THE 21ST-CENTURY CYBER SCHOOL

A PROPOSAL

FOR THE ECONOMIST-INNOCENTIVE CHALLENGE

ABSTRACT

The 21-st Century cyber school must be first and foremost, a place of local learning. Learning must be introduced to students where they are, not where others wish them to be. Learning must be made contextual. This paper explores a number of policies and practices that support contextualized, individualized learning.

Further, the learning environment in the developing world must be addressed prior to the introduction of technology. This proposal outlines the role of community, of parents, even of governments and NGOs, in the delivery of education to individual students. Without a holistic consideration of the issues of teaching and learning in the developing world, one cannot begin to suggest how technology can be applied. All members of a community must be seen as students, and their learning experience be one that is co-created. Technology can play a significant role in assisting this wide array of learners achieve their goals by delivering individualized learning and connections to other learning communities, but it must be deployed to meet specific needs, in a way that is appropriate to the level of learning to those who receive it.

INTRODUCTION

Although this challenge specifically targets the development of 21st-Century cyber schools, this proposal does not see technology as the primary driver of change in the developing world, despite the desire and the recognition of technology's value by those who live there. Fundamental, structural issues need to remain the primary concern of those attempting to empower people in the developing regions. This proposal will focus on Africa, as it becomes a focal-point in the future with rich deposits of rare-earth elements, a young population, oil and political interests that range from the aging Europe to the oil hungry China. In this confluence of events that will likely put Africa in the forefront, education needs to be the most important of altruistic investments, as it is the tool that will allow Africans to resist visions of the West and shape their own destiny. Education is the tool that will allow Africans to craft economic prosperity out of a history of chaos and incursion. Education will help Africans navigate through the technological legacies of America and Europe, and create a new, more mobile, more integrated society of their choosing.

Unfortunately for Africa and other developing parts of the world, from Pakistan to Bolivia, the disparity between urban dwelling students and rural living students continues to increase. And the answer, as we know from India and China, is not to create subpar shanty towns and move people from rural areas where they have the ability to be self-sustaining, to cities where they require

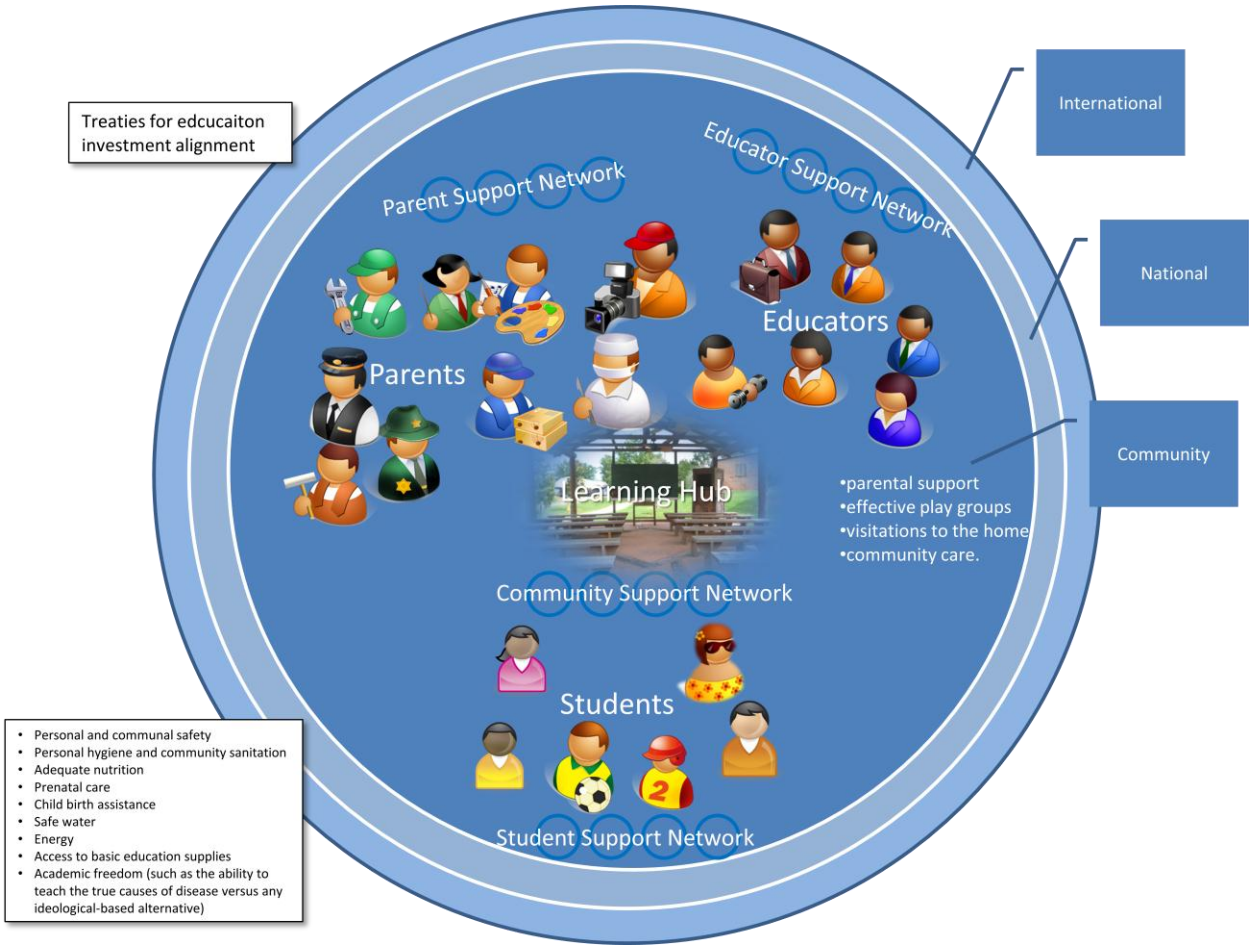
economic assistance, if they can get it. Even if an economic environment exists that permits a viable income, city dwellers are often forced into low end industrial jobs and at a young age. Learning becomes narrowly focused on the skill of the moment.

The answer then, is not to assume the creation of centralized schools. The answer is not to widely distribute basic personal computing technology. Technology is an element. It is a tool of enablement. It is not the answer. The answer is local. The answer is the appreciation for learning. The answer is teaching basic ideas that will help people survive, then thrive, then innovate — in the context of where they are, what resources they have at their disposal, what political situations they find themselves empowered by or encumbered by, what capabilities they bring to learning.

Although the focus will be on Africa, the outlined approach will have a basic set of elements that can be applied to South America, Asia or the outback of Australia or the inner-cities of America. The adaptation of the ideas require social, economic and political re-orientation to meet the perceived needs of the area of deployment. The technology, the pedagogy, are adaptive to the content, and can easily be transferred. It is the prioritization of learning outcomes, and local political navigation that will be most crucial to adaptation.

A HIGH LEVEL DESIGN

This drawing represents a high level overview of the design for twenty-first century schools. It suggests designs for elements well outside of the classroom or the learning experience, but elements that are necessary influences on the success of education.



DESIGNING FOR BALANCE

Schools in the developing world must balance between meeting external objectives of success from funding organizations and education advocates, and the local needs of the indigenous populations and the local and national political reality in which they live. This should put a special burden on external funding organizations and education advocates to defer to local needs.

But those local needs must start with the child. A World Bank study suggests that the cost-benefit of early childhood learning is 3:1, almost double that for the most disadvantaged[i]. Not paying attention to this early need for engagement results in significant dropout rates and the repetition of classes[ii], which can result in a perception of failure and inadequacy. Children benefit from improved parental support, effective play groups, visitations to the home and community care.

The child is the most local of needs, the most immediate. We then pan out, learning is challenged by an environment that lack basic cleanliness from water or adequate latrines. They have no legacy of

learning to demonstrate value, which results in a culture that does not value education, particularly education for girls. Centralized schools create transportation issues and safety issues. And when they arrive at school, the learning methods, the very language of learning, is foreign, is antithetical to their experience. And when they return home, they cannot reinforce their learning because their parent have not connection to their learning environment.

To return to the issue of balance, these revelations, common in the literature of learning in the developing world, suggest that the West's attempt to impose its learning model on schools in the developing will fail for reasons other than those same systems may fail in their countries of origin. So rather than take the Western traditions to the developing world, organizations should think more about designing experiences that meet the needs of the community, the family and the individual student.

Given that this design, like many of the designs being proposed, are coming from the West, a balance must be struck Western Expectations of performance and design, and those that are required to move local populations toward education engagement and attainment using their definitions of success. The building of schools and the distribution of computers and achievement on standardized tests should not be the foundation of achievement in the developing world. We must first design education environments that create an appreciation for learning, demonstrate value in local terms, use education to create basic economic improvement, safety and health, and then we can move toward more abstract and integrated learning.

Another view of balance is that between computer-mediated interaction and human interaction. It is the intent of this design to suggest that computer-mediated interaction be used primarily for educator training early in any implementation. Part of a research project would need to determine how and when a population reaches a level of trust and appreciation so that technology can be deployed earlier. But because much of the technology available would be pushing Western forms of learning, it would be seen as alien and would be unlikely to promote the learning objectives set out above.

Other considerations for design balance are between the recipients political model and those of the provider, between parent need for education and student need for education. The balance between being local and being global. These balances must be accounted for in any credible design.

THE ROLE OF POLICY

In order to achieve an environment where cyber schools are possible, local and national governments must be willing to invest in critical policy issues. These should be considered pre-requisites to success. Outside funding agencies and well meaning activists and volunteers can make a difference,, but the highest level of success will come from the cooperative integration of local and national governments.

The policies include:

- Personal and communal safety
- Personal hygiene and community sanitation
- Adequate nutrition
- Prenatal care

- Child birth assistance
- Safe water
- Energy
- Access to basic education supplies
- Academic freedom (such as the ability to teach the true causes of disease versus any ideological-based alternative)

This list represents critical prerequisites to the building of successful education. For instance, rampant incidents of birth asphyxia affects the ability of children to learn. No amount of technology or clever design will overcome brain damage, malnutrition or early death. Basic needs of learners and a safe environment for learning are absolutely crucial elements of any learning program.

As soon as agencies put forth a metric like Universal Primary Education (UPE), educators and governments adopt an industrial age mindset and start to design programs that meet enrollment goals, but may fail to meet local education needs. External metrics may be well meaning, but a metric like UPE is a false indicator of success. Having children on roles where they cannot attend, where educators do not attend, where course work doesn't align with local need, does not meet the education needs of the local or national economy. It is simply a way to placate funding agencies and keep money flowing, as well as to serve the political needs of those who describe the metric.

Political bodies, most notable the UN and the World Bank, need to work diligently to ensure that economic interests do not trump a general education interests This means that foreign countries doing business in developing countries would need to agree to certain strictures for education and the maintenance of local culture, even if they have not done so within their own boundaries. Education policy guidelines, enforced by treaty, will prove important if the world is to preserve remaining local cultures.

Such a treaty would not imply the abdication of any obligation to educate young people in places where foreign interests dominate local economies. It would rather mean that the local government would need to ensure that foreign interests do not use schools as centers for ideological indoctrination, but rather fund efforts as they are described throughout this proposal.

Policy needs to be focused on the most critical issues, and access to technology is only one item among many. In a UN report, dated 1998, Professor Christopher Colclough of the University of Sussex for the ADEA reports that "Teachers are often unqualified, teaching aids are few and textbook provision is desperately poor." This condition has not changed significantly in the ensuing decade according to UNESCO where only 58% of primary school age children were inrolled[iii].

Several policies should govern the learning of students in schools in the developing world, the following states outline high level concepts that should be expressed in these policies:

Learners

- Learners have the right to a safe learning environment
- Learners will be permitted to learn at their own pace
- Learners will have access to technology, but will not be forced to used the technology unless it meets their learning goals

Educators

- Educators have the right to a safe instructional environment
- Educators will set goals and objectives for learning for each student based on his or her learning style and pace

Parents

- Parents should recognize the right of their children to good education
- Parents should be able to obtain an education themselves
- Parents should be given the latest information on how they can contribute best to their children's learning

There are a number of policy areas that can be expanded upon to support a cyber school design. These are only suggestive of the highest level policies.

THE ROLE OF TECHNOLOGY

Technology is one of the elements that can be manipulated to create a positive learning experience. Technology is not an immutable force, but a bag of tricks that can be applied to different circumstances. Imagine, for instance, the need to train educators on a particular form of latrine digging to match local terrain. That educational experience may best be conducted via video conferencing and supplemental video. It is not because no one could teach it directly, but the need to teach it did not represent a cost model that included sending the expert locally within the timeframe needed. Technology can be used to offer the knowledge to those who might not otherwise have access.

On the other hand, using technology to develop basic learning skills, may be overkill when good books and other aids exist. They may not be high-tech, but they are, nonetheless, effective to the objective at hand.

Technology is an infinite canvas, but it is not the only canvas. Students will come to learning from a number of places, and their familiarity with technology should be understood before assumptions about the role of technology as a learning tool can be determined. It may well be the case that technology can assist with older student literacy, but the applications and platforms used, must be aligned with the capabilities of the students.

Ideally, technology would be introduced early, but it should not be introduced as a substitute for a curriculum that encourages the development of a sense of self, of basic competencies and of local issues. If the software provided cannot help the youngest students achieve basic competencies then it should be avoided in favor of face-to-face instruction. Significant works needs to be conducted to create software components that offer a wide range of entry points to learning.

Face-to-face instruction, does not mean technology free. Instructors should be given access to a global support network that provides just-in-time learning as well as curriculum and pedagogy support. It is unlikely that educators in developing schools will have personally mastered all of the topics required to help their students achieve a personal view of success. This type of support network will add value to the educator, as well increase the value of the educator to the community.

For cyber-schools to be successful, it will be necessary not to think about them from the industrial scalability perspective initially, but from the knowledge economy perspective. Content should be developed to fit niches. It should be personalized and individualized in its delivery, and contextual to the local environment in its design. This does not mean that Western ideas or art or literature can't be introduced, but they should be done so in the native language, as part of an integrated experience. Technology can play a role in connecting dots. Illustrating relationships. In this, it should be used regularly as a tool to reinforce context.

INFORMATION ARCHITECTURE

At the highest level, the UN, World Bank and others should enhance their education profile databases for countries and regions (this needs to be very granular, and very timely) in order to cover the understanding of local cultures so that aid organizations and local leaders can create programs that meet the needs of these populations.

The profile should include:

- Political situation (local and national)
- Political profile
- Safety situation
- Food and safe drinking water availability
- Child birth (particularly birth asphyxia rates)
- Child labor rates
- Native language spoken
- Access to energy

Although this information may be available from a variety of sources, it needs to be consolidated and made available on the web. Understanding elements like this can help local teams building educational institutions.

At the next level of information architecture, that of the classroom, funders should encourage a transformation by publishers to component-based technology. This is not simply the application of metadata to deconstructed existing work, but a fundamental rethinking of content in light of technological capability.

Imagine that we have a deep profile of each student: their competencies, their learning style and preferences, what they have read, what sports they have played, etc. Imagine then that as an educator creates a goal-directed lesson plan, that the system, using the principles of business intelligence, aligns content to that particular student. The educator sets the goal, but the system chooses among available content components, classified with rich metadata – of the same type that describes the student, to bring together materials of particular attraction and relevance to an individual student.

This type of system would require that publishers create content at a much more granular level than they do today. Individual sections of history and science, literature and art, written differently to serve different audiences. This may perhaps argue for an open source approach to content development, or perhaps a less radical, and more controlled approach, using open innovation techniques to attract and pay individuals to construct components to specifications. You could

imagine a number of writers, each with a particular audience orientation, taking basic text and making it come alive for the audience that they represent.

NETWORK ARCHITECTURE

I was once told by a manager at the United Nations that laying copper wire in a developing country did not create an Internet a economy, but one based on recycling copper wire. Safety: safety of individuals and safety of infrastructure, must be at the forefront of any cyber school development plan.

Wireless communications that are tightly tied large physical infrastructure, like buildings (embedded receivers) may be useful. However, the most likely long term solution will be 3G and 4G telephone networks without any other local infrastructure. Because the telecoms providers monitor their equipment, and perhaps more importantly, that cellular networks are as much needed by criminals as educators, they are less likely to be disturbed than land-based wire or fiber options. And being more distributed, they are not as prone to single point failures. So rather than thinking of networks for education, we should be thinking about negotiating bandwidth deals with local telecommunications providers for use in education.

SOFTWARE ARCHITECTURE

Software should be primarily open source. This is not an indictment of commercial software, but a recognition that a community learning model reinforces other learning. As learners become more sophisticated in their interactions with technology, the contribution of ideas back into the open source community, and the acceptance and incorporation of those ideas, would be a strong reinforcement for the value of learning.

Software, being the most mutable of technology components, should be aligned with the needs and capabilities of individuals, not used generically. Software is also a strong analytical tool, so creating profiles of individuals, and then using those profiles to drive appropriate learning experiences into the PC or web browser, could prove a powerful way of leveraging knowledge and giving time back to educators (for whom, personalization is often time prohibitive).

Software can also offer access to experiences not possible in the physical world, such as teleconferencing, gaming, simulation virtual worlds and other tools that can be used as ways to deliver learning materials.

Software also offers the means for students, educators and community to connect with distant support systems. All education software deployments should include collaboration technology, as well as repositories, life-cycle management, as well as authoring tools.

To emphasize, software should be used to create appropriate, and personalized experiences. These experiences should be culturally contextual, as well as aligned to individual learning needs and styles.

At the deepest level, software needs to be deployed that offers an integrated infrastructure with well defined feedback loops. Figure 2 illustrates a conceptual level drawing of a system that uses information about students, as well as metadata about content, to deliver personalized learning

experiences. It also includes synchronous and asynchronous collaboration, administration data tracking and data warehousing for reporting, and various other elements required to support the desired functionality.

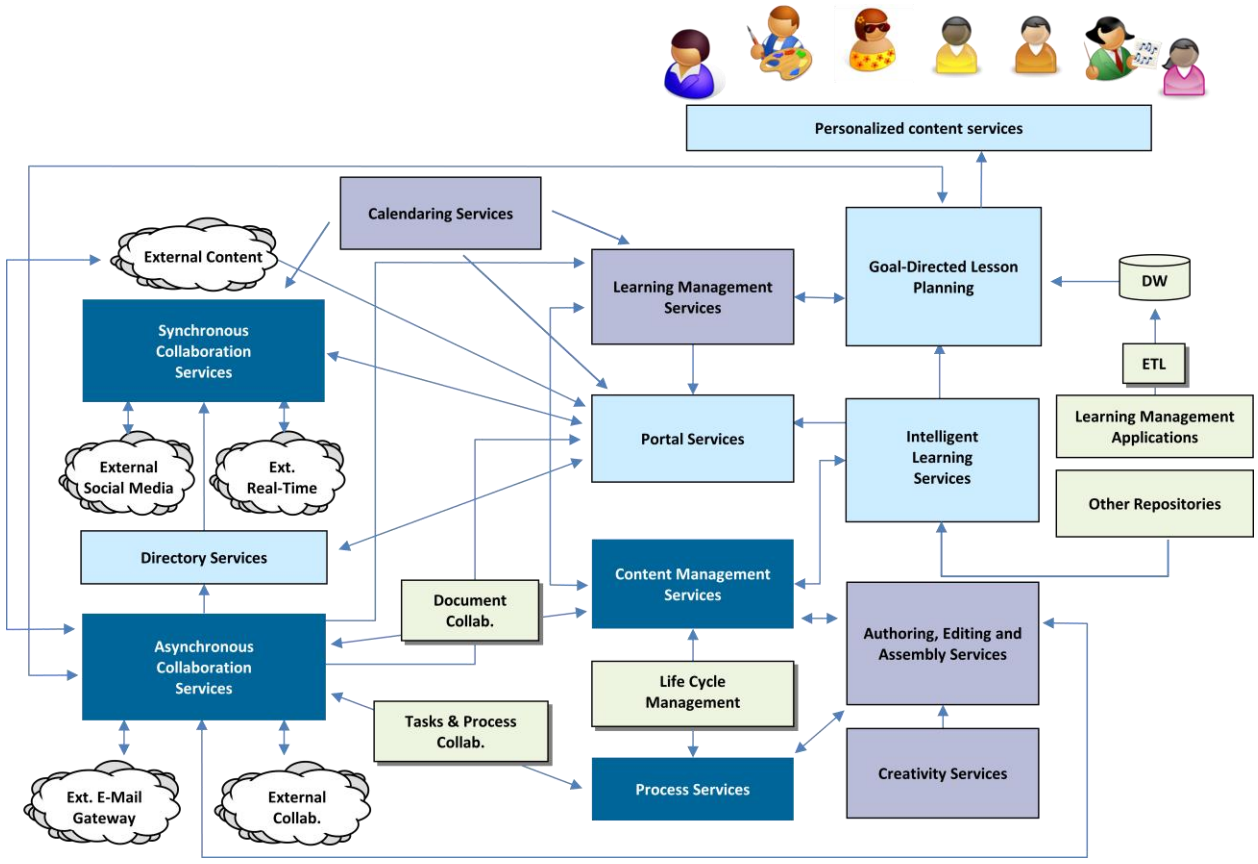


Figure 2: An idealized software architecture

It is important to point out the idea of intelligent learning services. This layer of software would include the following capabilities:

- Alerts/Notification
- Categorization/Tagging Indexing
- Pattern Recognition
- Profiling
- Summarization
- Competency Discovery
- Linguistic/Semantic Analysis
- Statistical Analysis

These capabilities are used to understand content, recognize student learning patterns and match content with rich metadata. Goal directed lessons, developed by educators, are then translated into appropriate learning tools that meet the students current level of competency, preferred learning style, cultural background and other attributes.

MOBILITY

It is highly likely that over the next decade, especially in developing countries, that mobile devices will become the interface to the Internet and to communities. Any education solution that fails to incorporate mobile devices will be sub-optimal to personal experience of learners. Thus the architecture in Figure 2 needs to assume that any out-bound information, from portals, to learning experiences to collaboration, be available on mobile platforms. In some markets, this may mean, early on, simple text message reinforcement of learning ideas, calendar reminders and other basic information sharing. As more sophisticated handsets become available, much of what is being targeted for the One Child laptops will be transferred to mobile devices, eliminating the need for any specialized student hardware.

EDUCATOR

Educators will likely form a community of their own. In some cases, educators may be mobile, moving from location to location. In other cases, they may be local residents of villages, townships or cities. Regardless of their physical constraints, educators should have a network of shared learning and community feedback established prior to any technological support for students. If technology is introduced to students at the same time it is introduced to educators, it can be a distraction as educators attempt to integrate the foreign devices and software into the learning environment, sometimes force fitting because it is so expensive, it must be useful. By focusing on educator reinforcement and community, educators can figure out how best to integrate technology into their own learning, and find value by using it to answer questions they pose.

LEARNER

Technology for learners should be age and competency appropriate. This means that the technology, for the most part, should leverage existing skills rather than require new ones explicitly. Part of the responsibility of the educator is to understand how to incorporate technology, and to align it with student capabilities.

At the earliest levels, students should be allowed to play with physical objects. If a physical object also contains digital aspects, that may prove positive for students as an acclimation tool for later incorporation of more sophisticated digital technology. Virtual physical objects, as well as touch screens would take students to the next level. In order to compete, it will be important for the youngest children to be provided experiences early, or they will be at a disadvantage to their peers in the "virtuals[1]" generation.

It is important here to point out that any new school in the developing world is likely to encounter a very large disparity of digital skills and competencies. As with other competencies, appropriate guidance should be provided so that technology does not overwhelm, distract or otherwise reduce the overall effectiveness of the education process.

[1] Virtuals is this emergent demographic term for those born after 2000 who have been brought up in a world of virtual worlds, such as WebKinz and Club Penguin.

PARENTS

Parents, like educators, may be best served by a network that helps them cope with parental responsibilities. But many parents may be more technologically challenged than their children. This means that user interfaces need to be very simple, and that information delivery needs to take places within the confines of existing experiences, like mobile devices.

In cases where parents do not have access to technology, or where they are not capable of taking advantage of technology, the educators should form study groups and other meetings to impart important information about parenting to parents, and to supplement their learning in other ways.

COMMUNITY STUDENTS

Learning is not limited to the classroom. The education process should be open and transparent. The community should have access to the same lessons being taught to students, however, they should also have access to the context for lessons so they can explore. With the proper software, a single lesson on weather cycles, could link to extensive material on weather, crops, flooding, etc. Community members should have complete access to any learning materials available to students. If they were not the product of the local education system (e.g., not profile exists for them) assessment tools could be put into place that would provide rudimentary individualization.

THE ROLE OF PLACE

An investment in education should not be predicated on the building of a facility. Successful learning does not require a dedicated facility, thought it does require a consistent experience, which can take place in a home, a shared space or even out of doors.

First principles may eliminate the need for place-based learning, but there are also practical considerations, such as the risk of traveling to a location, by students and by educators.

Space should be seen as a fluid attribute, and not as a fixed place. That may be counter-intuitive to the idea of space, but essentially it suggests that any space, properly, if only temporarily, allocated and equipped for learning, will be adequate for learning.

The learning institutions of the West are currently struggling with the increasingly virtualized nature of their own learning. Significant shifts in building fund endowments, for instance, may force traditional universities and private schools to rethink their business models. This will not happen immediately, but the success of online education, from the University of Phoenix and Western Governors University point toward challenges to traditional models.

The more traditional use of space, with a fixed location, remains ideal for creating a learning space. What is important in design is that the space be amenable to the learning experience, not that it be fixed. A mobile form of learning creates greater challenges for space, but they are not insurmountable. An individual classroom, complete with whiteboard or flip chart, LED projector, computer and various student materials, can placed into a moderate duffle. The location for deployment should be large enough to provide the students room for movement, be protected from the elements and be rich in natural light. Using this approach educators can adapt a learning space

to different constituencies. Thus a learning hub is not a school, as a school has a fixed audience. A learning hub can be reconfigured as necessary to teach any group, at any time.

Where more traditional, fixed location facilities are available, the experience should consider engaging, flexible environments that can meet a number of needs. If you think about a modern office conference room, but one in a company focused on design, the walls are often easy to write on. Creativity tools hide in bins and drawers. A classroom should be the same thing. It should be a place that students can co-create. But it should also be a space that surprises, challenges and intrigues. This can be accomplished through novel lighting, exploration areas, color and a host of other design elements.

THE ROLE OF TIME

As with place, we must not become overly concerned with time and metrics set by those outside of the learning experience. Learning needs to recognize local conditions, and therefore recognize the need to earn a living, the need to stay safe. Learning must be seen as an extended act, not limited by a artificial calendar year, UNESCO reporting cycle or the needs of a World Bank task force. Time means different things, in different countries, in different cultures. We must eliminate the sense of gates of passage and replace them with moments of success. We must steal moments of success when they can be found, not based on the schedule of others.

Technology can speed up time, but it can also fill time. For those who have access to technology, they can engage in learning on their terms, in a style that fits their needs, recognizes their competencies, stretch their own learning capacities.

THE ROLE OF PARENTS

In many developing markets, parents need to be the first target of education. They need to understand several fundamental issues so that they can support their children. These issues include:

- Basic hygiene
- The importance of verbal interaction
- Support and permission for learning
- Child safety and anti-exploitation
- Financial management

For education to succeed in Sub-Saharan Africa, it must start with parents, not with children. Parents must be engaged at multiple levels. First, they should be taught, in a credible, culturally aligned way, information that will make them more self-sufficient, safer and more healthy. They must be taught with a curriculum and with measures that are meaningful to them. Information about crops, about health and cleanliness, that they can see reflected immediately in their own lives will be the best demonstration that education is of value. The abstracts of global world, common languages, even mathematics and science, have little meaning for those living in subsistent conditions. This level of education should be delivered even to childless adults, as they may later become parents, and they may, through this interaction, become valuable supporters of education within the community.

At the next level, parents should be taught how to encourage early childhood development. This should be complemented by very local assistance with community-based learning, again, focused on the parents. But this too, must be balanced in that each community needs to be modeled, and the connections drawn between Western learning about early childhood development and local perceptions of the role of the parent.

The parents may also want to engage in various other programs, and opportunities for individual learning, and child-parent learning. These may include basic literacy as well as foreign languages, mathematics and science.

Parents should also be offered the opportunity to engage as educators where they can enhance the learning capabilities of the community by passing on skills, history, local knowledge, etc.

THE ROLE OF COMMUNITY

The community must start with permission. If learning is not valued, it either ceases to take place, or becomes clandestine, neither of which creates a positive learning environment. Community is also the keeper of social norms and permissions for negative investments in children, such as child labor. If community enables poor behavior, if it condones the mistreatment of children, then it can only make learning more difficult.

Community, however, can be the advocate for learning and for its children. Learning need not take place in a location, but can be embedded in the community environment. Children need to see models of learning, and they need to be engaged with older children who demonstrate that learning is positive and beneficial — and that learning is something shared through mentoring.

Community is also the place to learn responsibility and limits. Empowerment is not about anarchy but about growth. Communities must themselves be given permission to set norms that apply to their own behavior models. This will need to be an area of negotiation for any outside organization as Western views of human rights, as they have evolved, may not be shared by local populations. That negotiation may be the most crucial success factor in creating an enduring educational environment.

Other issues that need to be negotiated at the community level include:

- Inclusion for ethnic or cultural minorities
- Inclusion for girls and women
- Marginalization, such as child labor, treatment of refugees, individuals with disabilities.

If those issues can be negotiated, then the community can start using its empowerment to become a learning environment in itself. This would include sponsoring playgroups, learning circles and community level awareness for the issues stated in the policy section. The more the community can manage the basic care needs of its constituency, the more educators can concentrate on higher level skills. Community-based and school-based education must be coordinated and employ feedback

Understanding Local Politics

When it comes to community, it is important to align learning with the political style dominant in the community .

In Africa, three types of political organizational forms exist. These are:

- Kinship
- Lineage and clan
- Administrative authority

The !Kung of the Kalahari Desert Basin of Botswana and Namibia divide labor between the men who hunt, and the women who gather vegetables, roots and nuts. These groups focus communal life around watering holes. This organization is based around a Headman who lays claim to the watering hole and the food. Political leaders exist who are not necessarily the hereditary leader.

For education, people of the !Kung tradition, would not see space as being particularly important. The leader, rather than the Headman, would need to be engaged to negotiate external learning. If he recognizes the value, he would be able to rally opinion among the group.

In lineage forms, such as those of the Tallensi, Logoli and Nuer space is important, and politics revolves around the village. In this groups, leadership is inherited through a linage going back to a single memory of a male leader. Moral and ritual authority usually separated from duties of the chief and guardians of the Earth. These later two titles are tightly bound as a chief derives power from blessing of the earth.

For those seeking to introduce external education opportunities, it is important to navigate this complex triad of power and beliefs in order to gain community acceptance.

What the West would recognize as a kingship is practices by the Banyoro of Uganda. Where the supreme leader would be required to accept any outside assistance.

All of these historical contexts, are of course, overlaid by the remnants of colonial and imperial political structures that set out to undermine the more local associations, which continue to persist.

Regardless of the political structure in place, those seeking to introduce education must be capable of navigating the power structures that exist in order to bring their ideas of education to fruition.

loops in order to remain aligned, to optimize resources and to coordinate learning goals.

A final issue: safety of infrastructure. The community must protect the education assets of the community. This includes facilities, materials, content, technology and educators.

THE ROLE OF EDUCATORS

Educators should think of themselves as guides. That means they will need to understand the needs of individual students in order to achieve their goals as educators. This may be a difficult ask of underpaid, under-skilled educators. So rather than set expectations that are too high early on, we must think about the opportunity in a way that creates better prepared educators. We must also work with governments to provide for adequate health and safety of instructors. It is often the case that educators in the developing world are just as prone to miss class as students. This must not be the case. The community should be a partner with educators to help them fulfill their obligations as leaders.

Educators are also responsible for what would be seen as more traditional tasks, such as lesson planning, discipline, parent communication and conducting the class. In the developing world, these can be very challenging activities, where the authority of the educator may not be respected. So educators must also be tactful delegates to the parents and community in order to garner support needed to fulfill their duty of passing on knowledge.

Because many educators are not adequately trained, the educator must also take on the role of student, so that he or she can enhance their own abilities.

THE ROLE OF STUDENTS

The role of students, should be to learn. That is their job. Unfortunately, that is often not their only job in the developing world, where the need to support the family may come upon young children. Ideally, as we design the learning experience for the developing world, we should ensure that students have but one job, that of student.

In the learning environment, students need to learn more than subject matter, they need to learn how to learn, how to be disciplined, how to be respectful of others. The goal of education at a national or international level should be to develop engaged citizens of the nation and the world, and that means they need all of the requisite skills that will give them the ability to interact at multiple levels of society.

Students also need to learn how to teach. Mentoring, and the recognition of competency by doing, will be an important elements of future education models. Transferring skills through teaching is the ultimate expression of learning. Students need to acquire this skill so that the distributed learning model and can knowledge economy development in the future.

THE LEARNING EXPERIENCE

The learning experience for every child should start with a parent. Without the permission to learn, learning becomes a cultural rift that leads to dropout or division. As students progress, there needs

to be an emphasis on co-created learning experiences, so that students ultimately, understand how to pass their knowledge to one another.

CURRICULUM

For a "cyber school" to be successful, the cyber must take a back seat to the current learning needs of students. The West has a profound need to push its good and services into other, often poorer parts of the world. We have seen local economies of weavers decimated by hand-me-down clothing from charitble Westerners. The one computer per child movements seek to provide access to technology at very very low costs. The effort to provide the technology, however, siphons off funds that might be better used to create learning experiences that are aligned with local need, which may not require a computer. We are so enamored by the hardware, we forget the software and the wetware. And it is the wetware, the human being, that matters most. Technology is important, but it should not be a distraction.

Technology must provide value in an appropriate context. It is not a stretch to say that American and European schools remain challenged as to how to effectively use technology beyond technology training. Some efficiencies may be gained with digital whiteboards, but the use of technology in literature, history, theater arts and even some sciences, remains nascent. It is very presumptuous of Western education leaders to suggest the deployment of computers to young children in the developing world for learning purposes when there is little evidence that their own children benefit from unfocused introductions of technology in their own schools.

Thus, the curriculum for the developing world must be one that helps people develop. Teaches them about their world first, as a starting point for drawing connections to the broader world. This is no different than for any child. Children first experience a day away from home, in the company of others. They start from that moment to see that the world is a bigger place than they have imagined. Education is a bridge to a broader world. Curriculum should be built that helps move children from what may be a very subsistence existence, even a threatened existence in a refugee camp, by providing them first the tools of survival, the tools that will allow them to prosper wherever they may find themselves, not where idealists wish they could be.

TEACHING AND LEARNING LOCAL

Industrialization and globalization have conspired to not only to threaten the diversity of life on the planet, but the diversity of human thought. In a recent report in *New Scientist*[iv], the idea that human beings inherit a genetic language component is being challenged. Many now think that the local language actually has a unique influence on the development of individuals raised using that language.

The following map of Africa from the UNESCO *Interactive Atlas of the World's Languages in Danger* illustrates languages that are vulnerable, endangered, or extinct. All parts of the world have equally poor records of maintaining indigenous cultural diversity. With the advent of technology, we can capture these local language and dialects, translate important materials into them, and use them as a basis for education, communication and negotiation. It will be important as the population and economic shift from Europe and America to Asia, Africa and South America that we recognize this factor and cease the wholesale export of global languages into local markets, but rather come to the

market through the local language. This will build trust, and preserve cultural heritage and knowledge.

v

Thus the curriculum must include elements of cultural preservation along with introduced facts and processes that may be non-native. An early over emphasis of non-native ideas will precipitate continued deterioration of indigenous languages. We must integrate and bridge, not replace.

It would be presumptive to suggest what curriculum would need to include in a local curriculum. An example, however, would be the concept of *Muntu*, from the Bantu language, *Mtu* in Kiswahili, which means a moral or ethical person — the achievement of which can only be done through community. A person cannot become truly human on his or her own. A subtle concept like this should not be lost in eager striving to convert, either religiously or ideologically. As individuals make choices to be more Western or not, the education systems being constructed around them need to be respectful of their heritage on multiple levels—and to balance that against the choices that people make as they become more aware of the outside world. We should not create curriculum that degrades local knowledge and history, because in many places, that knowledge and history far exceeds the longevity of those who come to teach.

This discussion suggests that those investing in developing world education should come not just as educators, but as learners, willing to document and preserve native languages and cultures as they bridge the gaps between modern and ancient ideas and perspectives.

COMMUNITY CURRICULUM

Curriculum must reach above the individual and embrace community. Certain topics of learning can be accepted by the individual, but they are not effective in that the individual cannot execute on what they have learned. Some of these community curricula include:

- Disease control and cleanliness
- Agricultural optimization and livestock management
- Safety
- Management and conflict resolution

INDIVIDUAL CURRICULUM

The individual curriculum would be far too extensive to document here, but certain design elements need to be included, these are:

- Communication (local at first) – writing or reading in native tongue
- Basic first aid
- Local history
- Basic mathematics
- Personal safety
- Traditions (art, history, other cultural elements)

It is important that students of schools not appear to drift too far from the center too quickly, thus possibility alienating themselves from their community. This local-first emphasis helps create a sense of self, as well as a tie to the community, which will provide those who go on to be successful, and perhaps to leave, an incentive to return and bring their wealth back to the community that nurtured them.

As children progress through the system, they will need to take on increasingly external, increasingly sophisticated topics in science and math. Where at all possible, the connection back to the application, to examples, of how this learning applies locally, will be important. That local connection can be used to develop analogies to other places, to other needs, to other applications.

PEDAGOGY AND INSTRUCTIONAL DESIGN

Current research suggests that students do not have a universal way of learning. Martin Gardner's multiple intelligences build on other distinctions, such as Jung's archetypes, which lead to applications like Myers-Briggs. The recognition that all people learn differently is starting to become a major theme in Western Corporate education. However, when it comes to developing countries, in particular, elementary school education, we see the industrial mindset of more of something is better than nothing. And that may well be true, but it is perhaps not the most effective means of investing the scarce resources available.

Investing organizations need to work through the following areas:

- Content in native tongues
- Content that can manifests based on learning style
- Digital technology that either complements, supplements or replaces traditional content and follows the same approach to multiple learning styles

Educators will need to engage students through a number of approaches because the life experience and current living situations may widely vary, as much as the individual students capabilities, learning styles and intelligences. It is highly probable that one of the reasons mass

investments in generic learning fail in developing countries is because all students are treated equally. Equitability is not about equal treatment, but about unique treatment that recognizes the differences of each student.

PERCEPTIBILITY – MEASUREMENT AND ASSESSEMENT

First and foremost, we must ask if the idea of a school is the right idea for the developing countries. As educators now question the underpinnings of centralized school systems in the United States, Europe and elsewhere, it may be better to question the predominate model before continuing to impose it on those in the developing world. As noted above, available and reliable transportation, transportation costs, rough terrain and personal safety should call centralized education infrastructures into question. A more distributed model would also be a more personalized model, a more culturally sensitive model. It is also a model that requires higher personal touch, and thus may cost more, but the cost trade-offs may well prove positive if the de-centralized model achieves more than a centralized model. This cannot be ascertained without more data, but for the purposes of this design, the de-centralized model will be suggested.

Perceptibility describes that metrics used to show progress. In the case of education, competing platforms exist. It is suggested in this paper that the idea of a *universal primary education* has difficulties with all three words in the phrase. *Universal* must be inclusive of parents and community in order to be effective. *Primary* is too narrow a field for the developing world, as issues of permission, support and safety require education beyond the primary in order to make traditional primary age education viable. *Education* is itself a question, as in educate people in what? Is education strictly driven by standardized tests which are coming under increasing scrutiny in the West[vi], or is education in the developing world better gauged by economic success and mobility such as that suggested by Kenneth Ross in his extensive research and commentary at the Southern and Eastern Africa Consortium for Monitoring Educational Quality (SACMEQ[vii]).

Perceptibility in design is about exposing the elements of an experience so that people participating in the experience can understand their place in it.

REPORTING

One of the questions in the prompt for this exercise is the idea of a twenty-first century exam. I would propose that for much of the developing world, more traditional examinations be administered than those the West see as standard. Traditional African education, to generalize, consisted of art and performance, ceremonies, games, festival rituals, dance and song that prepared the learner for life within the local culture. Education designers should consider returning to these interactive approaches as a basic level of competency determinant where that culture continues its struggle to exist.

Rather than gauging intellectual accomplishment through writing and multiple choice, the examination of the twenty-first century might consist primarily of mentoring demonstrations such as that practiced at the Seattle Science Foundation's program for children in Medicine[viii], and brought forward to their higher end education experiences for practitioners.

This will cause a bit of consternation among those looking to compare scores, such as the OECD, which bases its results on standardized reported achievement scores. Using this methodology, the

examination would test for proficiency with a particular competency. Students demonstrate competency by teaching a skill to another student. They would end up with a portfolio of skills, some of which professions, like lawyers or physicians, require future proof of continued proficiency (such as CPR or web-based research). Early on, however, the concentration would be on achieving levels of competency at the most fundamental level.

In African regions where European, American, French or Chinese culture dominate the local economy, preparation for a more global sense must be incorporated. This may require standardized testing in order to provide adequate placement of individuals into working roles. The next level of education then needs to go to these firms to understand new approaches to learning and competency and how to rate portfolios of learning as qualifications for work.

EXPERIENCE – DAY IN THE LIFE

Kunbai is awakened by a brightening sun and the rumble of trucks heading off on errands of mercy, perhaps errands of disruption. At fourteen, Kunbai isn't overly interested in what these men are doing. She is much more interested in resuming her sewing project in class, and learning how the girl Dorothy makes out in the Emerald City. Her phone beeps with a text message from Nosa to remind her where class will be held.

Kunbai's classroom for the day is once again the community center. Last week, when the leaders needed to meet, school was held in a grain storage facility for a couple of days. It is usually in the community center.

A few students, including Kunbai, arrive early to help teacher Nosa, setup his technology. Nosa was educated in Nairobi, but has now stayed in this village for two years to help teach. The students ranges from age 7 to 14. Nosa pulls down a weathered-white screen from one wall of the community center and sets up his LED projector. His computer starts-up and connects to the Internet via a 4G cellular network. There are no cables here. Power is intermittent, but not bad. Nosa has checked the gasoline in the backup generator already this morning.

With everything setup, Nosa calls the students around. Several of them give him big hugs as they arrive. Three of them arrive with their mothers, who wait patiently for Nosa to bring them into the learning circle. From his backpack, Nosa pulls out his paperback copy of the Wizard of Oz. He projects a map of the United States on the screen and reminds the students, reminds them of the location of Kansas with his laser pointer.

He opens up the book, but rather than reads, he hands it to the mother nearest to him, and asks her to read for a while. She bows her head and takes the book.

Nosa sits down with the computer, hides the screen from the projector, and connects with a classroom outside of Ghanzi. Today his students are going to compete on geography with Mr. Akims students.

In the background, he hears the stumbling reading of the mother, who is not holding the children's attention. A din of side conversations is starting to rise. He quickly bows to the mother, reaches out for the book, and continues to read as an animated actor. Growling and whining for the Lion. Squeaking and squinting for the Tin Man. Dropping his voice to a boom for the Wizard.

The children laugh and recoil. As the flying monkey's take flight, he closes the book and assures them he will continue tomorrow. A tap of a button on his remote brings the LED projector back to life. On the screen now, is the class outside of Ghanzi, waiting to compete with these students. The student in Ghanzi are a little hard to see, as the natural light floats in from the canvas sides of their usually exposed classroom. The rumble of the generator can be heard over the speakers.

Nosa may have a better classroom, but his students lose by two points. Some of the students have grown to know each other over the years and text messages back-and-forth with brags and rebuttals. Nosa completes some instant messages back-and-forth with Mr. Akim, and accepts a file, which downloads a series of pictures of Dorothy and her companions. Nosa does not show them to the children. He wants them to draw what they imagine they look like before he shows them what artists and America's Hollywood imagine them to be.

The students break for recess. They play football for 30 minutes. Many of the older students are teaching the younger students the basics. For the last 10 minutes the older students play a quick game to show the younger students "how it is done." The younger students don't pay much attention, deciding instead to awkwardly kick a ball amongst themselves.

The mothers look one waiting for any signs for conflict. They see nothing. One lights a cigarette and is instantly berated by her peers. She shrugs them off and goes on smoking.

By the time students arrive back in to the community center, their desks have bright white sheets of paper on them and a digital paper projection device with today's mathematics lessons. Although the students are at multiple levels, they are all learning aspects of the same thing - water volume. The younger students are learning about weight, the intermediate students about volume and the advanced students about the calculus of dividing up the container into a series of triangles in order to recreate it digitally. Nosa needs only one jug and a handful of equations. The jug belongs to one of the mothers who uses it to bring water from the nearby watering hole. Before they start she tells the story of the jug to the children, how her mother acquired it, and how old it is. For a bonus, the children are asked to figure out how many days old the jug is.

After math, the intermediate students, they move from painting with brushes and fingers, to painting with light. Nosa opens up a few tablet computers and let's the students get the feeling of painting with their figures against glass. He also introduces a stylus and a drawing tablet so they can understand the different ways, and different disconnections between visual orientation and fingers and feedback, that can exist. The younger students draw on big sheets of paper. The older students are still trying to get their jugs to render. They are all drawing jugs.

One of the village elders enters the room as the students are cleaning up. Shows them a stick with carvings on it. He tells them the story of the stick. He teaches them some ritual concepts, a song that is related to the story.

Nosa is not worried about attention here. The elder always commands respect and he is a very good story teller.

The children are asked to write their own story. The youngest ones are allowed to draw. Nosa takes them aside and has them tell stories before they start to draw. Some of the stories are about moving away to a big city and having money for a big television and their own store of frozen food. Nosa is used to stories of wanting rather than adventure.

As the sun drops lower into the sky, the students help Nosa clean up the room.

Kunbai is playing with the stylus of the main computer and proudly showing a digital jug rotating against a bright purple background. Kunbai is proud of her work. She likes that Nosa let's her use purple in math class.

Nosa stays behind, at the little desk in the corner. Tomorrow he will be teaching about storytelling. He draws out his lesson plan. On a server in the cloud, different pieces of content assemble themselves to match each student's current capability related to storytelling. For the young ones, picture books are assembled. For the Intermediate, a series of related short stories are collected. Although each is different, the themes are close. For the advanced students, an interactive story deconstruction kit is readied. They can pull the story apart – characters and places, plots and themes, and create a mindmap, right from the reading. Some have supplemental audio or visual material to support their reading. Nosa reviews the material, saves the lesson plans and head home to his wife to help her prepare dinner.

RECOMMENDATIONS

Although this is a design of a 21st Century Cyber School, it is clear that such an entity cannot exist as a standalone entity that is simply plopped down in the sub-Saharan desert, near a village, with hopes that technology will connect, enhance and transform the local people into more worldly, globally conversant, contributors to the national and international economy. If this is the vision of a 21st Century Cyber School, then it is doomed to failure. If, however, the advocates of learning in the developing world approach the opportunity holistically, recognizing the myriad factors that contribute to a learning environment, then technology can play a significant role in the lives of young people, adult learners as well as those who presumably are teachings, but may well be learning more themselves than they expected. In that light, I have extracted several recommendations from the body of this paper and put the forth here for both summary and highlight.

- Develop education designs in light of local need.
- Incorporate local, traditional learning methods wherever possible.
- Do not impose Western models of education.
- Work with communities to develop policies for personal and communal safety, personal hygiene and community sanitation, adequate nutrition, prenatal care, child birth assistance, safe water, energy, access to basic education supplies, academic freedom.
- Design for distributed, not centralized learning.
- Use technology for collaboration and for personalization.
- Consider the highest level learner the community. Include parents in the learning model.
- Create meaningful metrics to the community, do not fall into the trap of false metrics like Universal Primary Education.
- Negotiate treaties so that foreign interests in local areas support general education for local need, rather than any ideology they practice in their native countries.
- Create learning experiences that foster a sense of accomplishment for the learner in the way they define accomplishment and success.
- Develop an international database that provides local intelligence for education planners.

- Develop technology that uses the principles of business intelligence to deliver personalized, individualized learning experiences.
- Work with publishers to develop componentized content, using multiple perspectives as input to the individualized learning algorithms.
- All solutions should be designed to accommodate mobile devices.
- Education should be built on wireless public networks rather than private, wired networks.
- Creating *learning hubs*, not schools, so that learning spaces can be mobile and configurable to different learning objectives.
- Eliminate any sense of school year and engage in continuous learning.
- Adopt mentoring and skill portfolios as the 21-st Century assessment and competency communication tools.

CONCLUSION

When we think about students in the developing world, the image is often that of young people in rural settings, reading from torn books, with a chalkboard hung haphazardly on the wall. Perhaps they have uniforms, but the floor is dirt or straw, the one teacher reads to eager students of clearly multiple ages. This may well be the case, but it needn't be. The portability of materials, as well as access to digital infrastructure (online or not) means that the money spent of facilities should be redirected to content and experience design.

This is a design. This design is not complete. It says little about administrative issues, compensation models or other management issues. These would need to be worked out prior to deployment.

This design does, however, recognizes elements far outside the use of software or hardware to solve learning issues in the developing world. Because it is a design, it must be tested in the real world in order to garner the feedback necessary to make any of its tenets viable. Learning in the developing world requires a visceral connection to the reality of any given village or township prior to any outside entity proposing, let alone building, a school. Cyber school will not exist without recognition of environmental elements critical to their success.

A cookie cutter transfer of Western ideas for education will fail at the grandest level, even if individual instances survive and thrive. For without a context of cultural intimacy and continuity, the developing world may simply be destined to repeat the failures we see in America's inner-city schools, the disconnects between what needs to be known in the West and what is taught, the forced indoctrination of indigenous peoples of many countries by the political entities that govern their traditional lands.

Some would argue that this is progress. But we now stop freeways when a mastodon skeleton is discovered, or a native village unearthed while excavating for new homes. As we pave over the world with Western thought, we should pause when we encounter a live culture, and attempt to negotiate the boundaries of belief.

We are not going to simply walk into villages where locals wait with frustrated hesitancy for the tools of the West to arrive and fulfill the needs that they cannot fulfill themselves. The truth is, people have their own lives, their own traditions. They live now without the education we want so desperately to provide. They posses forms of knowledge and traditions of learning that we must actively integrate in order to succeed. If we are to build cyber schools that are successful, we must

take the malleability of technology and bend it in a way that is meaningful and valuable to those who learn, not to those who wish to teach. As the *New Scientist* article on languages points out, brains are wired based on culture and language. What we say, may not be heard the way we believe we said it. What we hear people asking for may not indeed be what they are asking for. Progress takes many forms and is accomplished through many paths. Technology is a tool, that like the human mind, can adapt to the needs of many. As we design the educational experiences of the future for the developing world, we must co-create those experiences in a very intimate way, and take the time to learn as we go, not to simply pave over other cultures with our enthusiasm to spread our light. The best educators will take the time to absorb the world they encounter, before they start negotiating ways to represent their world in a way the complements and supplements. A cyber school must represent our best attempt to use technology to help people first of all survive where there are, and afford them the opportunity to make choices about where they go after that.

---

[i] Mingat, A., and Jaramillo, A. (2003) 'Early Childhood Care and Education in Sub-Saharan Africa: What would it take to meet Millennium Development Goals?', Washington DC, World Bank. Van der Gaag, J., Tan, J-P. (1998) 'The benefits of early child development programs: an economic analysis', Washington DC, World Bank. Heckman, J. (1999) 'Policies to foster human capital', NBER Working paper series No. 7288. Schweinhart, L.J., Montie, J., Xiang, Z., Barnett, W.S., Belfield, C.R. & Nores, M. (2004) Lifetime Effects: The High/Scope Perry Pre-school Study Through Age 40, Ypsilanti, MI: High/Scope Press.

[ii] Arnold, C., Barlett, K., Gowani, S., Merali, R. (2006) Is everybody ready?: Readiness, transition and community: reflections and moving forward. Bernard van Leer Foundation. Background document for the EFA Global Monitoring Report 2007. Forthcoming Foundation Working Paper.

iii UNESCO, Regional Overview, Sub-Saharan Africa.
http://www.unesco.org/education/efa_report/zoom_regions_pdf/ssafrica.pdf

iv Kenneally, Christine. "Language lessons: You are what you speak." New Scientist. 01 June 2010.
http://www.newscientist.com/article/mg20627621.000-language-lessons-you-are-what-you-speak.html?full=true

v http://www.unesco.org/culture/ich/index.php?pg=00206

vi Sacks. Peter. Standardized Minds. Da Capo Press. New York, NY. 1999.

vii http://www.sacmeq.org/research.htm

viii http://www.seattlesciencefoundation.org/kids-in-medicine.htm