Designing E-Learning Games on Cellphones to
Promote Language Learning and Literacy in the Developing World

Literacy is one of the great challenges in the developing world. Even more challenging is the tension between regional and "world" languages – that economic opportunities are often closed to those who are literate only in a regional language. India for instance is a country with 22 regional and two "national languages" Hindi and English. But for most practical purposes, English is the language of economic opportunity. It is the language of instruction in private schools and all universities, a large fraction of business and government, and the language which is driving India's service economy – the fastest growing in the world. Fluency in English can almost be equated with membership in the middle and upper classes [6]. The value of English is widely recognized by ordinary Indians [15], and it is the poorest citizens who are lobbying most strongly to expand English teaching. A recent article states that mastery of English is the "single most influential factor that determines access to elite educational institutions, and hence to important avenues of economic and social advancement" [9].

More broadly, the literature [e.g. 6], our conversations with development professionals in Africa, Latin America, and Asia, and further experiences in the field indicate that a large proportion of low-income people want to improve their command of an appropriate "world language." English is certainly one of these, as is Mandarin Chinese and Spanish. But even in countries where such a language is an official "national language," many speakers (inevitably the least empowered) have a different native language, and many *regional* languages (let alone dialects) are often spoken. In India, Hindi and English are official "national languages," but Hindi is native to only 20% of the population. "World language" fluency opens the door to further education, a larger regional (or world) marketplace, to "new economy" outsourced jobs, and often improves access to government, health and legal services.

Our current work concentrates on ESL (English as a Second Language), but we believe many of the lessons will transfer to other "WSL" (World language) learning challenges. Unfortunately, formal English teaching in public schools is not succeeding, and it is far out of reach to the large numbers of children who are not able to attend school regularly. From the literature [e.g. 1] and our fieldwork in the poorest state of India, two significant factors stand out: irregular school attendance owing to the need for students to work in fields, homes, etc., and the preparation of local teachers, who themselves have very poor training in English. Regional schools typically have no "English teacher," rather a handful of teachers who cover everything. In our 3 years of fieldwork, we have usually been unable to communicate with local teachers in English and have relied on interpreters.

At the same time, high technology – in the form of cellphones – are being used by Indians at all economic levels. India is the largest market for cellphones worldwide, and the majority are now being bought by illiterate and semi-literate users. And a growing percentage of these phones feature advanced multimedia capabilities for photos and gaming. We argue that these devices are a perfect vehicle for new kinds of informal (out-of-school) language learning. All these factors create an extraordinary opportunity: to dramatically expand English skills in young Indians, which is the fastest way to open the doors for employment and further education. While our

work can be integrated with, and can complement the school English curriculum, the greatest opportunity is in out-of-school learning. The Indian children we studied, even those with work commitments for the family, spent an hour or so daily playing with friends, and several hours watching television.

We believe that ESL learning games on cellphones can address the above challenges. Games have well-known "immersive" properties – that is, the learner experiences themselves as being "inside" the game. Games continually challenge players to develop new skills, and reward their acquisition. Players often spend long hours in games which allows them to develop advanced skills. Games can be social experiences which encourage communication with other players. And finally, games can be designed to mirror the real-world games that children play, providing them with tools and encouragement to use English recreationally *outside* the electronic game.

Leveraging e-learning games for education in developing regions is not far-fetched. At least two non-government organizations, Pratham and the Azim Premji Foundation, have used computer games in their initiatives for children in the urban slums and rural areas of India respectively. Most importantly, a large-scale evaluation by Pratham[1] showed significant gains on mathematics test scores from playing computer games that target math learning [2]. It is plausible that similar learning outcomes can be replicated using mobile games for ESL.

In this paper, I introduce my dissertation work, which is now in its 4th year. It is informed by six rounds of fieldwork over three years with children living in the urban slums and rural areas of India. Our total time actually in the field is over six months. A goal of these field studies was to learn first-hand about the everyday learning contexts of the above children as part of a broader needs assessment. Another objective was to examine the feasibility of our ideas for technology-assisted learning, by piloting off-the-shelf software and early designs of our mobile applications on a very small scale with children from the urban slums and villages. Building on the systems requirements that we have learned iteratively from these studies, we are completing a final round of design and prototyping in Fall 2007 in preparation for a year-long deployment in 2008.

Rural children displaying "You win!" screens from two cellphone games that we have designed. Success in these games, and mastery of the technology, was a considerable incentive and source of pride for these children. These kinds of behaviors were repeated over and over.

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[1] A longitudinal randomized experiment over more than two years with over 10,000 urban slums students.

Since our previous findings are already published, I will only review those games that we have designed so far and their learning outcomes. Instead, in this paper, I want to focus on meta-issues related to the project's design methodology and its interdisciplinary nature. In particular, I want to draw attention to the challenges of doing information systems research in this highly difficult domain and offer strategies based on how I would undertake a project in this domain differently if I had to do it a second time.

The rest of this paper addresses the following issues:

- What is an effective model for multidisciplinary collaboration? While the most conventional approach is to assemble a specialist from each domain to form a team, we have learned that specialists in their respective areas are not always able to relate to the unique problem that lies at the intersection of these multiple areas of expertise. I have often found myself acting as the "interpreter" between computer programmers and curriculum developer in my team. More importantly, I will describe the theoretical frameworks that I drew upon from second language acquisition [3, 4, 6, 10, 11, 12, 16] and game studies [8, 13, 14, 17], and how my knowledge of both areas (to a certain degree) in addition to human-centered design made it possible for me to perform the essential "conceptual footwork" for integrating them in our e-learning game designs, even as I relied on our curriculum developer for her practical experience in teaching English in India.

- How can we develop competencies across disciplinary boundaries that make interdisciplinary work possible? Here, I will trace my intellectual development from my initial schooling in computer science and human-computer interaction to my realization that the problem I am confronting in my dissertation actually belongs to the education domain, and my subsequent socialization in the School of Education to learn their "trade."

- What are some appropriate approaches for conducting cross-cultural research in information systems? While ethnographic methods are critical for understanding the practices and beliefs of a community, culture is a dynamic phenomenon that changes quickly especially in the face of rapid technology uptake (e.g. cellphones) in emerging regions. I will cite my experiences from an international development project in Africa involving handheld technology to argue that conducting feasibility studies with multiple user communities is necessary for revealing our cultural assumptions. In particular, I will support this claim by describing the differences in how children in North and South India play our games differently.

- What data collection challenges are there with users in developing regions who lack the exposure to technology and literacy levels for them to articulate their thoughts meaningfully so as to be *directly* useful for technology design? We have found that while it is difficult to obtain useful data from child users other than by observing them use the technology, we have obtained useful feedback by showing our designs to highly educated, local informants who know these children well as caregivers or educators. Similarly, the mundane obstacles in conducting fieldwork with local communities with the help of interpreters offer clues to ingrained beliefs and deeper patterns of behavior that affect technology use. I will describe a few of these behaviors that we have observed.

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