

Connecting Community Elders and Schools in Malawi
Using Mobile Phones and Web 2.0 Technologies

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Subject/Problem

In this project, we investigate the facilitation of connections among community elders, primary school teachers, and science teacher educators using mobile phone (Tinker, Horwitz, Bannasch, Staudt, & Vincent, 2007) and Web 2.0 technologies (Anderson, 2006) to learn about sustainable agriculture in Africa. Past research has shown that elders are a valuable source of knowledge for schools and villages (author A, 2006, 2007). However, this knowledge has not been systematically connected to the school science curriculum, due to social and technical barriers. As an important goal of the primary school curriculum in Africa is for children to learn from elders in the community, we were interested in how mobile phones and Web 2.0 technologies (blogs and wikis, instant and text messaging, cf., O'Reilly, 2005) could be used to establish and nurture connections. Establishing technological connections between indigenous knowledge and school curriculum is particularly important when posed within the context of developing nations that are struggling to modernize and improve the educational experiences of their citizens in the midst of widespread challenges such as poverty, hunger, disease, lack of infrastructure, and environmental degradation (Leach, Ahmed, Makalima, & Power, 2006).

As most primary schools in Africa have limited access to electricity and wired telecommunications, the potential for using mobile devices for educational purposes to access and create information is immense. For example, in the year 2000, one sub-Saharan country had 49,000 cell phones in use and by 2004 the number increased to 222,100. Mobile phones are being explored as a platform for delivery of instructional multimedia (author B, 2007, 2008) and are critical for addressing the digital divide (Jones & Marsden, 2006), but also progress in developing countries (Curry & Kenney, 2006).

Theoretical Perspectives

Teaching science to all students requires understanding the scientific worldviews and epistemologies of diverse cultures as well as the conflicts and problems that students may experience when crossing cultural borders to learn western science (Aikenhead, 2001; Aikenhead & Jegede 1999; Snively & Corsiglia, 2001). Although science is potentially a driving force for economic solutions to poverty, little attention is given to the cultural context in which science is taught, particularly in reference to indigenous science and technology of which the villagers are most familiar. Indigenous science represents descriptive and explanatory knowledge about nature acquired across generations from cultures with strong oral traditions (Kawagley, Norris-Tull, Norris-Tull, 1998; Dzama, E.N.N. & Osborne, J.F., 1999; Snively & Corsiglia, 2001). Indigenous knowledge has transformed modern science in many areas, most notably taxonomy, medicine, agriculture, natural resource management and conservation (International Council for Science, 2002).

Research in developing countries requires a perspective of understanding emerging technologies as not simply external tools, but integral parts of socio-cultural practices within a community (Miller & Slater, 2000). From an organizational learning perspective, establishing social and technical connections

among community constituents is critical (author B, 2006). Further, information and communication technology (ICT) can be “used to promote connections: between one learner and other learners, between learners and tutors [or elders]; between a learning community and its learning resources.” (Jones, 2004, p.1). Although the current network infrastructure in many African nations is underdeveloped, mobile phones are prevalent in developing countries and are inherently democratic as many poor people make sacrifices to pool resources within a community to purchase airtime for purposes such as conducting business in the market (Friedman, 2007; Jones & Marsden, 2006). As mobile smart phones can now be used for maintaining communications, accessing computer networks, and capturing and delivering multimedia (Giulio, Antti, & Antti, 2007), there is vast potential for connecting African schools to the internet for the first time and for using mobile devices as a data gathering device to share and communicate ideas within the context of their local culture (Rogers, 2003).

Design

In this project, science educators and instructional designers are collaborating with elders, teachers, teacher educators, and community members in a sub-Saharan African country to establish a mobile network to develop curriculum that draws from local resources and makes them available on a global network. These ideas and curriculum artifacts are shared with educators and designers who are developing instructional multimedia materials to align with and enhance the primary science curriculum by including indigenous knowledge about sustainable agriculture from elders in the communities.

The following research questions were proposed: 1) What is the cultural context for implementing a mobile phone communication network in a sub-Saharan African country? For example, what are teachers’ attitudes toward indigenous knowledge? What kind of indigenous knowledge might be useful for learning about sustainable agriculture? 2) How do we connect the indigenous knowledge of elders, classroom teachers, and science teacher educators using mobile technology? 3) How do we design and develop multimedia curriculum that draws from these knowledge sources using mobile technology? In this paper, we will report on findings that address the cultural context and instructional technology issues that are part of the design phase of this project.

Data sources and analysis. Data sources include: (1) audio-recorded interviews with African community elders to learn about the feasibility on connecting sustainable agricultural practices to the primary school curriculum; (2) audio-recorded interviews with African teacher educator and teachers to assess their feasibility of using mobile, web-based devices as a means of connecting understandings of the use of indigenous scientific knowledge in the curriculum; (3) primary school curriculum guides and other artifacts that pertain to indigenous knowledge. Formative evaluation has employed the model proposed by Tessmer (1993) and with additional techniques for alpha and beta testing from Alessi and Trollip (2000).

In the tradition of qualitative research, iterative processes of data analysis are used to generate themes reflective of the data, to capture the complexities of the research context, and illuminate the questions that guide this research (Hammersley & Atkinson, 1983). Interviews are coded and categorized to identify emerging themes related to the subjects’ perspectives on indigenous science, sustainable agriculture, and the use of mobile web-based technologies (Ely, Ansul, Friedman, Garner, Steinmetz, 1991). The data will be further reviewed to look for confirming and disconfirming evidence related to interpretation of the data (Erickson, 1986). From a post-colonial theoretical framework (Carter, 2004), we are interested in understanding the cross hybridization of ideas from Western and indigenous science perspectives as we explore teaching about sustainable agriculture.

Results

In reporting of the results, we focus on the cultural context that is necessary to understand as part of the design phase of this project. First, we will report on the perspective of a community elder on sustainable agriculture. Second, we will report on teachers’ perspectives on including indigenous knowledge in the curriculum. Finally, we will discuss how these cultural elements are being considered in the design of the curriculum that is being developed using mobile phone devices.

Community Elders: Organic Gardener. The late Dr. C was established Freedom Garden 1982. Originally an economist, he realized that farming was the only profession that would give him food sovereignty. Freedom Garden employs channel irrigation and traditional organic methods of growing

crops without the use of mechanized equipment or synthetic fertilizers. Diverting water from a river, the farm is irrigated from hand-dug channels, sunken fields, and underground seepage from dammed ponds. The farmers use organic compost from recycled plant material, natural pest control, and crop rotation. Maize is grown three times a year (normally maize is harvested once); the farmers also harvest a variety of fresh fruits and vegetables, legumes, and farm fresh fish. Food is supplied for six villages and the local hotels in the capital city. Villagers work for food at the farm. Dr C was awarded a doctoral degree by a prominent university in Africa in recognition for his experimentation, observation, knowledge creation and exemplary practice in the village and to the world at large. He valued education and expressed the opinion that more students graduating from agriculture colleges should return to the land to farm.

African Teachers. The interviews revealed that contemporary African educators were very aware of traditional beliefs and practices; however, this knowledge was not expressed in relation to understanding how indigenous knowledge might provide a context for the learning of Western scientific concepts. Teachers expressed that it is advantageous to discourage the use of traditional knowledge because it is not “scientific.” According to the teachers, the importance and application of traditional ecological knowledge was also marginalized due to the severe impact of deforestation and economic pressures for survival. From our analysis of curriculum guides, Western science knowledge was largely compartmentalized and taught as a subject separate from the culture and environment where the children live. Most examples of indigenous knowledge were portrayed negatively as examples of “non-science.” Nevertheless, the African educators are very interested in participating in a project designed to use mobile devices to connect them to information and resources outside their classrooms.

Curriculum Design Considerations. Curricular and structural barriers pose severe limits to the building and exchange of knowledge: indigenous knowledge is absent in schools, community elders are displaced from curriculum, and resources are outdated and scarce. In response to these barriers, we are iteratively designing, implementing, and evaluating mobile and Web 2.0 technologies in a participatory manner (Sharp, Rogers, & Preece, 2007). An activity-centered design approach (Bodker, 1989; Gay & Hembrooke, 2004) creates a living archive of traditional and scientific knowledge related to sustainable agriculture. This approach takes the position that “to *understand* development, it is essential not to impose assumptions about the goals of development of one group on individuals from another. Interpreting the activity of people without regard for *their* goals renders the observations meaningless.” (emphases in original, p. 117) The pedagogical goal is to provide technologies for unfettered knowledge building and communication within real-world constraints.

For this project, the nodes of the network to connect knowledge cultures within Africa and in the United States include the following: (1) A community elder in sub-Saharan Africa is a farmer providing knowledge of sustainable agriculture practices, including channel irrigation, composting, and organic pest control; (2) A science and agriculture educator in sub-Saharan Africa is conducting field testing of mobile devices and sustainable agriculture curriculum with pre-service teachers; and (3) A target primary school classroom and teacher has been selected from a primary science and agriculture class in sub-Saharan Africa. The class will be involved in developing a sustainable garden based on elder knowledge. In an effort to establish a culturally diverse virtual team connected by mobile phone technology (author B, 2005), a living archive website is being developed to share information and document the communication patterns and progress of the project.

Using open-source software, blogs and wikis, WordPress (<http://wordpress.org/>) and MediaWiki (<http://www.mediawiki.org/>) are being developed and implemented as distributed knowledge and communication platforms. Moreover, taking the lead from projects such as MobilED (<http://mobilized.uiah.fi/>), we are exploring text-, voice-, and multimedia messaging, and the potential of solar-powered devices, including battery chargers (Solio, <http://www.solio.com/>) and wireless outdoor routers (Meraki, <http://meraki.com/>). The rationale for using mobile phones and handheld devices is that they consume less power than other hardware (e.g., laptops and tablet PCs) and can access the Internet via a cellular network, much needed in African countries.

Significance

Knowledge gives power to individuals, even in traditional or indigenous cultures. Indigenous knowledge is powerful, secretive knowledge but is not accessible or known to everyone. An important challenge was to reveal what this knowledge is so it can be incorporated into the school curriculum. Presently, Western Science has the power and influence in the school curriculum but is largely irrelevant to most African villagers. Indigenous ideas should be explicitly identified and addressed in the school science curriculum as important funds of knowledge that are essential to the sustainability of the environment and culture (e.g. Gonzalez, Moll, & Amanti, 2005). The challenge in this project will be for science educators and instructional designers to legitimize indigenous knowledge by connecting with Western Science by using mobile devices and Web 2.0 technologies. By connecting indigenous practices to Western Science concepts and principles, teachers and children will learn to value knowledge and practices that are part of their everyday lives.

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