

Research Report for GeSCI Meta-Review of ICT in Education Phase One

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Meta-review of ICT in Education Research

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Integration of ICTs into Teaching and Learning

Overview

In this section of our narrative, we address various factors related to the successful integration of ICT into the curriculum. Literature citations address the question of what contributes to effective implementation. For example, it is suggested that the affordances offered by newer technologies should prompt a fundamental rethinking of educational purpose and practice. This suggestion carries implications for educational leadership and policy. Several researchers cite the importance of teacher education, professional development and support to reflect fundamental reorientation of educational vision so that practitioners can move forward boldly to seize opportunities that were unimaginable only recently.

Challenges and constraints impacting progress

Perhaps the greatest challenges of ICT integration relate to vision, policy and leadership. ICT is changing faster than educators have shown themselves able to track. In order for each sector to capitalize on the knowledge of other sectors, this suggests a need for closer cooperation among educators, university researchers, teacher preparation personnel, government policy makers, non-government organizations (NGOs), and the private sector. To put it charitably, the prior track record for such collaboration is modest. Better strategies are needed to evaluate the impact of efforts to integrate ICTs, especially so that competing practices can be compared for future selection.

These challenges appear to exist equally in the developed and the developing world. In Turkey, for example, survey research by Gulbahar (2008) on the integration of ICT for 4th and 5th grade social studies reveals that a general willingness of teachers to innovate is not matched by sufficient ICT resources in the classroom or by the in-service professional development that sustained innovation would require.

Evolving approaches in the field

Literature emerging between 2006 and 2008 on the integration of ICT into teaching and learning is robust, building upon an even more extensive literature base preceding it.

Let us begin considering the relationship between transformative ICT integration and school structure. Drenoyianni (2006) provides a philosophical discussion on the contemporary condition of ICT for schooling. According to her, current school practice tends to reinforce existing educational values and structures reinforcing the positive and negative aspects. For ICTs to be used to transformationally, educational leadership must reevaluate the fundamental meaning of schooling and what this implies for institutional structure. Technology cannot lead school reconceptualization; technology must reflect it. Similarly, reporting from Norway, Krumsvik (2008) urges a strengthening of the theoretical foundation for ICT integration, especially among classroom teachers expected to undertake it.

As teachers become more secure with underlying research, school policy should also be well anchored in theory. Emily Wong (2008) offers a qualitative case study of eight schools in Hong Kong and Singapore where factors associated with transformational ICT integration were analyzed. Factors related to effective transformation include: leadership promoting future collaboration and experimentation, and teacher commitment to learner-centered pedagogy. Tondeur et al. (2008) report from Belgium that the efficacy of ICT integration can be predicted by the characteristics of school leadership. Schools characterized by participatory management and decision-making, supported by effective ICT policy, typically implement a relatively efficacious integration of technology into the curriculum.

Discussion about school structure leads to consideration of teacher characteristics related to ICT integration. Drent and Meelissen (2008) attribute innovative ICT integration in the Netherlands primarily to the entrepreneurial spirit possessed by teachers. Not surprisingly, risk takers seem to be more transformational than the risk-averse. Several studies present a dismal picture of actual practice. For example, a mixed-method case analysis of Cypriot elementary classrooms found sporadic and superficial use of ICTs, tending more toward reinforcement of traditional practice than enablement of curricular transformation (Eteokleous, 2008). This sense is reinforced by a study of technology use in New Zealand secondary schools by Lai and Pratt (2008).

Gorder (2008) suggests that teacher experience is strongly related to actual ICT practice. Her study found that effective use of technology was related to technological comfort levels and the liberty to shape instruction to teacher-perceived student needs. VanFossen and Waterson (2008)

conducted survey research among high school social studies classes in the US state of Indiana. Results showed a wide disparity between higher-order and lower-order Internet use to support social studies teaching. The single most significant predictor of the "order level" of classroom Internet use centered upon core teacher pedagogical belief.

Survey research conducted in nearly 800 Québec elementary and secondary schools examine the link between professional values and kinds of technology use. Important values determining the quality of ICT use are: teacher expectations of success; perceived value of the tools implemented, and personal teacher use outside the school. ICT is predominantly used for "information seeking" purposes rather than for student creation, collaboration or the original production of knowledge. According to Yuen and Ma (2008) the nature of ICT implementation among Hong Kong teachers-in-training seems related to ease of tool use and perceived teacher self-efficacy.

What promotes the perception of self-efficacy among teachers? Several observers point to the importance of professional development and ongoing support. Some of these issues have been discussed in this document's thematic section on teacher education, but the literature cited in this section explicitly connects professional development to classroom integration. Gulbahar (2008) views the lack of professional development as a major barrier to ICT integration. Mueller et al. (2008) connect professional development with effective technology integration. Based on a randomized survey of nearly 400 elementary and secondary teachers, professional development and the ongoing reinforcement of good practice are among the strongest predictors of integrative success.

Two studies explicitly correlate ICT professional development programs to improved classroom integration. Overbaugh and Lu (2008) surveyed hundreds of K-12 participants in a US federally-funded professional development program. Results indicated a positive relationship between program completion and teacher perceptions of ICT self-efficacy. Through qualitative document analysis, Schibeci et al. (2008) affirm that a funded ICT professional development project promoted growing technology sophistication and confidence among Australian primary school teachers. Over time, this growing competence progressed toward genuinely transformed practice. These relationships seem also to pertain in the developing world. Mixed-mode research on novice Rwandan teachers indicates high motivation levels to innovate with ICT. Based on this motivation, successful integration is better secured by ongoing professional development, availability of resources, and teacher autonomy of professional judgment.

Ongoing professional support for ICT integration is effectively promoted by electronically mediated communities-of-practice (eCOPs). According to Parr and Ward (2006), eCOPs help to reduce professional isolation, especially for teachers practicing in remote geographical areas. Success with this technique is better assured in situations where commonly-held professional needs are clearly articulated and served, and where access to online community tools is simple and transparent. Among secondary-level history and science teachers, Haydn and Barton (2008) discovered a positive correlation between teacher self-image and satisfaction with the ICT curriculum resulting from professional time regularly made available for collaboration and communication about ICT practice. Newer Web 2.0 technologies (e.g. social networks, Wikis, asynchronous chatting) can support new directions in teacher communication for their own professional development, according to Sawchuck (2008).

From a Norwegian case study, Elstad (2006) affirms that the dynamics of the technology-infused classroom reduces teacher control thereby creating a threat that students will carry out non-educational activity with the technology devices made available to them. (Teacher control, however, may not be the point of ICT transformation in the curriculum.) Groff and Haass (2008) offer innovative ideas about how computer-based games, simulations, and social networking can be put to constructive educational use in a well-managed school setting. These authors acknowledge the potential disruption of newer technologies to traditional educational practice, but suggest that educational leaders might beneficially assume responsibility for devising creative ways to transform disruptive student behavior into constructive learning activity.

Several studies address the challenges that the acceleration of technological innovation pose for ICT integration. Several "ubiquitous computing" projects are described. Burns and Polman (2006) assessed the middle school infusion of one-to-one wireless laptops throughout the curriculum. Project evaluation points to performance improvement in the following areas: teaching skills, professional communication, learner knowledge acquisition, and quality of student-teacher dialogue. Based on a mixed-mode case study, Dunleavy et al. (2007) posit that massive computer infusion among students can elevate ordinary curricular ICT applications into transformational practice in American middle schools. To justify the high cost of such initiatives, high-quality professional development must accompany the computer investments. Kay (2006) examined the relationship between ubiquitous one-to-one computer distribution and gender differences between pre-service teacher groups. Using pre-and post-program observational analysis, gender differences noted before program launch appeared to equalize by the time that the program had ended.

Ubiquitous one-to-one computer infusion, however, has generated criticism. Clausen et al. (2008) report on a survey of 74 school administrators from the state of Indiana in the USA. This report challenges some of the more positive assumptions about the one-to-one laptop initiative, concluding that massive hardware distribution efforts of this nature often fail to meet expectations of instructional change and student learning outcomes. Such major funding investments must be supported by clear articulations of vision, according to Clausen, and by teacher/administration commitment to effective curricular integration. Failing this, investment goals may not be achieved. (Further discussion on the implications of one-to-one laptop computer initiatives appears in the section of this report entitled "Infrastructure, Connectivity and Accessibility.")

Evidence exists that laptop use in an urban elementary school has promoted the acquisition of higher-order thinking skills among students (Barron and Harnes, 2006). Banyard et al. (2006) performed case studies at 37 primary and secondary schools on students' self-regulation of learning and higher-order thinking where the large-scale infusion of ICT made a distinct contribution. Positive outcomes of a primary school curriculum that integrates gaming technology to foster higher-order reasoning ability are reported by Bottino et al. (2006, 2007). Blaisdell (2006) describes the potential of collaborative computer-based virtual environments (e.g. "Second Life") to engage children in learning activities that they might otherwise eschew. Blaisdell suggests that this kind of integration capitalizes on gaming behaviors already familiar to young learners. However, Song (2007) suggests that the predicted educational revolution prompted by the infusion of handheld devices has not yet occurred in any sustainable manner. She bases this perception on a meta-analysis of other research.

In addition to the relatively concrete issues related to ITC integration, various human factors also bear discussion. Beisser (2006) describes a project through which Lego-Logo applications were implemented in US midwestern elementary schools. Mixed-mode research findings suggest that, as a result of their exposure to this project, girls' gender self-perceptions about technology competence improved. Boys' self-image of their technological gender superiority did not change. In Greece, Vekiri and Chronaki (2008) surveyed more than 300 elementary school boys and girls, revealing that technological conditions in their homes influence their attitudes about ICT in school. They found is that Greek boys use computers more frequently and with greater parental support than do girls, and that such support is related differentially to their respective perceptions of self-efficacy.

Qualitative research on 15 to 25 midwestern American teachers on ICT decision-making prompted Oncu et al. (2008) to report that teacher decisions were related primarily to the following perceptions: resource availability, tool applicability, collegial influence, self-assessment of technological competence, and prior student knowledge. Thus, ICT decision-making may stem from factors similar to other kinds of curricular decision-making.. Russell et al. (2007) surveyed nearly 3000 teachers and determined that the quality of ICT integration is related to length of teacher service.

Wijekumar et al. (2006) warns that educational decision-makers have failed to heed the effect of ICT affordances on curricular integration. Affordances are defined as "the interaction supported by [tools] for each individual ... affected by their prior experience." The prior experience of many young people is to use technology for gaming and entertainment. Thus, they tend not to be prepared for "learning" affordances. The success of ICT integration will continue to be limited until such affordances are fully taken into account. Does this failure create implacable digital miscommunication between generations? Probably not, according to Selwyn (2006) who believes that conventional wisdom about a generational divide is overblown. His research failed to reveal a technology-driven communications barrier between the younger people and their teachers. But there is a different communications gap according to Tondeur et al. (2007). He suggests that the technical focus placed by teachers on ITC use aligns poorly with the more educationally integrative focus of school curriculum. Policy and practice needs to remedy this gap so that teachers think of ITC as a means for teaching and learning more than as a technological toolbox.

“Hot” topics in this field

In this section of the literature review, the following questions present themselves as high priorities:

1. In what way should education be re-visualized to optimize the impact of emerging ICT technologies?
2. What resources are needed to create and sustain successful classroom integration?
 - a. network access/infrastructure
 - b. software
 - c. training and professional development
 - d. planning time
3. How do we evaluate the success of integration efforts?
4. In what way can successful practices be disseminated across wider school populations?

5. How can technology be used to support ICT development by teachers writing curriculum and designing lesson plans?
6. How can we define effective leadership for ICT integration and assure that it is applied where needed?

Research gaps suggesting further investigation

The link between educational practice, particularly for ICT integration, and background theory is weak. More attention is warranted to reduce this gap. From this literature review, it appears that better research strategies are needed to support educational leaders and classroom personnel to make the best use of the resources that are emerging at an increasingly rapid pace. Outcome evaluations of pedagogical practice need to continue as technologies become more fully secured in schools. Commonly-applicable research templates would help teachers compare practices against one another, the better to inform their own curricular choices. By the same token, improved evaluation protocols are needed for the learning benefits of ICT costs incurred. Although the current literature reveals vignettes of teacher and student attitudes about the technologies they are being asked to adopt, a more comprehensive perspective about these perceptions would help inform decision-making.

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