT use in classrooms and determine effect sizes, if any, of factors affecting teachers' acceptance and use of ICT. We find that teachers' perceptions about the usefulness of a particular technology are twice as important as their perceptions of the technology's ease of use. We also find that two particular facilitating conditions—the provision of one laptop per child and on-site coaches—increased the use of technology by teachers by effect sizes ranging from 0.48 to 1.31.

Introduction

The use of ICTs in primary and secondary schools in developing countries is expected to take student learning to higher levels, but that promise has not been realized (Bingimlas, 2009; Lagrange, Artigue, Laborde, & Trouche, 2001; Tamim, Bernard, Borokhovski, Abrami, & Schmidt, 2011; Tamim, Borokhovski, Pickup, Bernard, & El Saadi, 2015; Tolani-Brown, McCormac, & Zimmermann, 2009). Studies of large-scale government interventions in the United States, Canada, the United Kingdom, and Europe have found that ICTs do not bring about the expected benefits in the developed world either (European Commission, 2013; OECD, 2015; Ringstaff & Kelley, 2002; Ungerleider & Burns, 2002). Recent system-wide surveys of ICT use in schools in Organisation for Economic Co-operation and Development (OECD) countries, for example, indicate that the strength of a school's ICT infrastructure is not correlated with educational achievements.

Many studies are available on ICT use and learning outcomes in specific subject areas, in mathematics in particular. For example, Cheung and Slavin's (2013) systematic review of research on the effects of ICT-based applications of mathematics on student achievement in K–12 classrooms found that educational technology applications produced a positive but only modest effect (effect size = 0.15) compared with traditional methods. Effect size is the difference between the average or mean outcomes in two different intervention groups. An effect size of 0.2 to 0.3 is considered a small effect, 0.5 a medium effect, and 0.8 to infinity a large effect (see, e.g., Sullivan & Feinn, 2012). As Cheung and Slavin (2013) note, the length of time that students get to use computer applications and the extent to which those activities are integrated into the curriculum in the classroom should be investigated more closely:

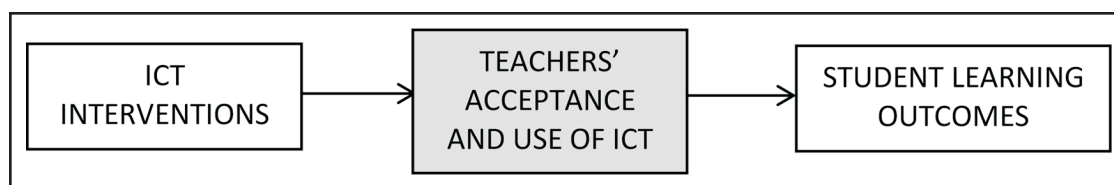| ICT INTERVENTIONS	→	TEACHERS' ACCEPTANCE AND USE OF ICT	→	STUDENT LEARNING OUTCOMES

Figure 1. The black box in the use of ICT in education.

Reviewers and researchers often treat the limited time devoted to technology as an implementation problem, but perhaps it speaks to a fundamental problem that separate CAI [computer-assisted instruction] programs are not well accepted or seen as central to instruction by teachers, so teachers may not make sure that students get the full amount of time on technology recommended by vendors. Future studies should investigate more closely the impact of the time and integration factors for various grade levels. (pp. 101–102)

In the present review, we focus on what one might call the black box in ICT in classroom education—that is, the acceptance and use of ICT by teachers (see Figure 1). Ideally, a teacher's acceptance and use of technology should be seen as a necessary condition for the success of technology interventions, but the vast literature on the impact of ICT on student learning outcomes neglects the critical role played by teachers. In the next section, we examine in detail the black box—or teachers' acceptance and use of ICT in the classroom.

Theories of Acceptance and Use of Technology

The literature reveals five or more theories about the factors that influence teachers' use of technology: social cognition theory (Bandura, 1986, 1994); innovation diffusion theory (Rogers, 1995); expectancy value theory (Eccles, 1983); the technological pedagogical content knowledge framework (Koehler & Mishra, 2009); the technology acceptance model (TAM) and its variations; and study-specific theories (Davis, Bagozzi, & Warshaw, 1989; Venkatesh & Davis, 2000; Venkatesh, Morris, Davis, & Davis, 2003).

The TAM by Davis and colleagues (1989) is an application of the theory of reasoned action by Fishbein and Ajzen, first introduced in 1975, and improved later (Ajzen, 2006). According to the 1975 version, intention toward a behavior is the strongest predictor of a particular behavior. The intention in turn is determined by behavioral beliefs and resulting attitudes. In the case of technology acceptance by a teacher, perceived usefulness and perceived ease of use of the technology are the behavioral beliefs. Perceived usefulness is the degree to which a person believes that using a particular system would enhance his or her job performance. Perceived ease of use is the degree to which a person believes that using a particular system would be easy.

Unified Theory of Acceptance and Use of Technology

To improve the explanatory power of the TAM, Venkatesh et al. (2003) evaluated 12 other models from the literature to develop the unified theory of acceptance and use of technology (UTAUT). According to the UTAUT, the efficacy of interventions to introduce a particular technology in a workplace depends on the perceived usefulness, perceived ease of use, social influence, and facilitating conditions. A detailed view of processes within the black box, which is based on the UTAUT, is given in Figure 2.

A preliminary mapping of the studies included in the review found that most studies used study-specific models or theories of change for their analyses and hence were not suitable for synthesis across studies. On the other hand, studies using TAM, UTAUT, or related theories constituted the largest subset of studies, and the set was comparable across studies. Therefore, we limited our review to studies that used the TAM or related theories such as UTAUT as the analytical framework for the theory of change.

Specificity of Technology Used

Fishbein and Ajzen (1975) identified three main factors that determine the correspondence between intention and behavior: specificity of the behavior, stability of the intention, and volitional control. They highlight the important role played by specificity: "Perhaps the most important factor influencing the size of intention-
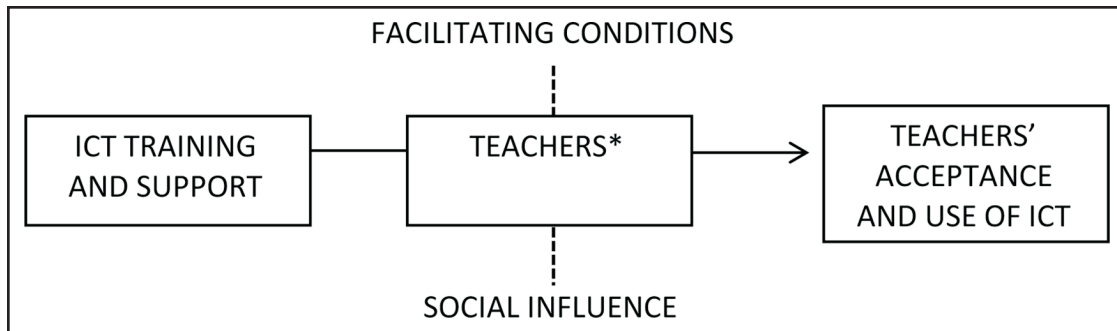
Figure 2. Inside the black box: Factors affecting teachers' acceptance and use of technology, based on the unified theory of acceptance and use of technology.
*Individuals with perceptions of usefulness and ease of use of ICT and attributes such as age, gender, and education.

behavior relation is the degree to which the intention is measured at the same level of specificity as the behavior to be predicted" (pp. 369).

In a more recent work, van Acker, van Buuren, Kreijns, and Vermeulen (2013) reiterate the importance of specifying the technology when examining factors affecting technology use. For example, teachers may have a positive attitude toward using e-mail to communicate with students but might feel quite anxious when using an electronic blackboard. Therefore, measures of a general attitude toward ICT or of the intention to use ICT may vary widely due to the different ICT applications teachers may have in mind when responding to surveys on ICT use in the classroom.

Since *ICT* is a generic term that captures a range of technologies—such as computers, computer programs, electronic learning management systems, digital learning materials, and access to the Internet using computers—only studies that specified the particular ICT in question were included in the final synthesis of results.

Method

We used a systematic review protocol approved by the Evidence for Policy and Practice Information and Coordinating Centre (EPPI-Centre, 2014) at University College London Institute of Education to review the literature. Systematic review protocols ensure that literature reviews use transparent procedures to search for, screen, assess, and synthesize the results of relevant research.

Our search was limited to research papers published between 1990 and June 2014 and archived in ERIC, EBSCO, SCOPUS, SSCI, and ProQuest electronic databases with the title and abstract reported in English. These databases included or overlapped the Australian Education Index, British Education Index, Canadian Business and Current Affairs, Education Abstracts, PsycINFO, JSTOR, Sociological Abstracts, and Dissertation and Theses (United Kingdom, United States/Canada, and Australia), which were of interest as education research sources. The keyword phrase we used for the search was "teacher AND [ICT OR technology] AND [integration OR adoption] AND [training OR development]." We searched Google Scholar (http://scholar.google.com) and relevant institutional databases for research papers not captured by electronic databases, but we did not find any additional research papers from this "gray literature."

The screening process filtered out papers that did not include one or more studies that concerned the use of technology in the classroom, measured ICT use in the classroom, used TAM or a related theory as the analytical framework, and specified the technology in question (see Table 1). The risk of bias analysis tools of Waddington and Hombrados (2012) were used to assess the internal validity of one or more studies from each of the included papers. Any study that indicated a high risk of selection bias or confounding was excluded. There was insufficient information in most of the papers to evaluate other biases. The effect sizes of factors influencing teachers' use of ICT in the classroom were calculated by applying the standardized mean difference method from Waddington et al. (2012).

Table 1. Number of Included Papers by Review Step and Review Criteria.

Step	Criteria	No. of papers included
Search	Performs electronic search of ERIC, SCOPUS, PsycINFO, and ProQuest databases, and hand search of the gray literature	11,419
Screen 1	Concerns the use of technology in the classroom	1,999
	Measures ICT use in the classroom	64
Screen 2	Uses TAM as the theory and specify the ICT application	13
Appraise	Is free from a high risk of bias in regard to selection or confounding	9

Source. Gamage and Tanwar (2017).

Contextualization of findings is an important part of a systematic literature review. Typically, users of research are involved in the review process in an advisory capacity (Bunn et al., 2013). The users in the present case are policy makers who are responsible for making decisions about deploying ICTs for use in schools. Because it was difficult to identify such individuals with sufficient interest in contributing to the review process, we employed two alternative approaches. One was to contrast the findings with findings from national surveys of school systems in the countries where the studies included in the review were conducted. Since seven of the nine papers in the final review were from countries in the Organisation for Economic Co-operation and Development, and five of those were from the European Union, we contrasted our findings with observations from the latest OECD (2015) report and European Commission (2013) report.

A second approach was to share the findings after the fact with a range of stakeholders, including peer researchers, policy makers, and civil society organizations committed to using ICT in education in Asia. Our first user consultation was held on November 26, 2015, in Colombo, Sri Lanka, with the participation of policy makers from the Access to Information program at the prime minister's office of Bangladesh; the National Institute of Education, Singapore; and the Ministry of Education, the Ministry of Telecommunication and Digital Technology, the Department of Education of the Western Province, the Information and Communication Technology Agency, and the National Institute of Education of Sri Lanka. The consultation also included educators, researchers, and ICT industry and civil society representatives with an interest in ICT in education (for details, see Gamage and Tanwar, 2017).

Results

A systematic search of literature published from 1990 to July 2014 with at least the title and abstract in English yielded 11,419 records that captured the keywords used. The first title and abstract screening yielded 1,999 papers that concerned the use of technology in the classroom (Table 1, row 2). Of these, only 64 papers measured technology use in K–12 classrooms (row 3), and all except five of those 64 studies were published after 2000. A second screening for the theory used and specificity of the technology yielded 13 papers (row 4). After appraising for low to medium risk of bias, only nine papers could be used for effect-size calculations (row 5).

Of the nine included papers, seven reported measurable effect sizes for teachers' perceptions in the use of the following eight technologies:

- Algebra software, Singapore (Teo & Kwok-Kee, 2001)
- Digital learning environment, Belgium (Pynoo et al., 2011)
- Digital learning materials, Netherlands (Van Acker et al., 2013)
- Digital learning materials portal, Belgium (Pynoo et al., 2012)
- E-books, Republic of Korea (Kim, Choi, & Kim, 2012)
- Geographic information systems, Taiwan (Lay, Chi, Hsieh, & Chen, 2013)

Table 2. Ratio of Perceived Usefulness to Perceived Ease of Use, By Technology.

Technology	Ratio	95% CI
Digital learning materials (Van Acker et al., 2013; Netherlands)	2.79	[2.70, 2.90]
E-books (Kim et al., 2012; Republic of Korea)	2.70	[1.30, 4.10]
Geographic information systems (Lay et al., 2013; Taiwan)	2.65	[2.50, 2.80]
Digital learning materials portal (Pynoo et al., 2012; Belgium)	2.09	[2.00, 2.20]
Algebra software (Teo & Kwok-Kee, 2001; Singapore)	2.05	[1.60, 2.40]
Communication use of a learning management system (De Smet et al., 2012; Belgium)	1.29	[1.10, 1.50]
Information use of a learning management system (De Smet et al., 2012; Belgium)	0.89	[0.70, 1.00]
Digital learning environment (Pynoo et al., 2011; Belgium)	0.50	[0.10, 0.90]

Note. CI = confidence interval.
Source. Gamage and Tanwar (2017); eight studies from seven papers.

- Learning management systems for information, Belgium (DeSmet, Bourgonjon, De Wever, Schellens, & Valcke, 2012)
- Learning management systems for communication, Belgium (DeSmet et al., 2012)

In all seven papers, the relevant education authority in each school system either mandated the integration of the technology into the curriculum or made the technology widely available. All seven papers also used cross-sectional surveys of teachers for data collection and multiple regression or its variations for analysis. A standardized beta coefficient in a regression equation represents the increase in the dependent variable (in standard deviation units) for each standard deviation unit of increase in the independent variable in the question. In this study, the dependent variable is the extent of ICT use in the classroom, and the independent variables are the teachers' perceived usefulness and perceived ease of use the ICT in question, facilitating conditions, and social influence.

Teachers' Perceptions

The effect sizes for perceived ease of use (ES1) for the eight technologies ranged from −0.28 to 1.24. Similarly, the effect sizes for perceived usefulness ranged from −0.13 to 2.42. These wide ranges are not surprising given the diverse nature of the technologies. Facilitating conditions and social influence factors were not comparable across the studies. Details of calculations are described in the full systematic review report published by the International Development Research Centre and the Department for International Development (Gamage & Tanwar, 2017). Since it was not meaningful to synthesize effect sizes for seven different technologies, we examined the ratio between the effect size of perceived usefulness (ES2) and the effect size of perceived ease of use (ES1).

Ratio of Usefulness to Ease of Use

Venkatesh et al. (2003, p. 447) found that perception of usefulness is the strongest predictor of the intention to use technology in business settings. Yousafzai, Foxall, and Pallister (2007, p. 266) corroborate Venkatesh and colleagues' observations through a meta-analysis of the effect sizes for perceptions of usefulness and perceptions of the ease of use of a given technology. They find a body of literature that justifies the expression "no amount of ease of use will compensate for low usefulness." To our knowledge, no such prioritization of perceptions of usefulness or comparisons of usefulness with ease of use has been established for technology use in educational settings. In the present study, we compared the ratios of the effect size of perceived ease of use (ES1) to the effect size of perceived usefulness (ES2) for seven technologies to find two distinct groups of ratios—those with 95% confidence intervals within the 1.30–4.10 range (Table 2, rows 1–5) for an average value of 2.43 and those within the 0.10–1.50 range (rows 6–8) with an average value of 0.90.

Interestingly, the nature of the studies in the two groups is distinctly different. The first set of technologies (Table 2, rows 1–5) has ES2/ES1 ratios greater than 2 and is made up of five studies where the ICT applications

Table 3. Effect Size of Facilitating Conditions on ICT Use.

Facilitating condition	Measure of outcome	Mean effect size	95% CI
One laptop per child (Lowther et al., 2003; United States)	Use of technology as a learning tool, grade 6	1.31	[0.30, 2.31]
	Use of technology as a learning tool, grade 5	1.25	[0.24, 2.27]
On-site technology coach (Lowther et al., 2008; United States)	Use of technology as a learning tool or resource, Launch 1	1.13	[0.77–1.50]
	Meaningful use of computers, Launch 1	1.06	[0.70, 1.42]
	Use of technology as a learning tool or resource, Launch 2	0.90	[0.55, 1.25]
	Meaningful use of computers, Launch 2	0.48	[0.14, 0.81]

Note. CI = confidence interval.
Source. Gamage and Tanwar (2017); six studies from two papers.

were specific and concerned direct instructional use. The second set (rows 6–8) consists of three other technologies from three studies. These studies feature a learning management system or digital learning environment with many features that teachers can choose. For example, in Pynoo et al. (2011), teachers in the target group used the Smartschool digital learning environment, which consists of three modules (digital learning, communication, and administration). The use measures do not distinguish among those. De Smet and colleagues' (2012) measures of use distinguish between informational use and communication use, but the target group used one of three commercially available tools (i.e., Dokeos, Blackboard, and Smartschool). In future studies, learning management systems or digital learning environments perhaps should not be included in a specific applications category since these have multiple and highly diverse uses. Further, researchers should focus on one technology and go deep into teacher factors affecting the use of such technologies.

Facilitating Conditions

Of the nine included papers, only two measured the effect of facilitating conditions on the use of ICT in the classroom (Lowther, Ross, & Morrison, 2003; Lowther, Strahl, Inan, & Ross, 2008). Both were experimental studies carried out in the U.S. state of Tennessee. These two papers included two types of facilitating conditions in the form of one laptop per child (OLPC) and on-site coaching for teachers. The two papers together highlighted six technology use outcomes, which are listed in Table 3 (rows 3–6). For example, teacher training in the use of technology, when complemented by OLPC, increased the use of technology in the class by effect sizes of 1.31 in grade 5 and 1.25 in grade 6 (rows 1 and 2). Teacher training in the use of technology followed by an on-site coach in each school yielded effect sizes of 0.48 to 1.13 depending on the measure of technology used and the timing of the intervention's launch (rows 3–6).

The causal mechanisms behind the success of OLPC and on-site coaches as follow-up support for teachers are self-evident. Each child having his or her own device would lead to a higher use of technology in the classroom. Having on-site coaches would increase technology use by enabling teachers to get help for any difficulties they encounter. OLPC and on-site coaches are facilitating conditions. The expected outcomes are broadly defined as use of technology, meaningful use of computers, and use of computers as learning tools. The training given to teachers presumably concerned the expected outcomes.

Facilitating conditions that are proven to be effective in the present review are good, but they are expensive interventions. Would it be more cost-effective to work with a set of specific technologies and focus on identifying technologies that are already being used by some teachers?

In the present review, we did not find any synthesizable evidence on social influence.

Key Findings and Discussion

Teacher training followed up with facilitating conditions increases technology integration by effect sizes of 0.48 to 1.31 when compared with control situations with no such facilitation. The two facilitating conditions

are OLPC and on-site coaches. More importantly, teachers' perceptions of a technology's usefulness are twice as important as their perceptions of its ease of use. Due to the lack of studies, we are not able to show how perceived usefulness, for example, compares with the effects of peer influence or facilitating conditions.

Limitations

Some relevant studies may have been missed in this review because studies that measure learning outcomes may also measure technology use as an intermediary step, but this measure may not have been identified in our title and abstract screening. The screening process also may have screened out interesting studies on the use of mobile technologies in the classroom because they were not amenable to statistical comparison across studies.

Extending the Findings

Some relevant studies on ICTs do not get included in systematic reviews. For example, the European Union and OECD carry out system-wide surveys that provide a host of descriptive statistics useful to policy makers. The OECD (2015) study focuses on ICT inputs, ICT use, and student outcomes, and the EU study is more focused on teacher factors (European Commission, 2013). In both cases, teachers and students were surveyed about their generic use of ICTs or computers. The present systematic review highlights the importance of specificity of the technology for generalizing about technology use. To make system-wide surveys more generalizable and policy-amenable, teachers should be asked about their perceptions of usefulness, usability, peer influence, and facilitating conditions. As Yousafzai et al. (2007) note, it is unfortunate that well-established theories such as the TAM or its variations are not used more extensively.

Contextualizing

The systematic review process is designed to provide as accurate a picture as possible of the existing literature. The methodology has its origins in clinical research. Therein lies the main problem with systematic reviews as applied to social science research. As Sayer (1993) argues in his classic text on *Method in Social Science: A Realist Approach,* in analyzing the effect of one or more factors in a social science research problem, we try to control for other factors, but the controls rarely approach those that experimental studies are able to approximate. Therefore, the findings of systematic reviews of the social science literature must have a strong contextualizing component before they can be generalized and applied to other localities of interest (Bunn et al., 2013).

Of the nine papers included in the review, seven were from OECD countries (Belgium, 3; Netherlands, 1; Republic of Korea, 1; United States, 2); the other two were from Taiwan and Singapore. Therefore, we first evaluated the findings in relation to survey results from school systems in this collective of OECD countries (we were not able to find such surveys for Singapore or Taiwan).

Second, since all the studies included in the present review concern developed countries, the conclusion about the perceived usefulness of a technology being more important than its perceived ease of use needs to be tested in developing country settings. The TAM has been tested under many situations (Davis et al., 1989; Venkatesh et al., 2003; Yousafzai et al., 2007), although it is not clear whether it has been tested in organizations in developing countries. Therefore, we shared the review results with stakeholders from Sri Lanka and guests from Bangladesh and Singapore (see the introduction for details).

Comparisons With the Ground Situation in the OECD and the European Union

The OECD (2015) published a comprehensive report on students' use of ICT in school systems in OECD countries. One of the key findings of the survey is the lack of correlation between investments in ICT and educational achievements of children sitting for the test conducted by the Program in International Student Achievement. Teachers' lack of acceptance and use of technology could be major reasons for this finding, but such explorations were beyond the mandate of the study.

In an earlier survey, the European Commission (2013) reported its findings on teacher attitudes toward ICT use in OECD countries (excluding Germany, Iceland, the Netherlands, and the United Kingdom, for which the response rate was insufficient). The survey found that students have the highest frequency of ICT use during lessons when they are taught by teachers with

> high confidence in their own ICT operational as well as social media skills and ability to use the internet safely and responsibly, having positive opinions about ICT use for teaching and learning, as well as facing low obstacles and having high access to ICT infrastructure at school. (p. 14)

Such teachers are defined in the survey as "digitally confident and supportive." Further, between 20% and 25% of students in the survey were taught by such digitally confident and supportive teachers having high access to ICT and facing low obstacles to their use at school. Interestingly, students taught by teachers who are

> confident in their own ICT competence and positive about ICT use in teaching and learning, but facing low access and high obstacles to use it at school report more frequent use of ICT during lessons, compared to students taught by teachers having high access and facing few obstacles, but not being very much confident in their own digital competence nor positive about ICT use for teaching and learning. (p. 15)

These findings do not distinguish between the effect of teachers' confidence in ICT use (or their perceptions of ease of use according to the TAM) and their positive attitude toward ICT use (or perceptions of usefulness of ICT), but they demonstrate the overall importance of teacher perceptions in ICT use. A finding not revealed in our systematic review of the literature but revealed in the survey of schools is the modifying effect of teacher attitudes on low-access and high-obstacle situations (or poor facilitating conditions in the TAM).

Reactions of Stakeholders in the Developing World to the Review Findings

During a dissemination event held in Colombo, Sri Lanka, in 2015, Anir Chowdhury, policy advisor at the Access to Information program in the prime minister's office of Bangladesh, identified four myths about ICT for education strategies: (1) ICT education is essential for ICT use in education; (2) computer labs need to be established; (3) students should be taught computer literacy; and (4) the focus should be on technology, not teachers. In contrast, the Access to Information project's approach is to allow teachers to develop their lesson plans using very basic multimedia equipment, with digital learning material secured from the Internet or wherever as needed. The project facilitates peer-to-peer sharing of lesson plans through a Web portal. In effect, the program values technology and digital materials that teachers find useful and pays less attention to the specific digital technology or materials and their ease of use.

Other experiences presented at the dissemination event focused more on content and the technology than on teacher factors. Nenasa TV; Guru.lk; Khan Academy in Sinhala and Tamil, the local languages; E-Thaksalawa; Web Patashala; Edulanka; and ShilpaSayura are some initiatives from Sri Lanka that were presented at the event. Incidentally, most self-reported success was evident in the Bangladeshi case where the focus was teacher centered.

Implications for Research

Teacher Factors

The European Commission's (2013) Survey of Schools found that having "digitally confident and supportive" teachers was more important than facilitating conditions in the school systems in the European Union, but our systematic review of the literature did not find sufficient studies that quantified this relationship in a manner that is consistent across the studies. This lacuna leads to the important insight that in trying to understand factors affecting ICT use in schools, it is perhaps more productive to monitor implementation of system-wide ICT initiatives by school boards, or add value to system-wide surveys such as the European Commission's survey, than to attempt to apply study designs that are less than ideal for synthesis across studies.

Specificity of Technology Used

Adding to the above observation, future research on ICT use in a generic sense should be discouraged, and studies on specific ICT tools should be encouraged. For example, if the technology is specified as, say, "one e-book per student provided to all students by the school board," it is possible to understand in a meaningful way teachers' responses to questions about their attitude, acceptance, intention, and use in relation to the particular technology intervention.

Theories of Technology Use

Researchers of the use of ICT in education can explore the effects of different variables on technology acceptance and use, but they need to be encouraged to situate their findings in the unified theory of acceptance and use of technology or other well-established theories of change to make their studies more comparable. We were unable to use the bulk of exploratory observational studies because the independent variables used were not consistent across the studies. In contrast, where the TAM was used, the variables were always clustered within the four major variables of perceived ease of use, perceived usefulness, social influence, and facilitating conditions. If new variables are tested, it is the responsibility of the researcher to demonstrate the necessity explicitly.

Policy Implications

In situations where a school board or some authority is seeking to introduce ICT to improve learning outcomes, they are well advised to consider the teachers' perceptions of the usefulness of the technology. If the teachers feel the technology is useful, then their perceptions of the ease of use of the technology are less important. This finding is particularly important for developing countries, where introducing and using a new technology may involve a host of other facilitating conditions and training. Contextualizing the review findings to developing countries, we may conclude that it is far better to find technologies that one or more teachers have found useful and facilitate the sharing of those experiences. Further, it would be far better to leave it to smaller administrative units to determine the facilitating conditions appropriate for their particular context. ∎

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