

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

-Partial document-

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In response to:

Terms of Reference for GeSCI Request for Proposal

Meta-review of ICT in Education Research

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Educational Content and ICT

Overview

The relationship between ICT use and disciplinary content reveals a robust literature base on actual educational practice with a much less definitive research foundation on the results of such practice. Moreover, search strategies using keywords and terms designed to generate reports on educational content yielded outcomes also germane to the other themes derived from the GeSCI Terms of Reference, such as Teacher Education, Educational Leadership, and Efficacy Evaluation.

Nevertheless, resources were found across a variety of subject areas and levels of schooling. Partly due to the search terms employed, a relatively greater number were revealed in language education, mathematics and science. Several citations focused on ICT use for preschool and early childhood education. This is noteworthy because conventional wisdom suggests that ICTs are antithetical to the exemplary practice of early childhood education.

Challenges and constraints impacting progress

Because the nature of educational "content" is changing so rapidly, teachers of all subject area disciplines need to focus as much on skills of research and scholarly discretion as on content itself. Education can no longer rely on printed textbooks as single-source content repositories for whole courses of study. Whether educators like it or not, learners will be exposed to alternative perspectives and information sources. If this is true, educators will also need to tackle issues of learner safety and privacy. In many countries, legislation and policy have been adopted to assure student and teacher privacy and the protection of intellectual property, but the technology is changing faster than the measures taken to address it. Thus, a sharper focus on the research effort in these areas will help publishers and policymakers keep up with events. Although it is beyond the scope of this investigation, these issues clearly have implications for academic

publishing. Future research is needed to ensure stability in the emerging electronic world of content creation and distribution.

Evolving approaches in the field

In a meta-analysis of eleven studies, Abraham (2008) provides evidence of effective ICT supported language (L2) learning, particularly related to vocabulary development and the promotion of second-language conversational fluency. Basharina et al., (2008), however, caution that ICT supported cross-border tele-collaborations (in Mexico and Canada) can produce counterproductive tensions if cultural differences and expectations are not carefully understood and taken into account prior to project launch. (See also Chadwick and Valenzuela, 2007, in the section on “ICT Leadership and Management.”) This perspective is supported by McKloskey et al, (2008) who describe an inter-governmental agreement between the United States and China supporting L2 online teaching strategies for citizens of both nations to acquire language skills of the other country. Evaluation of this project suggests the importance of incorporating cross-cultural awareness into the online learning activities. This report also stresses the value of productive integration between pedagogical designs and technical development.

Several observers describe the efficacy of wireless SMS text and technologies to support the more modest goals of L2 vocabulary development (Cavus and Ibrahim, 2008; Chen and Chung, 2008; Lu, 2008; Aderinoye, 2008). From Brazil, de Almeida-Soares (2008) describes the constructive use of blogs to promote English as a Foreign Language (EFL) instruction for secondary students.

Balajthy (2007) perceives ICT as a particularly powerful for authentic student diagnosis and assessment in the literacy education. According to Balajthy, networked computers hold unique potential for supporting the development of student portfolios and teacher record-keeping. Based on a mix of survey and case study techniques, this author reports that students require significantly more support and prior training than what is typically offered in order to succeed. Like Basharina, she strongly recommends extensive collegial communication to support implementation. The potential of ICTs for teaching language and literacy is not confined to the major, living languages of the world. Oyelami (2008) describes the use of computers with standalone software products supporting language instruction in a low-incidence native tongue (Igbo) at risk of disappearance.

Yarnall et al. (2007) have shown that handheld devices can support "writing across the curriculum" efforts throughout a school district. In such cases, devices support essential learning activities including networked collaboration. Yarnall's report builds on an earlier study describing the use of handheld devices in science education. Her work strongly promotes the use of constructivist, student-centered instructional strategies. She makes an interesting distinction between technology-driven "automation" versus "information." If the ultimate benefit of ICT is only to automate, she feels that it is bound to fail. At a lower level of technological sophistication, Aderinoye (2008) advocates the use of traditional tools such as radio and television to support literacy education in resource-poor countries. Like several other studies in this report, Aderinoye indicates a strong relationship between effective teacher education and robust classroom implementation.

Small, handheld devices are not only being used for instruction but also to support teacher education with communication tools and the development of content. For example, Wishart (2008) presents findings from project that equipped training teachers in modern foreign language education with PDAs. Seven trainees were loaned PDAs for the duration of a course. End-of-year interviews yielded mixed results. Users tended to default to more traditional technology practices rather than internalizing and continuing the use of PDAs. Michael Hardy (2008) discusses a middle school project called Technology in Math Education (TIME), noting the importance of effective teacher education in advancing the integration of ICT into the school mathematics curriculum. A comparative analysis of teacher mathematics practice via a case study by Crisan et al. (2007) found that effective instructional practice in the UK depended on a combination of pedagogical skill and ICT knowledge.

The literature on the application of ICT in mathematics education is extensive. The World Bank has published a particularly important study regarding the status of math and science education in Sub-Saharan Africa. In this report's earlier discussion about Teacher Education, Ottevanger et al. identified serious deficiencies in leadership, teacher training, and classroom implementation. Franklin et al. (2008) offer a case study evaluating the use of iPod Touch devices to advance middle school math teaching. Benefits cited by these researchers include student access to materials in various media beyond the constraints of classroom time and place. In an attempt to break the tradition of curricular fragmentation typical of much contemporary math teaching, Teasdale (2008) describes a British project that applies ICT to the promotion of authentic, outcomes-led, problem-based, learner-centered mathematics education. She suggests that ICT should be a driver of curricular transformation rather than simply a more efficient tool of transmission.

Two studies outline the use of tablet PCs in the mathematics curriculum. Kerawalla et al. (2007) describe the use of these machines to promote numeracy in the lower primary grades. A homework resource-sharing software system was designed to integrate the learning efforts pursued at school with those undertaken at home. Qualitative study results on this project suggest improvement in children's numeracy skills. The results also point to elevated parental engagement. At the undergraduate university level, Fister et al (2008) also depict the power of tablet PCs to improve mathematics instruction.

This literature review produced several reports linking ICT to the education of very young children. For example, Johanson et al. (2008) discuss the implications of ICT for pre-school literacy. In this American case, technology activities for classroom integration are described, as are telecommunication strategies between school and home. According to a program evaluation, learner literacy skills improved as did higher order technological tool skills. Mainstream and disabled learners seem to benefit equally. In Australia, Zevenbergen and Logan (2008) describe wide demographic variations in the home computer access. These findings are based on a parent survey of 4-5 year olds.

O'Hara (2008) recounts successful ICT practices for teaching social skills to this same age group. He cautions, however, that technology is not appropriate for all young children; nor is it a substitute for skilled pedagogy. Research on the use of technology with this age group continues to emerge in 2009. Levy (2009) suggests that young children already come to preschool equipped with sophisticated digital skills and need to have those skills reinforced while in school. Parette et al. (2009) describe "best technology practices" in literacy education for early childhood learners.

Between 2006 and 2008, other disciplinary subject areas appeared to receive less attention than literacy and mathematics. Zucker and Hug (2008) describe a one-to-one laptop to student ratio applied to secondary-level physics teaching in an American charter school serving low income children. Laptops are used in a variety of networked and stand-alone ways. The mixed-mode qualitative and quantitative evaluation of these laptop-specific ICT strategies demonstrated solid project success. Bennett and Fessenden (2006) describe the use of read/write Web tools to promote citizenship education in the elementary grades. Examples include the use of Web 2.0 networked composition tools for learners to contact elected political representatives, and discussion boards for sharing peer perspectives about public issues.

Literature on the potential of mobile technologies is emerging. In higher education, Kulkuska and Shield (2008) see the potential of mobile learning as a means for advancing curriculum from simple content distribution toward sophisticated interactive collaboration. Although this report

focuses specifically on language learning, it could apply to instructional improvement in any discipline. These researchers emphasize that effective instructional design must account for the personal and social needs of the target learners. The newer mobile learning tools, however, raise some red flags. Weller et al., (2008) report concerns about podcasting, for example, as a "push" technology distributing content but enabling very little communication about that content. They describe strategies to integrate mobile technology seamlessly with other tools that promote communications and production related to primary-grade curricular field trips.

“Hot” topics in this field

The following broad topics emerge from this preliminary thematic review:

1. ICTs and second-language education,
2. ICTs and education in mathematics and science,
3. ICTs and education for early childhood and pre-school,
4. The contribution of m-learning strategies to support content development in a variety of disciplines and educational levels,
5. ICTs as tools for learner diagnosis and assessment,
6. Lack of resources and investment to support and evaluate effective ICT implementation.

Research gaps suggesting further investigation

Work conducted to date in this study suggests the need for much more research and development in the application of ICT to science education content at all levels of schooling. Although some resources emerging from this search discussed the potential for m-learning in the distribution of content, this conversation needs more attention, especially m-learning's role as a tool for productive communication about content.

When the literature addresses "content," it tends to do so in a traditional manner. However, it might be argued that the nature of educational "content" has changed dramatically as a result of the contemporary digitization of all media types. Until recently, educational content primarily rested in the domain of textbook publishers. Today, content is available from countless sources representing diverse perspectives. Its authenticity and objectivity demands far more scrutiny, implying a deeper and greater range of discretionary skill for teachers and learners alike.

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