Three Hundred Libraries Later:

Evaluating the eGranary Digital Library and off-line information delivery in education

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About the eGranary Digital Library

For most educators and students throughout the developing world, the Internet represents an expensive, unreliable, and oftentimes impossible method to access the existing treasure trove of on-line resources. Using off-line technologies to deliver Web information has the potential to be effective in many areas.

Since 2002, the WiderNet Project, a service program in the School of Library and Information Science at the University of Iowa, has been delivering off-line copies of Web sites to schools in the developing world via the eGranary Digital Library -- "The Internet in a Box." Through a process of mirroring web sites (with permission) and delivering them to partner institutions in developing countries, this digital library delivers instant access to a wide variety of educational resources including video, audio, books, journals, and Web sites over local area networks. With a built-in catalog and search engine, the eGranary appears to the end user to be just like the Internet, only many times faster.

Among the 1,200 Web sites included in the eGranary are Wikipedia, MIT's OpenCourseware, the World Health Organization, the Centers for Disease Control, the Gutenberg Project, and hundreds of open source journals.

The eGranary is installed in more than 300 schools, clinics, and universities in Africa, Asia, and the Caribbean.

The eGranary Digital Library is a high-capacity hard drive that contains more than 14 million digital educational resources that can be accessed at extremely high speeds over wired and

wireless local area networks without using any Internet bandwidth. It enhances library infrastructure dramatically, often multiplying a university's or school's library collection by powers of ten. Most importantly, it allows access to millions of resources in areas where access to the Internet is non-existent, undependable, or inadequate.

This paper examines the results of a recently completed evaluation project assessing the use of the eGranary Digital Library in schools, hospitals, and universities in underserved areas around the globe. This year-long evaluation project, funded by the Rockefeller Foundation, involved surveys, focus groups, and server log analysis and reveals a host of challenges for those adopting digital solutions in education.

The eGranary has grown from 80GB, 120GB, 250GB, to 750GB capacities over the last six years. The newest 2TB version, launched in early 2010, also includes the Community Information Platform (CIP), which allows subscribers to make their own web sites and upload and share their own information via the library.   It is not, however, represented in this evaluation report.

Evaluation Overview

During the period from 2009-2010, the WiderNet Project developed and conducted an evaluation process to investigate three major aspects of its off-line eGranary Digital Library: use, usability, and usefulness. With the growth of the library, both in terms of the number of installations and the increased amount of capacity, the WiderNet Project felt a need to evaluate the current library and to develop on-going reliable mechanisms for evaluating the library's impact in the field and improving the patron experience and feature set.

An evaluation grant from The Rockefeller Foundation allowed the WiderNet Project to develop, field test, and refine an evaluation system that can be used for the foreseeable future to meet the needs of a variety of project stakeholders. This report will outline the evaluation process; synthesize the findings from the four modes of data collection used; discuss our business model including utility, efficiency and sustainability as supported by the data; discuss what was learned and how this will shape future management of the product; provide recommendations; and outline an on-going evaluation system for the eGranary Digital Library.

Three major aspects of the eGranary Digital Library were investigated: Use, Usability and Usefulness.

The 'Use' aspect included a census of functional eGranary Digital Libraries in the field, what kinds of information is accessed on these libraries, how many resources are used on a daily/monthly basis, what was required to install and maintain a Library, and what are the major constraints to using the Library fully.

The 'Usability' aspect included how easily patrons find information, how confident patrons are in using the Library, how much is the search engine used, does the catalogue aid in locating resources, and how satisfied patrons are with the selection of resources on the Library.

Finally, the 'Usefulness' aspect included how the eGranary Digital Library impacts the core institutional missions of teaching, research, and service, how often eGranary materials are used in classroom lectures or student papers or patient care, how the patrons rate the benefits of the eGranary versus the Internet, and the fiscal impact of the Library versus the Internet.

In the past, the WiderNet Project has relied on informal feedback from subscribers to evaluate and guide the eGranary Digital Library. With this more formal evaluation process, however, feedback has been garnered from a wide variety of stakeholders through four modes of data collection:

- Online and paper **surveys of administrators, librarians, and technicians**. This survey was intended for individuals associated with the purchase or installation of an eGranary and was not anonymous. It was intended to gather facts and figures about eGranary installations as well as general observations about the installation, support, and use of the system within the target organization.

- Paper and online **surveys of everyday users** and administrators. This survey addresses eGranary use and usability questions in a format where people could express their opinions and ideas in an anonymous way.

- Face-to-face **focus groups** conducted in several countries to gather data through discussions where questions and answers could be discussed and interpretations noted. The three countries selected were Ethiopia, where several of the oldest installations of the eGranary are located, Zambia, where the installation was done just a year ago, and Nigeria, where there are both older and newer installations.

- **Log analysis** from eGranary Digital Libraries installed in the field. Each eGranary keeps a meticulous log on every document and search request made to the hard drive, including information about when the device is turned on and off. By analyzing these logs, it is easy to determine the number of pages accessed, the amount of bandwidth saved, understand the types of files being used, learn about user preferences, and see which sites were logged onto most frequently.

These four modes of evaluation were developed as a way to accommodate as many respondents as possible and overcome the communication constraints and several cultural barriers that were identified at the start. The Project had to consider the connectivity constraints (most subscribers do not have any Internet connection or the connection is not reliable) as well as cultural barriers such as different interpretations of common words and the fact that many of the eGranary subscribers are not accustomed to participating in evaluation processes. Therefore, the Project needed to develop survey methods that would

- accommodate the myriad of communication challenges that its subscribers face
- be as transparent, sustainable and as uncomplicated as possible
- use incentive schemes to increase subscriber participation
- employ field contractors to encourage participation
- make the results useful to stakeholders so that they would be encouraged to continue their participation.

Since many subscribers do not have easy access to the Internet, we adapted the surveys so that they could be taken online as well as on paper.

Outcomes

Administrators, Librarians, and Technicians Survey

A total of 82 Administrative surveys were collected by the end of November 2009. This represents 29% of the 300 installations in the field.

Basic Infrastructure

Median number of computers per institution 88
Median number of computers with access to eGranary per institution 21
Percent of institutions with no Internet 10
Percent of institutions with more than 2Mbit Internet bandwidth 36
Median monthly cost for 1Mbit of Internet bandwidth $1,200
Percent who reported having electricity "all day, every day"...33
Percent who reported having electricity less than 6 hours a day...17
Percent who report daily breaks in electricity service 35

The bulk of the responding institutions report having little or no bandwidth. (Anything less than 2 Mbit of connectivity shared to more than a handful of computers will be extremely slow.) The average amount of bandwidth per computer was 8Kbit in Africa and 20Kbit in India. (For comparison, a typical connection at a U.S. university would be 25,000Kbit while the eGranary provides more than 50,000Kbit.)

Clearly, reliable electricity is a problem for a large number of the institutions represented in this survey. This supports our field observations that a battery-powered wireless eGranary system would be worth developing for many areas.

eGranary Purchase, Set-up, Support

Percent of those who heard about the eGranary through a colleague 45
Percent who were very or somewhat satisfied with order/sales process.....................................92
Percent who think the price of the eGranary is fair 31
Percent who approved increasing the price to improve the eGranary 29
Percent of those spending less than 2 hours a month supporting their eGranary 54
Percent who supply eGranary access to patrons with their own laptops....................................32
Percent reporting no technical difficulties installing their eGranary..50
Percent reporting that their eGranary is not currently functional 20
Percent who contacted the WiderNet Project for technical support..52
Percent who were "somewhat" or "very" satisfied with technical support..................................85

While not ideal, the bulk of respondents reported that the WiderNet Project sales and technical support services were very good. Half reported no problems installing their eGranary, while most problems were addressed by contacting technical support. A non-functional rate of 20% may seem high, but considering the inherent difficulty supporting technology in some developing countries, these numbers might indicate that the eGranary attracts significant attention and care.

Usability

Percent who ranked their Internet connection as "very reliable"...22

About twice as many respondents see the eGranary as more reliable and faster than the Internet. While a mere 4% thought the eGranary content as "fresh", still it draws a 70% approval rating overall – with only 14% reporting often finding resources too old to be useful.

Users Survey Results

By the end of December, 2010, a total of 57 User surveys were collected.

A Snapshot of the Survey Respondents

Of the 57 survey respondents as of 12/31/2009…

The results of the survey seem to represent a narrow demographic: well-educated African males with a high degree of computer skills, a better than average income, and good access to the Internet. This is probably most informed by the fact that all of the surveys so far have come from the Web-based WebSurveyor tool and that most of the respondents were recruited through email and our previous administrator survey.

However, for this narrow demographic, the results are informative...

The respondents reported using the eGranary at various locations…

The respondents reported learning about the eGranary from numerous sources…

Percent who learned about it from **a librarian**..35
Percent who learned about it from **friend** 26
Percent who learned about it from **an instructor** 14
Percent who learned about it from **a poster**...7

The respondents characterized the frequency of their eGranary use as…

Percent who used the eGranary **daily**..13
Percent who used the eGranary **once a month or more**..18
Percent who used the eGranary **several times a year**..11
Percent who used the eGranary **several times** 47
Percent who used the eGranary **once or twice** 13

The respondents reported using the eGranary for multiple purposes …

Percent who used the eGranary for **educational** purposes...49
Percent who used the eGranary for **work** purposes...39
Percent who used the eGranary for **personal interests** 28
Percent who used the eGranary for **health information** 21
Percent who used the eGranary for **leisure** purposes 11

The respondents reported the following obstacles to using the eGranary…

Percent who were stymied by **unreliable electricity**...44
Percent who were stymied by **too few computers with eGranary access**............................37
Percent who were stymied by **lack of user training**..28
Percent who were stymied by **lack of administrator training** 28
Percent who were stymied by **a broken eGranary** 18
Percent who were stymied by **eGranary being used by others** 11

The respondents reported sharing eGranary materials with others…

Percent who shared resources through **verbal exchanges** 60
Percent who shared resources through **printing resources for others** 58
Percent who shared resources through **lectures**...37
Percent who shared resources through **copying to CD or flash drive** 26
Percent who shared resources through **research papers/citations**......................................26
Percent who shared resources through **community outreach** 11
Percent who **did not** share resources with others..4

The respondents favored various types of resources found in the eGranary …

Percent who favored **textbooks** 65
Percent who favored **Web sites**..60
Percent who favored **software**...37
Percent who favored **video** 37
Percent who favored **audio** 19

The respondents reported various favorite topics…

Percent who favored **science** 63
Percent who favored **education** 56
Percent who favored **development** 42
Percent who favored **engineering** 39

Percent who favored **medical information** 35
Percent who favored **literature** 21
Percent who favored **music**..9

The respondents ranked eGranary interface elements for helpfulness on a scale of 1-10…
Median score for "**Search**" (the word search engine)...9
Median score for "**Categories**" (the subject catalog) 8
Median score for "**Types**" (lists resources by format)...8
Median score for "**Help**" (the online documentation)...8
Median score for "**Social Marketing**" (rotating advertisements)...........................5.5

The respondents ranked the utility of eGranary to other sources of information…
Median score for **Internet** 9
Median score for **eGranary** 7
Median score for **Peers/Teachers**...7
Median score for **Print Materials** 6
Median score for **Radio** 5

The respondents ranked ease of use very highly…
Percent who rated eGranary ease of use as "easy" or "very easy" 78
Percent who rated ease of use as "hard" 2

And, finally, the bulk of users would recommend the eGranary to others:
Percent who would **recommend the eGranary to others**.................................... 91

There were three distinct themes in response to an open ended question, "**what would you like to add to the eGranary?**" The most common response (70%) had to do with adding more resources on a particular topic (information technology, maths, song lyrics, African history and cultures, reports from international science agencies, music lessons, etc.…). The second most common request (5%) was to update the content more regularly. The third most common request (5%) was to make it easier to upload local content.

Focus Groups Summary

Conducting these focus groups gave the WiderNet Project a valuable opportunity to explore broad ideas and themes with more than 50 librarians, technical support staff, and program administrators who had a role to play in procuring and deploying the eGranary Digital Library.

The focus groups ranged in size from 5-15 participants, all involved in administrative or librarian work. The general attitude of the participants was positive and forward looking, with many expressing a desire to improve the eGranary so they could deploy it more widely or improve its impact. As one participant said, "The eGranary MUST succeed. It brings information closer to us." Another pointed out that, "Off-line information is important with the poverty situation. <The eGranary> is highly valuable and essential."

Still, there were robust conversations regarding complaints rising from malfunctioning or absent features of the eGranary, the occasional lack of WiderNet Project support (including

a couple complaints that more "regular visits should be made by WiderNet group"), and a host of local infrastructural and administrative conundrums that made it hard for participants to provide wide-scale, consistent access to the resources in the eGranary.

The biggest question facing those who participated in the focus groups is common around the world: what are the best ways to effectively harness these technologies for the core missions of teaching and research when it means changing people's attitudes and information seeking behaviors? The "war stories" of the participants mirrored those of innovation advocates everywhere. "Many students coming into university from secondary school have never seen computers," reports one participant. "They are told to use Moodle without any formal training. They need more help."

They explicitly requested that the WiderNet Project help to provide them with tools to promote digital information literacy, to train librarians and patrons alike, and provide a means to verify that use is occurring and training is being taken. The emphasis on this aspect of eGranary deployment came as a surprise to us.

The second most common theme had to do with making the millions of resources on the eGranary more accessible and useful to specific disciplines. The participants widely believed that a focus on area librarianship and the development of topic-specific interfaces, which we call "portals", would lead to broader uptake in their institutions. This ties into the most commonly requested new feature: an improved facility to upload and share locally-generated content.

We have come away from this process with both a laundry list of improvements to make to the eGranary and, more importantly, a better sense of how to prioritize our development efforts to best serve the needs of our partners.

Server Log Analysis

In signing a license agreement with the WiderNet Project, subscribers agree to send in their logs at least once a year. However, in practice very few subscribers feel compelled to send in their logs. Requests may be agreed to, but the logs simply do not materialize. In the majority of the cases where a log was procured, a representative of the WiderNet Project physically showed up at the eGranary site to copy the logs onto a flash drive.

As of December 22, 2009, ten logs had been received from Ethiopia, India, Nigeria, Malawi, an Iowa shelter, and Iowa prisons. For these ten installations, the aggregated raw data shows more than 1.2 million "hits" and more than 122GB worth of downloads. Considering that many of these logs were partial reports, some covering just a month or two, these numbers are impressive.

Year	Hits	Pages	Bandwidth
2009	759,569	192,179	77.69GB
2008	567,400	151,378	44.99GB

The following chart shows the various types of files that were downloaded during this time period. Video files (highlighted in "Bandwidth" column) account for 82% of the bandwidth, while PDF and audio files account for another 9%. These are the file types most likely to be avoided by those using a slow Internet connection.

	File type		Hits	Percent	Bandwidth	Percent
	gif	Image	30112	39.6 %	35.66 MB	0.3 %
	jpg	Image	13448	17.6 %	428.21 MB	4.1 %
	html	HTML or XML static page	11226	14.7 %	185.51 MB	1.7 %
	css	Cascading Style Sheet file	6108	8 %	7.46 MB	0 %
	js	JavaScript file	4730	6.2 %	12.68 MB	0.1 %
	png	Image	2474	3.2 %	69.43 MB	0.6 %
	htm	HTML or XML static page	2340	3 %	17.20 MB	0.1 %
	xml	HTML or XML static page	2216	2.9 %	742.75 KB	0 %
	Unknown		1700	2.2 %	18.60 MB	0.1 %
	pdf	Adobe Acrobat file	518	0.6 %	485.82 MB	4.6 %
	mpg	Video file	164	0.2 %	5.44 GB	53.8 %
	mp3	Audio file	158	0.2 %	387.32 MB	3.7 %
	mov	Video file	144	0.1 %	949.86 MB	9.1 %
	jsp	Dynamic Html page or Script file	116	0.1 %	529.70 KB	0 %
	wmz	Document	108	0.1 %	148.85 KB	0 %
-	emz		80	0.1 %	9.58 MB	0 %
	jpeg	Image	70	0 %	143.33 KB	0 %
	shtml	Dynamic Html page or Script file	58	0 %	1.09 MB	0 %
	swf	Macromedia Flash Animation	58	0 %	1.76 MB	0 %
	wav	Audio file	32	0 %	86.30 MB	0.8 %
	asp	Dynamic Html page or Script file	28	0 %	3.60 MB	0 %
	zip	Archive	26	0 %	29.22 MB	0.2 %
	mpeg	Video file	26	0 %	1.84 GB	18.1 %
-	mid		18	0 %	72.10 KB	0 %
	bmp	Image	10	0 %	244.77 KB	0 %
	mp4	Video file	6	0 %	69.29 MB	0.6 %
	ppt	Document	6	0 %	1.81 MB	0 %

The most visited pages are the eGranary search page, followed by the eGranary catalog pages. This correlates with reports from focus groups and survey comments, where we were told that many users found it easier to locate resources using the menu of catalogued items (which only represents a tiny fraction of the resources on the eGranary) followed by a word search. The advanced search page, where users can construct more complex queries, was used infrequently. (In one sample, 116 times versus 1,700 for the simple search.)

The most visited sites are Wikipedia, one of several World Health Organization servers, one of many Bioline journals, and African Journals Online (AJOL.)

Conclusions

USE: The vast majority of the eGranaries represented in these surveys are still working, sometimes years after installation. From the surveys and focus groups, it appears that many of the reported problems that sideline installations are not eGranary-related so much as they are simply a function of the typical conundrums faced by those operating a computer (not just a server) within rough environments like those found in the developing world.

Investigations into non-functional eGranaries reveal that technical issues per se are not the problem: rather the problems are a little bit technical and a larger part logistics and

management. More than half the time when end users reported that their eGranary was not working, it was sitting in the bottom drawer of someone's desk, being protected by an overzealous librarian, or not deployed because of fear, uncertainty and doubt (FUD).

Chief amongst the findings on **use** is this: when the eGranary Digital Library sites are up and running and successful, it is because there is a person or persons who take ownership and responsibility in developing a computer lab with a digital library and making sure people know what it is and how to use it. When the eGranary site is not functioning well it is usually because of the following: there is no one managing the lab and library on a daily basis; many subscribers do not seek technical support when they experience problems; many subscribers are often not aware that they can contact technical support.

This is a systemic problem. What can the WiderNet Project do to foster an environment where an attendant's first and unfettered response is to ask for technical support from a WiderNet representative? There is a need to assist subscribers in getting past the fear, uncertainty and doubt, to build a good relationship with project technical support persons, and to increase the likelihood that they will feel comfortable seeking technical support.

The efforts of our solitary Field Associate in Nigeria to provide on-the-ground technical support has made a difference in a lot of situations, but the challenge is making it a consistent intervention in the sense of having someone like her visit the sites on a more regular basis — maybe annually, maybe every six months — to create a personal relationship with the librarians and to encourage open dialog about the systems and their use and state of repair.

USABILITY: Across the board users appreciated the speed and ease of which they were able to access information in the eGranary. The eGranary catalog, where librarians have highlighted information to make it easily browseable, drew the most positive responses. Over 78% of those who took the user survey ranked the eGranary as "easy" or "very easy" to use. Over 70% were satisfied with the content they found.

However, most sites reported a significant lack of training of staff and users on how to navigate and use a digital library. There is also a lack of knowledge as to just how much content is in the digital library and thus its possibilities.

Clearly the next focus for the WiderNet Project is the development of training materials for librarians to use in encouraging use of the eGranary Digital Library and in training users. Respondents requested training modules to certify varying levels of eGranary proficiency

The WiderNet Project is drawing up plans to build into the eGranary a set of self-paced computer-based training modules that can provide the foundation for digital literacy and capacity building in new eGranary installations. For example, modules customized for four groups: technicians who are going to manage the eGranary Digital Library (4 hours); librarians who will be training others to use the eGranary (20 hours); area librarians who need to master particular topics to support end users (20 hours); and end users of the eGranary (2 hours.)

USEFULNESS: Virtually all participants in the focus groups expressed an appreciation for the eGranary Digital Library -- with some librarians characterizing it as the best set of

resources on their campus -- while most were seriously engaged in the process to assess its usefulness and identify improvements. Over 90% of respondents in the user survey would recommend the eGranary to others.

Close to 96% of the respondents reported sharing with others the information they had gleaned from the eGranary, with 37% including the content in lectures and 26% including it in papers.

Everyone, of course, identified subjects or publications that could be added to the eGranary.

Final Words

It is the WiderNet Project's hope that the eGranary Digital Library (or something like it) will be installed every school, hospital, and library in areas around the world that are underserved by the Internet. Understanding the constraints and opportunities of off-line information is critically important. Thanks to the support of the Rockefeller Foundation, this evaluation project has yielded a great deal of good information that will inform developments as the WiderNet Project moves forward with the development and installations of the next generations of the eGranary Digital Library.

Note: a comprehensive 90-page report on the eGranary Digital Library evaluation and process, including raw data and appendices, can be found at
     http://www.widernet.org/whatwedo/projects/evaluation