The Digital StudyHall

The Digital StudyHall (DSH) project seeks to improve education for the poor children in slum and rural schools in India and Bangladesh. The educational opportunities available to these children today range from the very poor to the non-existent. In a nutshell, think of the technical approach of DSH as the educational equivalent of YouTube + Netflix + Kazaa. DSH stresses: (1) cost realism in a resource-constrained environment, and (2) solving end-to-end education problems, instead of narrowly focusing on merely the technological aspects.

1. Technology for Sharing Community-Generated Video in a Developing World Setting

A conventional “wire-the-school” attempt is simply not feasible for large-scale replication in rural India today or in the near future. Technically, what we would like to have is akin to a user-generated video sharing system. The question we face is how to build such a "Web 2.0" application without having to replicate the "Web 2.0" physical infrastructure in slums and rural areas of India and Bangladesh today.

Figure 1: A peer-to-peer system for sharing community-generated video.

A best example illustrating our approach is what we call the Postmanet, in which computer network packets normally placed on wires are now placed on DVDs
transported by the postal system. On top of this low-level connectivity provided by the Postmanet, we build the rest of the distributed DSH database in a way that is conceptually similar to how an existing peer-to-peer content sharing network works on the “real” Internet.

Figure 1 illustrates our end-to-end system. On the far left is a fleet of inexpensive digital camcorders serving as the eyes and ears (or input devices) of the system. They are shared among the DSH participants who contribute content into the system and, like rental cars, they may be constantly on the go. The resulting tapes are funneled to the nearby “hubs” for digitizing and uploading into the local databases, which communicate with other instances of the local databases at other hubs via the Postmanet and synchronize their content. (The DSH database is also connected to the conventional Internet as well so content can easily flow between the “DSH network” and the Internet.) On the far right, shared TVs and DVD players economically serve as the output devices of the system in slums and villages.

What Figure 1 illustrates is a “two-tier” model of connecting people in our system. In the center is a small “high-tech core.” The “core” is akin to “the cloud,” in Internet jargon; one difference is that the core here is embedded inside and run by the community. Outside the core, lies a “light-tech fringe,” which employs more practical, simpler, cheaper, and better-understood metaphors to allow our end users to contribute content and gain access to a “Web 2.0”-like repository. This approach can be seen as an extreme version of the “thin-client” model, tailor-made for a developing country setting.

2. A “People’s Database of Everything”

Using the system described above, we are enabling a community of volunteers to build several digital video databases. One is a comprehensive K-12 curriculum database for all the major languages in India. Compared to other education content production efforts, our approach has the following important unique characteristics. First, content creation in DSH is a community-based effort. The grassroots contributors to the DSH database include best teachers in middle-class urban schools, best teachers in rural schools, students, and other idealistic volunteers such as retired university professors, scientists working in government labs, college students overseas, and various NGO staff members. In short, the database is created by the people, and for the people. This approach has important scalability and local relevance implications.

Second, the DSH database is video-centric: our contributors film live lessons of model teachers in front of a real-life student audience. This approach is important for addressing a society with low literacy rate, effectively showcasing the “people skills” and “performances” of the best teachers, and cheaply and quickly producing a vast amount of content.

Third, the DSH database is (at least initially) populated by video lessons of curricula designed, sanctioned, and stipulated by the various state governments of India. This approach is important for us to gain easy acceptance and adoption by target schools, which by law or by choice, overwhelmingly tend to strictly follow official syllabus. At the same time, the adherence to official syllabus does not conflict with innovative teaching methods: our filmed lessons are all highly interactive and activity-based; they
incorporate established educational principles; and our contributors, including middle-class peer students, produce a stream of complementary materials, such as digital stories, science courseware, and drama to further complement the content dictated by the syllabus.

3. A Network of Hubs and Spokes

DSH is not a physically centralized system. Instead, DSH is designed to work as a decentralized network of hubs and spokes. Each hub is a center of education excellence and the hubs themselves communicate with each other. The spokes are typically the under-served rural and urban slum schools. The hubs-and-spokes model is how we may effectively scale up the DSH system (Figure 2).

In addition to being a scaling vehicle, another important role served by the hubs-and-spokes model is ensuring content relevance for the target audience. Factors such as language, syllabus, and student background differences contribute to a big gap that makes a direct transfer of content between middle-class schools and under-served schools ineffective. To address this gap, we enlist the best teachers from the middle-class schools, but instead of filming their regular classes in front of the middle-class students, we film classes given to poor girls from the neighboring slums. This hybrid model combines the best of both worlds: top-quality teachers and an appropriate student audience.

Yet another way for a hub to accomplish scalable content production and ensuring its relevance is to involve the under-served spoke schools themselves in the content production process. Under this approach, explored in our Bangalore hub, we identify the best teachers in the village schools, organize them in a regular recording schedule, and the resulting content is shared with the other peer schools. Under this approach, the model village school teachers being recorded strive to learn and use the best methodology.
to put on the best shows they can, and the peer teachers who receive the content are inspired to match their best peers. This approach is perhaps an even truer manifestation of the philosophy behind the “People’s Database.”

4. Mediation-Based Pedagogy

The principal means of disseminating the content in the DSH database is shipping DVDs to spoke schools. Each spoke school is given at least a TV and a DVD player. (We are also working with engineers on electricity generation schemes for schools that have no grid access.) Put simply, “mediation-based pedagogy” refers to the need of placing a teacher (or a “mediator”) in between the students and the TV (Figure 1(a)). The mediator periodically pauses the video and engages the students in various activities based on what has just occurred on TV. These activities may include asking questions, inviting kids to do board work, and organizing role-playing activities. The mediator’s job is to make his or her class as lively, dynamic, and interactive as the one conducted by the model teacher in video. In effect, the video and the mediator form a “team:” the video provides an example, a framework, a lesson plan, and a content and methodology model; while the mediator, who may not be particularly knowledgeable about a certain subject, supplies the crucial interactive element.

Another variation of the theme is “peer-mediation,” the approach of enlisting the brightest fellow students to serve as mediators during periods when the local teachers are absent (Figure 1(b)), which are common occurrences in government schools in India. The student leaders typically display a high degree of responsibility and enthusiasm, and a different social dynamic of peer-mediation can play an effective complementary role.

Yet a third way the DSH database can benefit the spoke schools is helping train the teachers of the village and slum schools. In traditional teacher training workshops that last just a few days, the short duration necessitates that the topics covered must be kept at an abstract level, and it is not always clear how such abstract principles should relate to the daily topics to be taught. In DSH, the videos carried home by the participating teachers provide an ongoing and highly specific training, as these teachers get to observe and learn from the model teachers in videos day in and day out, during either mediated sessions in class or private review sessions outside class.
Therefore, the focus of DSH is not to replace people with technology; instead, it is about amplifying the reach and the power of the relatively small number of the skilled teachers, and to train and empower the less skilled teachers. In this sense, DSH is foremost a “people system,” not just a computer- or network-system.

5. Details Requested in the MacArthur Grant Solicitation

**Prototype:** Please see [http://pnet.cs.washington.edu](http://pnet.cs.washington.edu) for a mirror of the prototype content repository being built by the communities that we work with.

**Partners:** for the efforts proposed in this proposal, we will be mainly working with the following organizations in India: the Study Hall Educational Foundation in Lucknow, the Loreto School in Calcutta, and the St. Mary’s Polyclinic in Lucknow. All these organizations have a long and strong track record of doing outreach work for the disadvantaged populations in rural and urban slums. We have already been working with the Study Hall Foundation in the past two years. (Indeed, the name of our project, Digital StudyHall, is derived from the Study Hall Foundation.) Work with the Loreto School started barely a month ago, and we are beginning to work with St. Mary’s Polyclinic.

**Work plan:**

- Building a hub in Calcutta in collaboration with the Loreto School. In addition to powering the under-served schools in and around Calcutta, the Bengali content will also help our partners in Bangladesh. The initial bootstrap stage will take about 3 months and then the hub will enter the steady-state production stage.

- Building a healthcare knowledge hub in Lucknow in collaboration with the St. Mary’s Polyclinic. The aim of the new hub is to use the same community-based video approach to train and help youths to perform frontline healthcare work in and around Lucknow. We anticipate the initial work needed for pushing content out of the hub to complete in the first three months, while the mechanism for managing the information flow in the other direction (the feedback mechanism) will likely take at least six months.

- Strengthening the Lucknow hub in collaboration with Study Hall Foundation. The new focus is working on primary curricula (standards one through three) so we can use the system to “power” a number of new spoke school initiatives (including UP state “bridge courses,” designed for re-integrating kids who have dropped out). We anticipate this work to last the entire duration of the twelve-month grant period.

- Bringing online spoke schools. We expect to equip about 20 spoke schools in and around Lucknow and Calcutta with video-playing equipment and power supplies, and train the teachers for mediation-based techniques. These schools will be phased in gradually over the period of the twelve-month grant duration.

- Exploring new spoke school models. We plan to explore a variety of new settings where DSH spokes can be established. These include after-school community centers where children and parents can spend time together, an adult women’s education center which doubles as a shelter, and a couple formal DSH model schools in villages
and slums where we may establish explicit staff accountability. These efforts will be
roughly evenly spaced during the first six months of the grant duration.

- Evaluation. We will perform pre- and post-tests, plan regular monitoring and
evaluation visits to all the spoke schools, and conduct monthly tests based on the
curriculum plan. We will use the same video-system to record and evaluate spoke
school teachers’ performance improvement over time.

The work will be managed and coordinated by the Digital Study Hall Foundation, a US-
based non-profit organization. The Study Hall Foundation, the Loreto School, and St.
Mary’s Polyclinic will be responsible for managing the sub-pieces of the work conducted
there. At the end of the twelve-month period, our goal is to use the capital investment
enabled by this grant proposal to establish that this new peer content sharing system for a
developing world setting helps improve kids’ learning and teachers’ training at these test
hubs and schools. We anticipate lower funding needs in the future at these established
sites. With proven success, we hope to attract funding to further replicate and scale up
the system beyond the grant period.

Current and historical context:

There have been many attempts of using video as an education tool ever since the
invention of TV. One of the perhaps more interesting such attempts dated back to the
1970s when researchers at Stanford got a group of master’s students to learn from taped
lessons in a peer-mediated setting, and concluded that students were able to excel as long
as a number of ingredients were present, chief among which was the appointment of an
active mediator who supplied the crucial live interactive elements. This experience,
known as TVI, or Tutored Video Instruction, was one of the main inspirations for DSH.
To the best of our knowledge, however, we know of no attempts of applying this
technique to learning environments of much younger children, or to developing country
settings, or by exploiting the community-generated video approach.

There have been many satellite-based distance learning systems. Satellites are a good
broadcast medium, but ill-suited for customized point-to-point and high-bandwidth
communication, which is what a YouTube-like Web 2.0 application requires. In addition
to being a technical mismatch, satellites are also a poor pedagogy match. Satellite-based
communication was originally intended for synchronous real-time applications such as
live teleconferencing. What we have observed is that teleconferencing is a poor
metaphor for enabling distance learning in rural areas: when an experienced remote
teacher attempts to “teach” to a large number of rural sites over a live teleconferencing-
style link, the many students at the many target schools cannot “pause” the remote
teacher or participate in any meaningful interaction across distance on a large scale. The
synchronous nature of the communication, paid for at a hefty price, ends up being a
liability. The asynchronous nature of the DSH communication, in terms of inexpensive
and “high-bandwidth” DVDs that allow local teachers to take full control, to play and
pause the content at will, at times and paces of their own choosing, to engage in
meaningful dialogs with their local students, to train themselves after school hours, turns
out to be a blessing.
The Google book scanning project is another inspiration. In spirit, we share its goal of creating a digital database of “everything.” Unlike the book scanning project, however, DSH is community-based and video-centric. Being video-centric is also what distinguishes DSH from Wikipedia. DSH also shares obvious commonalities with YouTube. But as we have explained earlier, requiring students in villages and slums to acquire computers and broadband in order to gain access to a YouTube-like system is simply not feasible in the near future at the kinds of places that we work at. Our approach is to use a Netflix-like practical solution to make the system accessible to the vast under-served population.

**Personnel:**

Randolph Wang graduated with a PhD in computer science from the University of California, Berkeley. He was on the faculty at the computer science department at Princeton University where the DSH project started. Recently, Randy joined Microsoft Research, which has allowed him to continue to work on the independent DSH project. Randy’s research area has been in operating systems and networking systems. DSH was started at a time when Randy became interested in applying technology to solving important problems in developing world settings, and the project took off after Randy teamed up with Dr. Urvashi Sahni, who lives and works in India and has been leading the education aspects of the initiative.

Thomas Anderson graduated with a PhD in computer science from the University of Washington, Seattle. He was on the faculty at the computer science department at University of California, Berkeley, before he returned to University of Washington, where he is a faculty today. Tom’s research interests are also in operating systems and networking systems. Tom has been instrumental in the success of many well-known computer systems over the years. Tom and Randy are two of the co-founders of the independent Digital Study Hall Foundation, which was created to channel resources and volunteer students to work on a cause that we are all very excited about in India, in Bangladesh, and beyond.

In addition, we have a strong team that include many Indian education experts (such as Dr. Urvashi Sahni), health care experts (such as Dr. Brigeeta), and many other talented and dedicated frontline workers in Lucknow, Pune, Bangalore, Calcutta, and elsewhere today.