Bridging the Educational and Digital Divide

The EduVision
E-Learning System
Pilot Project

EduVision, P.O. Box 30772-0100 Nairobi, Kenya • t: (20)861680/84, m: 0720-339126, f: (20) 861690 • info@eduvision.or.ke

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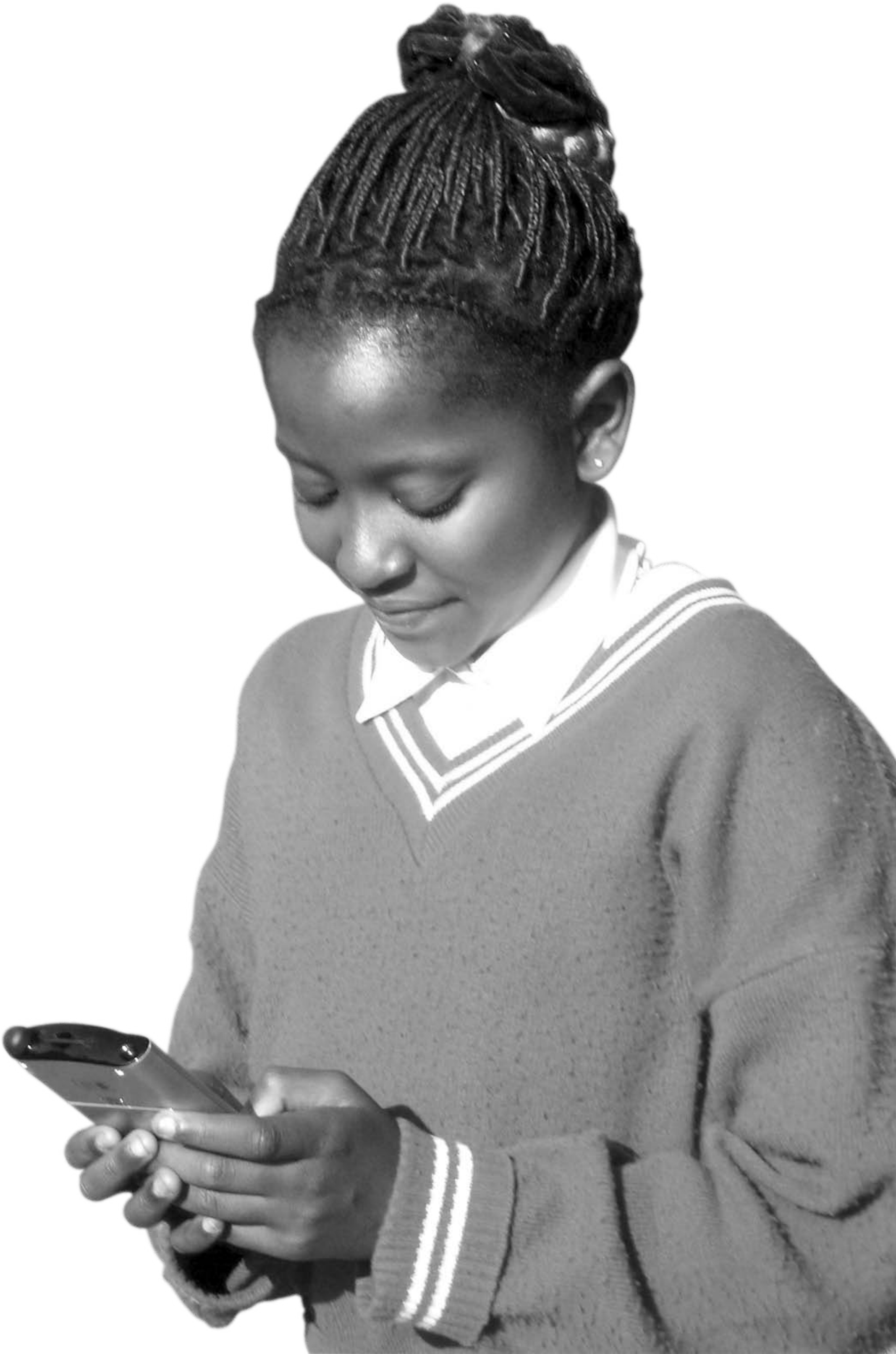
EduVision
P.O. Box 30772-0100
Nairobi, Kenya

info@eduvision.or.ke
http://www.eduvision.or.ke



1.0 Executive Summary

During the World Education Forum in April 2000, the international community committed itself to ensuring education for "every citizen in every society," and eliminating the current gender disparity in primary and secondary schools by the year 2005. As is shown in Table 4.1 (page 6) meeting these goals will not be easy; much work remains to be done.

The goal of BioVision's "EduVision" project – a goal which goes a long way towards realizing the WEF commitments – is to increase access to quality primary and secondary education throughout developing countries, by lowering the cost of education and simultaneously increasing the quality of the educational materials. EduVision achieves this through the development and application of appropriate information technology tools, which have the potential to create a sustained increase in the access to high quality educational materials. This includes textbooks and other curriculum content that form the basis of the current education system, as well as extra-curricular resources such as encyclopedias; current local, national and international news content as well as digital versions of the *15 million books* in the university libraries of Harvard and Oxford whose copyright has expired, thanks to Google's just-announced conversion project. The objective of this pilot project is to determine the feasibility of implementing such a system in a rural region of a developing country, both in terms of the technology itself, as well as the ability and willingness of the teachers and students to use it.

The EduVision E-Learning System (EELS) is an end-to-end content management system that can efficiently distribute educational material in real-time to anywhere on the African continent. The project will involve transforming current curriculum content into a digital form, which will eventually allow them to be made available to a greater number of pupils at a lower cost. Pupils will access these materials via a simplified tablet computer, or eSlate, which will be wirelessly connected to their school's BaseStation, a unit that downloads content from satellite radio. Perhaps somewhat surprisingly, EELS is cost-effective: unlike textbooks that can only be used for one year, a single eSlate follows a student through the course of their education, downloading new content and textbooks as needed. Even when the costs of loss, breakage and wear-and-tear are factored in the overall cost of EELS is lower than the overall costs of paper textbooks. Notably, EELS is not confined to cities and the few rural schools with electricity. Instead it is designed to work in the most remote of regions: when outfitted with its solar-power unit the entire system requires zero infrastructure. The EELS software platform is similar, and has been simplified and pre-configured so as to not require outside technical support.

What BioVision is proposing with EELS is more than a few interesting technologies, it is a comprehensive solution. The technology is only useful if there is information to access through it – and through the EELS network a wealth of information can be disseminated. EELS is designed to be self-sustaining, in addition to education there is already significant demand for a system akin to EELS among NGOs and government extension workers (particularly in the fields of agriculture and healthcare). Through such additional partnerships we can ensure that our technology will always be up to date, our infrastructure always supported and our technology cutting-edge. However, the initial focus on education will remain central to the project at all times, in no small part because it is this sector that will have the most far-reaching implications for society at-large. Students will become computer literate in primary school, and will be able to share the wealth of information at their fingertips with their families (such extra-curricular information could conceivably include tips for the prevention of malaria or sound agricultural practices).

The pilot project will have an initial start-up phase of three months during which the EELS technology will be finalized and purchased in the required quantity, textbooks will be converted to a digital format, school facilities prepared to accept the technology and teachers, school officials and students trained to use the technology. During the year of implementation the system will be continously monitored, and reports will be compiled detailing how students and teachers are using and reacting to the new technology. The project will identify any gaps and shortcomings and will attempt to rectify them as the project progresses. A consultant will be brought in to verify the results of the final evaluation. Finally, a proposal or business plan for a large-scale implementation of the system based around a public-private partnership will be produced.

The results of the pilot project will be presented at the second meeting of The World Summit on the Information Society in Tunis in November, 2005.

2.0 Goals and Objectives

This pilot project will contribute to the realization of the goal shared by governments throughout the world, the United Nations (notably UNESCO and UNICEF) and BioVision to increase both access to, and the quality of, primary and secondary education in developing countries. This long-term goal cannot be achieved in the one-year duration of this pilot project, however the short- to medium-term outcomes of the project are prerequisites of this goal. In particular, this pilot project will, through the development and use of appropriate information technology, create a sustained increase in the access to high quality educational materials, including textbooks, encyclopedias and current local, national and international news content.

The primary objective of the pilot project is to test the feasibility of the EduVision E-Learning System, both in terms of the technology and the willingness and ability of users to adapt to it, as well as laying out the groundwork infrastructure for the system to be implemented. The specific objectives are to:

Finalize the hardware and software development of EELS and procure the hardware in the necessary quatity;

Convert the curriculum of one class to the EELS platform;

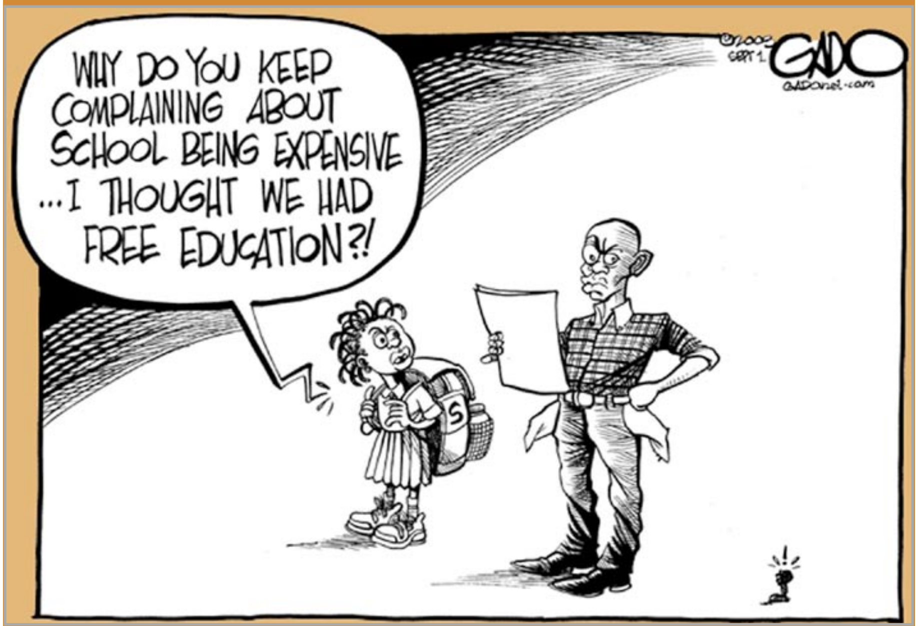
Provide the necessary training to teachers and students of the class;

Run a half-year pilot project to study the feasibility of EELS in rural, LDC schools;

Prepare a proposal for larger-scale, sustaiable implementation of EELS.

3.0 Introduction

That the pace of technology adoption in developed countries by far eclipses that of developing countries is well known (the so-called 'ever-widening digital divide'). Economists worry about the economic implications of such a disparity, as technology and productivity have a positive correlation. For developing countries already struggling to catch up with the industrialized world yet one more handicap may, at best, extend the path to development, or in a not-entirely-unconceivable worst case, prove to be one too many. However, the solution to this problem is found not in the adoption of the same technology tools used in the industrialized countries. Not only are they expensive, they are also ill-suited for use in developing countries, which lack the same level of infrastructure as the developed countries for which they were designed. Instead, technology needs to be designed specifically for a target audience in developing countries, both in terms of the role the technology will fill – ensuring the demand for it is present – and its ability to function despite sometimes limited levels of infrastructure. Perhaps most importantly, it must be affordable. It is these technologies that will quickly become commonplace in developing countries, and it is these technologies that will slow, halt and then reverse this ever-widening digital divide.



From Kenya's *The Daily Nation*, September 1st 2003. Cartoon comments on how free education is not, in practice, "free" because of textbook, stationary and uniform costs.

This proposal presents one such technology, one that is designed specifically for use developing countries, and one whose use is neither a novelty nor luxury – but caters to real need: increasing access to affordable, quality education. Indeed, that is its central purpose – the positive effect it will have on the digital divide is but a by-product, albeit a rather beneficial one.

EduVision, a project of the Switzerland and Kenya-based BioVision Foundation, seeks to assist countries in improving their education systems by providing appropriate information technology tools for the classroom. To lower the overall cost of primary and secondary education, EduVision aims to replace physical textbooks, notebooks and stationary items with a single integrated system which will follow each student throughout the course of their education. Not only are the long-run costs of this solution lower, but the quality of the information and textbooks disseminated via EELS is significantly higher. Instead of poorly printed black-and-white textbooks students will have access to multimedia content such as photographs, sound clips and even video clips. At the same time, students will be able to access an electronic library of vast proportions. All of this comes at a lower cost than their current textbooks.

EELS is an end-to-end content management system that can distribute educational material in real-time to anywhere on the African and Asian continents (as well as Latin America). It consists of user terminals called eSlates, which are simple tablet computers designed for students and teachers, and of a satellite radio-based network that transmits the material. This technology can be made available at a remarkably low cost – indeed one lower than the aggregate price of one child's textbooks used throughout their primary education. The benefits of EELS inculde the following:

Reduducing the cost of textbooks for governmnets and families;

Providing unlimited quantities of up-to-date textbooks electronically, making it possible for more school children to have access to their own books;

Increasing enrolment and decreasing the gender gap in schools;

Exposing school children to information Communication Technology (ICT);

Empowering schoolchildren to use the technology and to introduce it to their families;

Reducing the use of paper through electronic transmission of assignments from students to teachers.

In addition, over the long-run EELS will narrow the digital divide that currently exists between developed and developing countries by exposing the youth of developing countries to modern ICT tools.

Initially, EduVision proposes to run a pilot project to test the feasibility of using the technology in a rural developing country setting, and both the ability and willingness of students and teachers to use it.

4.0 Background

4.1 Government and United Nations Response

Meeting in Dakar, Senegal for the World Education Forum in April, 2000, the international community reached a commitment to ensure education for "every citizen in every society." This commitment encompasses two specific goals; the first being that by the year 2005 the current gender disparity in primary and secondary schools will be eliminated; and the second being that by the year 2015 all children will have access to complete, free and compulsory education. These goals were further incorporated into the Millennium Development Goals, signed by the member states of the United Nations in September 2000 (World Bank: Education For All). This commitment reflects the international community's collective belief that education is a prerequisite for the eradication of poverty, the improvement of healthcare standards, sustained long-term economic growth and the building of dynamic, democratic societies.

Despite the importance of education, securing these goals has not been a straightforward process. The World Education Forum in 2000 came as a follow-up to the 1990 Education for All Conference, where countries pledged to secure universal primary education by 2000. By 1999, however, these goals were far from realized: there were still 120 million primary-aged children being denied education, more than half of which were girls, and three quarters of which came from Sub-Saharan Africa and South Asia (Global Health Council 2002).

The year 2005 finds the world at the doorstep of the first of the WEF deadlines, a mere decade from the second. Current indicators, however, show that within this short time-period there is still much to be done, most notably in Sub-Saharan

Table 4.1: Education and ICT Indicators by Region (plus Kenya)

	Number per 100 Population		Primary School Enrolment Ratio				Net Primary School Attendance (%)		% of Primary School Entrants Reaching Grade 5		Secondary School Enrolment Ratio	
			1997-2000 (gross)		1997-2000 (net)		1992-2002		Admin Data	Survey Data	1997- 2000 (gross)	
	Phones	Internet Users	Male	Female	Male	Female	Male	Female	1995-1999	1995-2001	Male	Female
Sub-Saharan Africa	4	1	89	78	63	58	58	54	65	82	29	23
Middle East and North Africa	15	2	95	86	83	75	82	74	93	-	68	62
South Asia	4	1	107	87	80	65	76	69	66	91	53	39
East Asia and Pacific	23	4	106	106	93	92	-	-	94	-	65	61
Latin America and Caribbean	32	5	126	123	96	94	91	91	77	87	82	87
CEE/CIS and Baltic States	33	3	99	95	88	84	79	76	-	96	81	78
Industrialized countries	117	37	102	102	96	97	-	-	-	-	105	108
Developing countries	16	3	105	96	84	77	74	70	79	89	59	52
Least developed countries	1	0	87	76	67	61	58	53	66	79	30	25
World	32	8	104	96	85	79	74	70	80	89	65	59
Kenya	3	2	95	93	68	69	71	73	71	88	32	29

(Source: UNICEF 2004)

Africa. (Sub-Saharan Africa finds itself consistently behind world averages for all UNICEF education indicators, often in last place, see Table 4.1) In terms of the specific goals, the region still exhibits a gender disparity of 5 per cent at the primary level, and 6 per cent at the secondary level. The second goal is even more elusive; net primary school attendance in the region is a mere 56 per cent (UNICEF 2004). Only a radical change in the approach to providing education in these regions will ensure that these goals do not become just hollow promises, and in so doing deny to many what is perhaps the most human of the human rights – an education.

4.2 Kenya Context: Free Primary Education for all and Capacity Gaps

Kenya was selected as the host country for EduVision's pilot project for several key reasons. Logistically, Kenya is practical: it serves as BioVision African headquarters. More importantly, however, Kenya makes for an interesting case study in the implementation of an ICT solution akin to EELS. In 2003 a newly elected Government of Kenya made good on its election pledge to provide free primary education for all. However, this initiative – like the many others that have preceded it in other countries around the world – serves to highlight the problem of maintaining quality in education when access is dramatically increased. For example, Kenya's free primary school declaration was followed by a three-fold increase in student enrolment; an important milestone in reaching the WEF 2000 goals. However, it was not without problems: schools were left scrambling to deal with the influx of students, which severely taxed their infrastructure and supplies.

Students were crammed into classrooms and forced to sit on the floor for a lack of desks, while teachers were compelled to allow students to complete exercises in chalk on the walls of classrooms due to a lack of stationary supplies. However, the most serious deficiency (in terms of the impact on the quality of education) was the shortage of textbooks. Alarmingly, today (two years after the introduction of free primary education) the shortage remains acute. Primary school students in the younger grades are theoretically expected to be three to each book, until they reach the higher grades and the ratio improves to 2:1. This is according to government guidelines, while in practice situations of five students sharing a single book are not uncommon. While obviously better than the alternative of no education such a situation does not – it cannot – meet the standards of an adequate one.

Starting in the late months of 2004 Kenyan newspapers, televisions, and radio stations, were involved in a lively debate between the Government, civil society, educators and parents. This was instigated by Kenyan President Mwai Kibaki's declaration that parents have a responsibility to contribute towards the education of children when the Government's attempts fall short of standards and expectations. At first public reaction consisted mainly of anger at yet another unfulfilled pledge by the Government. Shortly after, however, commentators in the media shifted the focus from the political realm to the pragmatic one: As a developing country, the resources available to the Government are limited, yet as there are many signs of the Government working towards a better education system, it is indeed time for people as both parents and citizens to play a role. Within the following weeks a sharp change could be seen in attitudes country-wide. Clearly the education of their children ranks high among the priorities of families in Kenya, signifying widespread belief in its vital importance to the future – future of both individuals as well as their society. All that is lacking is a tool to overcome the access and quality barriers, the will is there. This project will test one such proposed tool: the EduVision E-Learning System.

4.3 Addressing the Capacity Gaps

A solution to education capacity gaps can be found in the implementation of appropriate ICT tools. The notion of using ICT tools, such as basic computers and communication accessories, in the education sector of developing countries is often dismissed out-of-hand due to several inherent limitations of these countries. These limitations include the lack of necessary infrastructure, general education level and the price and user-unfriendliness barriers of the technologies. However, such limitations apply only to ICT tools designed in and for developed countries. Instead of being designed for the task at-hand, and thus priced accordingly most of these technologies come with the capabilities and features suited for the infrastructure-laden developed world. Similarly, they forgo technologies that are well-suited to lower income countries with poorly- or under- developed infrastructure levels. As a result they are high-priced and poorly-suited for the physical and technical realities of many developing countries.

The ideas put forth in this proposal take advantage of the many technological advances that have occurred in developed countries, and deliver the benefits to disenfranchised populations in the developing world. In designing EELS, BioVision turned to the considerable technological expertise of developed countries, and adapted existing tools to new uses. The end result is a key that will allow the populations of developing countries to unlock the vast information and knowledge resources of developed countries, as well as facilitate the dissemination of indigenous ones.

5.0 Background

5.1 BioVision Capacity Statement and Approaches to Development

BioVision is a Swiss not-for-profit foundation with a global mission to alleviate poverty and improve the livelihoods of the poor, while maintaining the precious natural resource base that sustains life. BioVision functions as an intermediate between research institutes and local communities, ensuring that benefits of science reach the people most in need of them.

In 2002, BioVision provided seed money to begin preliminary work on the development of an ICT-based system to replace physical textbooks. The seed money was used to research available and suitable technologies for use as part of EELS. Along these lines, the goal of the seed money was the creation of a prototype eSlate and BaseStation and the theoretical design of the EELS network. This was completed by the end of September 2002, at which time the focus of the project shifted towards forming of strategic alliances with partners and the planning of a pilot project.

5.2 Why eSlate Technology?

EELS increases access to quality education by eliminating the recurring cost of textbooks. Following a large-scale implementation of EELS technology (a plan for which will be developed as part of this pilot program; see Objective 5) students will receive one eSlate that will follow them through the entire course of their education, instead of purchasing new books each year. Furthermore, additional expenditures on stationary will also be substantially decreased, as the majority of assignments will be completed directly on the eSlate and sent electronically to the teacher for correction. The reduction of costs is particularly important in impoverished regions, such as sub-Saharan Africa, which has the lowest worldwide level of both primary and secondary school enrolment. The cost of education, to both families and governments, is the single most important contributing factor. In such cases, the implementation of EELS will result in substantial increases to the enrolment levels of both genders, at both the primary and secondary levels, concurrent to a decrease in the per child cost of education.

While the primary benefit of EELS is a reduction in the cost of education there are numerous secondary benefits from the system. The first of these is an improvement to the quality of education. The quality of textbooks used in both primary and secondary schools is often substandard, both in terms of the information presented and their condition: they seldom withstand the wear and tear of a year's usage. This makes it increasingly difficult for teachers to provide the pupils with a quality education. Through EELS's continually updating content, the information presented to teachers and students will be relevant, up-to-date and easily customized for different learning environments. Furthermore, the multimedia capability of EELS allows students and teachers access to information in an unprecedented manner. Lastly, at the time of manufacturing the hard disks of the BaseStation units are stocked with electronic books, journals and other information resources giving the students access to a quantity of information that, in paper form, would fill a large library.

Yet another secondary benefit of EELS is the effect that it will have on bridging the digital divide that exists between the more and less developed countries of the world. This technological divide grows at an ever-increasing rate. While progress in the high-technology sectors has been achieved in many poorer countries, this is often, if not always, confined to capital cities, and even therein to limited and privileged percentages of the population. The vast majority of developing country populations have limited access to the wealth of information available to their developed country counterparts simply because the tools to access this information are not within their reach. With the world's collective future becoming more tied to technology with each passing day, the continued existence, not to mention growth, of this handicap could have a disasterous impact on future developmental progress.

The most striking aspect of this digital divide is that it exists at all. The state of available technology today provides no justification for this. The solution that we propose, to be first used as an electronic replacement for textbooks in schools throughout the African continent (and perhaps eventually Asia and Latin America as well) but has potential as an knowledge dessemination tool in a myriad of other applications, is built completely with off-the-shelf components. This has some notable benefits, including low costs and proven technology. The sheer number of students and teachers involved in the education sector make an excellent case for economies of scale. With the higher fixed- than variable- costs the proposed solution caters to this market. After the creation of our network infrastructure the costs of adding users to the system are confined only to their end access products (their eSlates and BaseStations). In other words, the EELS network costs the same to maintain whether we have one hundred or one hundred million users. The proposed EELS is a long-term sustainable solution but requires short-term support for the initial network development and in order to prove its viability.

A further example of the benefits of EELS reaching far beyond the classroom is the potential to use the system as a conduit to the family. Information on larger social issues, such as malaria prevention, personal hygiene and sound agricultural practices could be transmitted via EELS. Students would then be encouraged to share this information their families. The potential for this huge: for example, simple preventative measures such as the screening in of family dwellings can substantially decrease the prevalence of malaria.

EELS fits squarely within the mission goals of the United Nations' Information and Communication Technologies Task Force (UN ICT Task Force). Launched in 2001, the UN ICT Task Force is "intended to lend a truly global dimension to the multitude of efforts to bridge the global digital divide, foster digital opportunity and thus firmly put ICT at the service of development for all. The Task Force is supported by the Heads of State and Government of all UN Member States who endorsed the ECOSOC Ministerial Declaration at the Millennium Summit in September 2000." While EELS as a whole fits squarely into the mission statement of the UN ICT Task Force, there are particular clauses in its Plan of Action that call for solutions akin to the one that we are proposing so directly so as to merit their inclusion:

Help make Internet and other ICT relevant to the lives of the majority of the planet's population, including the poor and the illiterate, and empower them.

Help lay the foundation for future universal participation in the global information society; short-term: enable more people to benefit from ICT, via training, education, and institutional capacity building.

Support development and application of ICTs to strengthen health care system and infrastructures to combat diseases such as HIV/AIDS, TB, Hepatitis, cholera, diarrhea, malaria, etc. In support of the Secretary-General's global initiative to combat HIV/AIDS and the establishment of the Health InterNetwork.

Promote ande support ICT dissemination among the

children of the developing world, with special attention paid to girls; enhance the training of teachers on ICT and the "digital literacy" of pupils; expand opportunities for training/education for people living in under-served areas through distance learning; give special attention to disenfranchised, disabled and illiterate people through innovative partnerships to disseminate knowledge using ICT.

A partnership with a provider of solar equipment could ensure the ICT infastructure is powered even in areas without electricity.

While designed to increase access to high quality education in developing countries, the EELS program acts as a single door through which the key issues facing developing countries can be addressed. These issues include poverty and hunger eradication, bridging the digital divide, promoting gender equality and the empowerment of women, increasing awareness and combating diseases and ailments such as HIV/AIDS, malaria, and diarrhea. By educating the children of the developing world, these issues can be fought from many fronts.

5.3 Description of the Technology Components

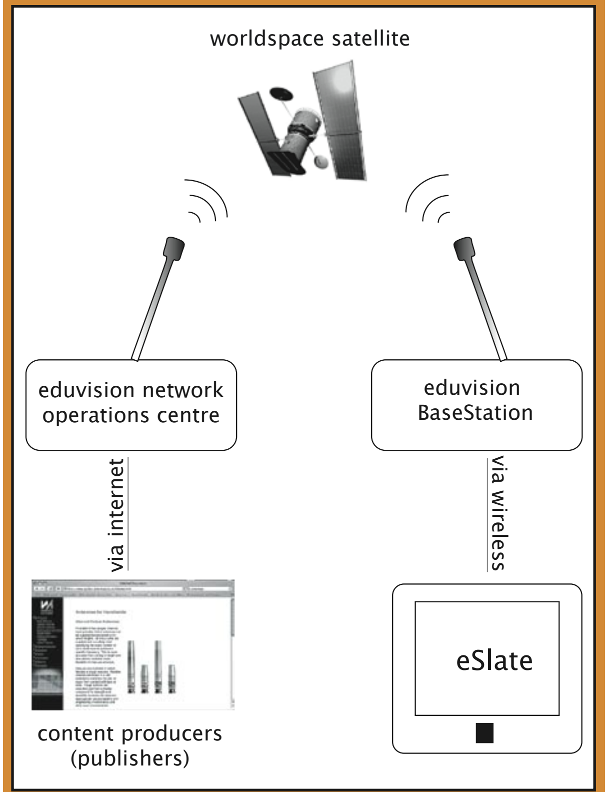
EELS consists of the three distinct pieces of technology: the eSlate, the BaseStation and the Network Operations Centre. While all three of these pieces are groundbreaking technologies in and of themselves, they become far more interesting – and far more useful – when they are used in conjunction with each other. This 'conjunction' is made possible via the WorldSpace satellite radio network, that already covers the entire African and Asian continents, as well as Latin America – and does so inexpensively.

The first of the EELS technologies is the eSlate, or tablet computer with which each student and teacher will be outfitted. Essentially, these are large versions of the popular palm-top (PDA, or Personal Digital Assistant) computers that have become commonplace. The eSlate – that will cost less than $100 per unit by the time EELS is ready for large-scale implementation -- contains a large screen that the user writes and 'taps' on to input data and navigate. It runs a version of the popular and free "Linux" operating system, that has been greatly simplified (the eSlates come configured to work with our system, so no configuration is ever needed, indeed to prevent inadvertent changes to configuration such controls are locked). The eSlate has a built-in wireless network card and antenna that it uses to transfer data from (such as textbooks, news content and other files) and to (such as completed assignments destined for the teacher) the second component, the BaseStation.

The BaseStation is the component that receives and processes the satellite beam. It contains a large hard disk drive, a digital satellite receiver, a wireless network card and a satellite (or, where available, mobile) phone. Information such as textbooks and up-to-the-minute news coming off the satellite is recorded onto the hard disk. The BaseStation then examines the content received, and determines if any of it is destined to the eSlates that connect to it (this is described in more detail in the next paragraph). Content that meets this criteria is stored, and transferred via wireless network to the eSlates when they come within range (100m) of it. While transferring content to the eSlates, the BaseStation also collects assignments from the student's eSlates that they have marked as ready to be handed in. When their teacher connects these assignments will be transferred to his or her eSlate so that he or she can grade them.

The final component of the EELS technology set is the Network Operations Centre. This is where the EELS network is controlled from. Textbooks and other content destined for the eSlates is sent to the NOC via the Internet. At the NOC it is prepared for the satellite transmission, and assigned a 'tag' that describes which eSlates are to receive it (these tags allow content to be routed to a location as specific as a single eSlate or as broad as an entire continent -- and everything in between). The NOC then forwards the now-ready content to the satellite's transmission station, where it sent up to the satellite and then back down the BaseStations.

Figure 5.3.1: EELS Network



A more detailed description can be found in Appendix A

6.0 Pilot Project Description

6.1 Objectives and Activities

Initialize the hardware and software development of EELS, and purchase the technology necessary to outfit one class in one rural school with the system.*

While the prototypes developed in summer 2002 exist, technology has been updated since then. The first phase of the pilot project, therefore, will be the finalization of the underlying technology for EELS. In this phase the remaining software programming work will be completed. This includes the software for the EELS NOC, BaseStation and eSlate. Also during this phase the technical specification for the BaseStation and eSlate will be finalized, and units procured.

Convert the curriculum content of the class to the EELS platform.*

During this phase teachers, school administration officials and EduVision staff will study the existing curriculum and create a plan entailing its conversion to electronic form. Following this the actual conversion will be carried out. Depending on the material this may be as simple as reformatting an existing electronic version, or may involve re-entering the content into a computer by hand.

Provide the necessary training to school officials, teachers and students of the class.*

The third phase of the project is the training of the users. EduVision staff will train teachers at the test school, in both the operation of EELS and eSlates, as well as in methodology for training students to use eSlates. Teachers will then in turn train their students, with EduVision staff standing by to monitor and offer any necessary aid, and record the students' progress. Based upon this data, EduVision will then prepare an EELS Training Curriculum for Students and Teachers.

Run a one-year test-phase of EELS to study the feasibility of it in rural LDC schools.*

Once training of the teachers and students is complete, the students will begin one school year of instruction based on EELS. During this period EELS engineers will be on hand at the school to deal with any technical issues that may arise. EduVision staff will meet frequently with teachers, school administration officials and students to monitor progress. Furthermore, an independent study on the progress of the students, in terms of both their academic performance and

* indicates activity is either currently in-progress or complete as of February 2005 (funding provided by BioVision)

their ability to adjust to EELS technology, will be carried out by an education specialist.

Evaluate test-phase and prepare a proposal for a larger-scale implementation of EELS.

At the end of the school year the collection of reports on the pilot project will be studied and collated into a final feasibility report. This report will highlight the strengths and weaknesses of the project. A conference will be held were these findings will be reported to various partners, including governments, NGOs, multilateral organizations and the key private sector members. This conference will put forth a series of recommendations for future steps, including the various roles to be filled by interested parties. The conference will emphasize the need to develop curricular and extra-curricular content for EELS. Out of this conference proposals for future, larger-scale, implementations of EELS will be created.

6.2 Site Selection

The selection of an adequate school is essential to the successful implementation of the EELS pilot project. EduVision has selected a rural school in Western Kenya located on the shores of Lake Victoria. The school, Mbita Point Primary School, is a public school located on the grounds of ICIPE's (the International Centre of Insect Physiology and Ecology) Mbita Point Field Station. Also located on the grounds of this field station is the African headquarters of BioVision.

Mbita Point Primary School has an enrolment of roughly 320 pupils who are taught by 9 teachers. The school is ideal as it is in close proximity to the facilities and infrastructure required to support the EduVision team while carrying out the pilot project, and yet the target student body come from a rural background, the majority of whom have had little exposure to modern ICT tools. Indeed, the village of Mbita was only recently connected to the national power grid.

6.3 Lessons Learned

Projects similar to the one proposed here have been attempted before, the most successful of which is the Simputer project based in India. The developers of the Simputer attempted at one point to link their technology with a satellite radio for use in schools. While their system worked, and was met with an enthusiastic response from students and teachers alike, it never led to a project along the lines of EELS, for two reasons.

The first was that the Simputer developers were never able to lower the cost of their device below $400. They were unable to do so because the technology they use is a proprietary system, which they designed and manufactured themselves. Under these circumstances, not only does it take time for them to realize economy-of-scale benefits, but the R&D expenditure they incurred developing the Simputer must be factored into each unit's cost. The project's second shortcoming was that their primary focus was on the Simputer tablet computer, with little emphasis put on the content or distribution system. This meant that the real-world applicability of the Simputer to the pupils and teachers was small, and the benefits never fully realized.

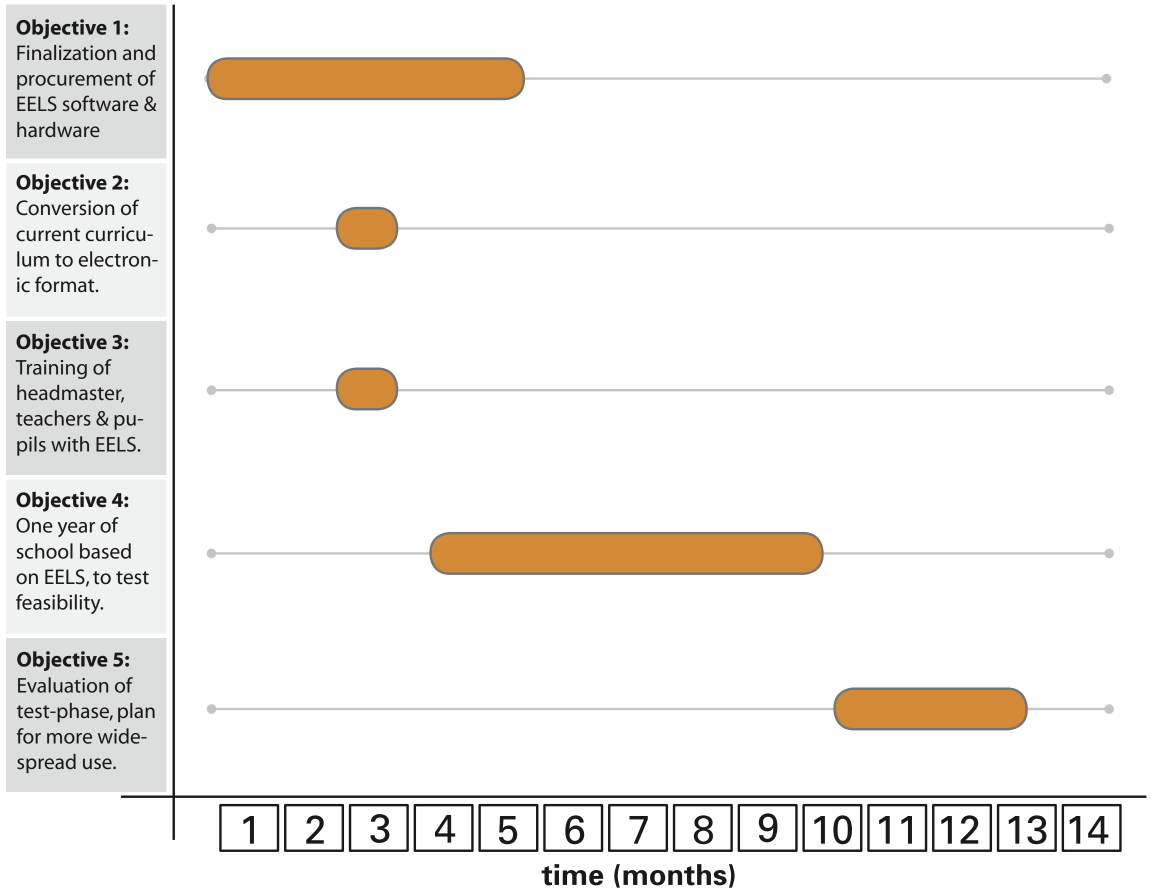
EELS was designed with the benefit of hindsight -- it takes note of the shortcomings of the Simputer program and circumvents them, while building on the Simputer's strengths. Instead of designing and manufacturing the eSlate ourselves we looked at what was available on the market, and devised ways to modify it for our needs (in the case of the eSlate, by installing our own software platform). By so doing we ensure that EELS is both cost-effective and affordable. Second, from its inception EELS was more than the eSlate -- indeed, the EELS network (the NOC, BaseStation and eSlate as linked by satellite radio) is the real crown jewel of this project. Or, more aptly put, the whole is greater than the sum of its parts.

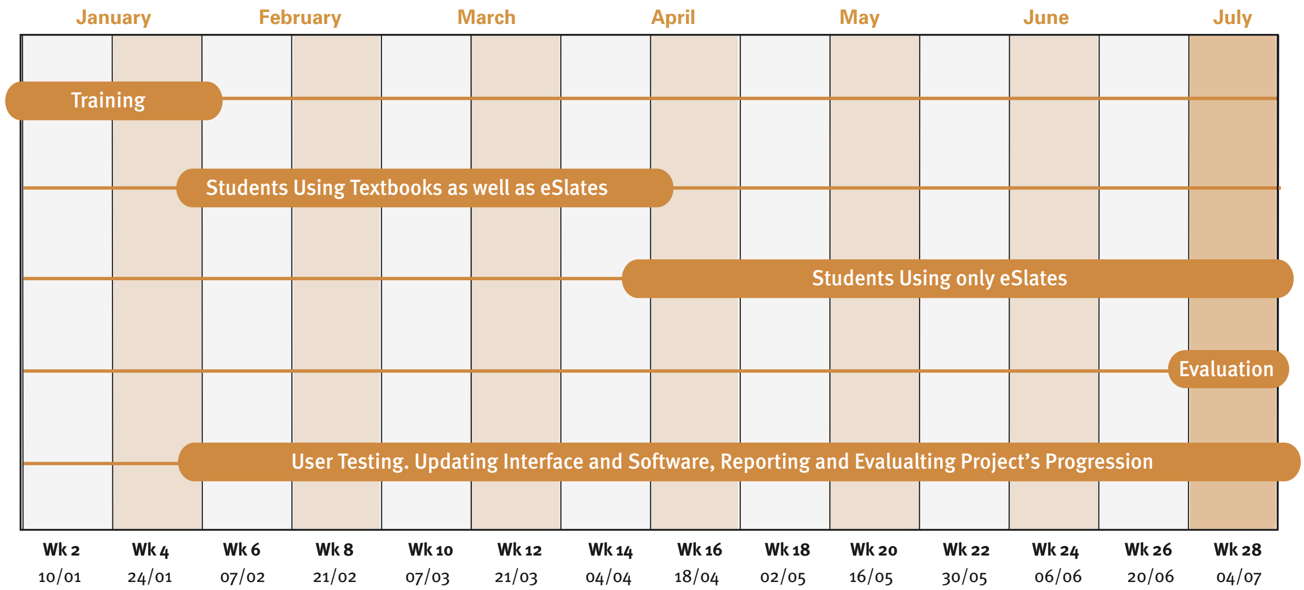
7.0 Project Log Frame

Table 7.1

Objectives	Activities	Outputs	Indicators
Complete design for EELS software and hardware components, and procure them in necessary quantities for a one-year test-phase at a Kenyan rural school.	Finalization of the specifications for the EELS hardware (eSlate and BaseStation) and software (to be used on the eSlate, BaseStation and Network Operations Centre). Outsourcing of software specifications to an outside computer programming consulting firm to program.	Hardware and software components procured for: • EELS Network Operations Centre • EELS BaseStation • EELS eSlate Computers and accessories necessary for pilot project administration staff procured.	Availability of EELS technology and accessories in two classrooms. Technology development lab, used for sample content creation, operational.
Conversion of one class' curriculum content to the EELS platform.	Print-to-digital conversion (digitization) of the curriculum content.	Electronic version of curriculum content.	Electronically-accessible curriculum material.
Training of school headmaster, teachers and pupils of one class in the utilization of EELS.	Training of headmaster and teachers in the operation of the EELS BaseStation and eSlate. Training of teachers in the methodology for training pupils to use the eSlate. Assisting teachers in the training of pupils.	One headmaster and up to ten teachers trained in all aspects of EELS BaseStation and eSlate technology. Ten teachers trained in eSlate training methodology. Pupils from one class trained in eSlate operation by their teachers with help of EduVision Team.	Headmaster and teachers of test school conversant with the EELS technology platform. Pupils from one class conversant with the manipulation of the eSlate.
Implementation of a year-long test-phase to ascertain the feasibility of utilizing EELS technology in rural LDC school	Introduce half-year of instruction based on EELS. Weekly meetings with teachers, school administration officials and students to monitor progress. Prepare test-phase report with analysis of results and lessons learned. Commissioning of an independent study to verify progress of the students, to be carried out by a social scientist/education specialist.	Pupils of one class at test school fully conversant with eSlate and the EELS platform, using it in place of their textbooks and benefiting from its multimedia, news and other capabilities. Publication of weekly meeting minutes for analysis and troubleshooting. Report on test-phase, with analysis of strengths and weaknesses. Report from social scientist on pupils' use of the eSlate and academic performance.	Pupils able to use the eSlate for all reading and writing activities. File of weekly meeting minutes made available. Project Coordinator's report on the test-phase submitted to the donor(s) and local education authorities. Final report from social scientist/education specialist submitted to donor and local education authorities.
Evaluation of test-phase and planning for a large-scale implementation of EELS.	Organize an evaluation and project formulation workshop. Produce project proposal/business plan for a large scale implementation programme of the EELS technology.	Test-phase is analyzed, evaluated and a large-scale programme is outlined. Project proposal/business plan with details on large-scale implementation submitted to donors, private sector partners and education authorities interested in supporting such an initiative.	Workshop proceedings published. Project proposal/business plan submitted to interested parties.

8.0 Activities Timeline





9.0 Proposed Budget

EduVision Pilot Project budget available on request. info@eduvision.or.ke

Appendix A

EELS Technology

The EduVision E-Learning System (EELS) is comprised of three separate components; the Network Operations Centre (NOC), the BaseStation and the eSlate. Networked together under the name of EELS, they provide a low-cost medium for the transmission of dynamic content anywhere in Africa, Asia and Latin America. Below each component will be briefly summarized, and its main features highlighted.

A.1 The Network Operations Center

The Network Operations Centre (NOC) is, figuratively, the 'head' of EELS. It acts as the gateway between the Internet and the EELS satellite network. Content, such as electronic textbooks, databases, Internet sites and EELS software updates destined for end-users is transmitted over the Internet to the NOC. Once received the data is encoded for digital satellite transmission. This involves assigning each piece of content a unique serial number, and compressing it. Once encoded the data is then moved into an outgoing spool, where it will be transmitted onto the satellite network when bandwidth becomes available. The satellite system has a digital bandwidth of 128 Kilobytes per second, which effectively allows the transmission of 650 megabytes per channel– equivalent to one compact disk – per day. This vast bandwidth allowance (an average textbook sizes up at 4 megabytes and need not be transmitted more than once per year, if that) ensures that the potential uses of EELS are infinite.

Running parallel to the compression process is a cataloguing one. The unique serial number is added to a database in the NOC. Operators in the NOC can add tracking cross-references into the database that identify the destinations for the content. Tracking numbers can direct certain content to a location as specific as a certain eSlate, or as broad as a certain country. At the start of each day a catalogue database dump is executed, and added to the front of the transmission spool.

Additionally, the NOC collates incoming data from the various eSlates. Since the satellite radio is limited to one-way transmission, each BaseStation is outfitted with a return communication device, details of which are outlined below. On pre-defined intervals a burst of data will be transmitted to the NOC. The system is configured to run self-diagnostic and usage statistic tests on itself, and for the most part this is what these short bursts shall consist of. However, this allows EELS to act as a transmission medium for other forms of data, such as surveys and questionaires. Large-scale family censuses are but one example of what is made possible by this. Upon reception by the NOC this data is sorted: diagnostic and user statistics are analyzed and any sudden changes or apparent problems are highlighted and sent to the network engineers, while any other data (such as the aforementioned hypothetical census) is scanned for serial numbers that are matched against the catalogue, and accordingly routed the responsible agency via the Internet.

A.2 The Network Operations Center

The BaseStation is the component that receives and processes the satellite beam. It consists of several pieces of technology: a cheap Linux-on-chip computer, a large hard disk, a digital satellite receiver, a satellite telephone and a wireless local area network (WLAN) card. The 'heart' of this component is the Linux-on-chip computer, which is low cost CPU designed specifically to run a simple, scaled-down, version of the Linux operating system. The operating system itself is stored in read-only FLASH ROM, which makes it unsusceptible to data corruption and the inadvertent modification of preferences and commands.

The four 'arms' of the BaseStation (the digital satellite receiver, hard disk, satellite telephone and WLAN card) branch out of this. The satellite antenna is a small (six inches in diameter) half-sphere that is placed on the roof the building. Unlike satellite dishes, it is bi-directional and requires no alignment. This antenna both receives the digital incoming stream, and transmits the occasional satellite telephone connection too the NOC.

The second component in the BaseStation is the hard disk, onto which the incoming satellite stream is recorded. Following each twenty-four hour transmission period a catalogue database dump is received. The BaseStation analyzes this database dump, and processes the recorded satellite stream accordingly. The content files are decompressed, and moved into an incoming spool file on the hard disk.

The third component of the BaseStation is the satellite telephone and modem. On a pre-defined interval the BaseStation will initiate a connection through it to the NOC, and transmit usage statistics, potential problems and output of any programs executed through EELS (using the example previously discussed, this could be the data on a census carried out through the EELS platform). These transmissions consist only of numerical data, and are extremely short – to ensure low costs.

The fourth ‘arm’ of the BaseStation is the WLAN card, which creates a network expanding outwards from it in all directions for one hundred meters. This network allows data transfer to and from eSlates to the BaseStation, and other eSlates in the area of coverage.

A.3 The eSlates

The eSlates are the end-user terminals of EELS, used by both teachers and students. An eSlate is Linux-based tablet computer, modified to survive in the technologically risky environment that is primary and secondary education. The tablets come in the same form-factor as a current textbook, and have a user-interface custom-designed for computer novices. Data input is done through a stylus on a touch-screen, using a combination of tapping and handwriting recognition. In addition, the bottom of the unit slides out to reveal a small keyboard for longer writing assignments.

eSlates contain WLAN cards, which allow them to communicate with the BaseStation. The BaseStation receives a unique identifier from each eSlate, and searches through its catalogue for content whose destination routing information corresponds with that of the eSlate, and any matching content found is transferred. At the same time the eSlate transmits its logging data to the BaseStation where it is analyzed for usage trends and potential problems. Also at this time completed assignments that have been designated by the student to be handed in to the teacher are transmitted onto the BaseStation, where they are catalogued (with routing information to the student-specified teacher’s eSlate) and placed in the received content spool file.

Like the BaseStation the operating system and preferences are stored in read-only FLASH ROM, preventing the system from falling victim the data corruption issues that plague personal computers. This isolation of operating system also ensures that users are unable to inadvertently cause damage to the system. While the ROM is read-only, it can be ‘flashed’ with a new ROM image. When new operating system is available and transmitted over EELS to the BaseStations, eSlates will automatically update themselves with this at the next synchronization with the BaseStation.

All of this previously described technology is invisible to the user. What he or she sees is that upon arrival to school up-to-date news and textbooks have been copied to his/her eSlate, and completed assignments have been submitted. All content, including textbooks, news, Internet sites and more, is accessed from one menu, while another allows the creation of new documents (including word processing, spreadsheet and picture files). Teacher-configured eSlates have an additional menu that allows them to grade assignments, administer tests and manage student grades.

The final feature of the eSlate is an anti-theft mechanism. Upon initial utilization each eSlate ‘binds’ itself to a specific BaseStation and stores its owner data in a locked file. A software component built into the operating system then logs each successful connection to the BaseStation, and will temporarily disable the eSlate if it does not connect with its original BaseStation for a pre-defined span of time. Upon being brought back within to range of its BaseStation the eSlate will begin to function again. A reasonable number of teachers throughout the EELS network will be trained to unlock eSlates and change owner information, for the occasions when it is legitimate to do so. Doing so, however, will be recorded and transmitted back the NOC where suspicious cases will be marked for further investigation. Furthermore, because our network and software is proprietary, demand for stolen eSlates will be minimal – they simply will not work for uses other than those for which they were designed.

Appendix B

Current Partners

The EduVision Pilot Project has been met with enthusiasm from a wide range of partners and collaborators, all of who share our desire to see increased access to quality education in developing countries. The following list of partners and collaborators is current as of October 1, 2004.

BioVision

BioVision is a Swiss not-for-profit foundation with a global mission to alleviate poverty and improve the livelihoods of the poor, while maintaining the precious natural resource base that sustains life. BioVision functions as an intermediate between research institutes and local communities, ensuring that benefits of science reach the people most in need of them. BioVision is currently EduVisions main donor, providing seed money to begin the implementation of the Pilot Project.

UNESCO

UNESCO's initial interest in an Information Communication Technology solution to counter the quality education access deficit, most prominent in Sub-Saharan Africa, is the EduVision pilot project's raison d'étre. The project was instigated at their urging, and they remain a potential source of monetary support, pending the approval of their 2005 budget by UN member nations. Additionally, UNESCO's role a proponent of the project has helped BioVision launch the EduVision project most notably in securing support from potential donors and relevant government agencies.

First Voice International

FVI is the philanthropic arm of WorldSpace, Inc., the company that operates the digital satellite radio network on which EELS content is distributed. FVI controls ten percent of the WorldSpace bandwidth, which they dedicate to the dissemination of information beneficial to impoverished regions in Africa and Asia. FVI's focus is on audio content that is accessed through WorldSpace radio receivers. Education is a central focus of FVI's information dissemination efforts, and includes audio lessons that students in schools with teacher-shortages can follow along to. FVI is an enthusiastic supporter of EduVision's technology-based solution, and has offered to support the initiative with a $50,000 grant towards our transmission costs.

ICIPE

The International Center of Insect Physiology, a longtime partner in many a BioVision project, is partnered with the EduVision project on two levels. Most importantly, in a symbiotic arrangement, ICIPE will provide content (environmentally-sound methodologies for controlling pests, or additional income-generating activities such as beekeeping are two such examples of ICIPE's content contribution) for dissemination to rural farmers via the EELS network accessed by their children alongside their curriculum content. ICIPE will thus aid in the testing of a technology that could, in the near future, greatly expand their outreach capability. Furthermore, ICIPE extends logistical support to the project, hosting the trial run's staff and office requirements at its Thomas Odhiambo Campus in Mbita.

Kenyan Government (Ministry of Education)

To date BioVision staff have met twice with the Kenyan Minister of Education, briefing the Government on the project and obtaining their support. The minister, who recently oversaw the introduction of free primary education in the country and is currently attempting to balance the vast influx of students with the limited resources available, has shown a remarkable level of interest. While lacking resources themselves, and thus being unable to provide direct monetary support, the Government sent an official request to UNESCO requesting urgent funding for the project.
The Government has also been forthcoming with logistical support to facilitate the execution of the project. Among this logistical support are, most notably, directives to our test-school and the surrounding regional educational authorities to provide us with all the necessary support and assistance required, as well as a copyright waiver allowing us to reproduce the necessary textbooks on the eSlates.

Mbita Point Primary School

This public primary school situated in Mbita Point, on the shores of Lake Victoria, was EduVision's first choice while selecting a rural school at which to test the EELS technology. When approached in May 2004 with the possibility of playing host to the project the response from students, teachers and the school administration alike was one of interest and enthusiasm. This did not fade even as we explained that we would require teachers and students to commit a fair portion of their December holiday as well as numerous weekends and afternoons throughout technology trial.

Bridgeworks

Bridgeworks is a privately owned Swiss- and Kenya based enterprise that incubates and commercializes lasting product and service ideas. Bridgeworks strongly believes, that in the long run, entrepreneurship and economic principles are the main pillar of an intelligent and lasting development, in industrial as well as developing countries. This key driving force has to be enveloped in a framework consisting of social and ecological principles that have a global acceptance and therefore generate an appropriate market price. Narrowing the gap between developing and developed countries, building a bridge between ecologically, social and economically promising research initiatives and the industry. Eduvision and bridgeworks are exploring opportunities for private sector funding.

Appendix C

Glossary of Terms

BaseStation:	Component located at the school that receives and processes the satellite beam
BioVision:	A Swiss not-for-profit foundation with a global mission to alleviate poverty and improve the livelihoods of poor people while maintaining the precious natural resource base that sustains life
CPU:	Central Processing Unit
Digital Divide:	Technology gap that exists between the developed and developing worlds
ECOSOC:	Economic and Social Commision
EduVision:	A project of BioVision specializing in creating sustainable development through the technology medium
EELS:	EduVision E-Learning System
eSlate:	Simplified tablet computer with wireless network connection, component of EELS that students and teachers will use
FLASH ROM:	Read-only memory chips that can be flash upgraded with new data.
ICIPE:	International Centre of Insect Physiology and Ecology
ICT:	Information Communication Technology
IT:	Information Technology
LDC:	Less Developed Country
MDC:	More developed country
NOC:	Network Operations Centre where the EELS network is controlled and textbooks and other content destined for the eSlates is sent via the Internet and prepared for the satellite transmission
UNICEF:	United Nations International Children's Education Fund
UN ICT Task Force:	United Nations Information Communication Technology Task Force
WLAN card:	Wireless local Area Network card that connects the base station to the eSlate
WEF:	World Education Forum
WSIS:	World Summit on the Information Society

REF

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The State of the World's Children 2004, © The United Nations Children's Fund (UNICEF), 2003

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CD contains EduVision Presentation, UI demo, Project Photo Gallery, Project Videos, and EduVision Documents.

eduvision

EduVision
P.O. Box 30772-0100
Nairobi, Kenya

info@eduvision.or.ke
http://www.eduvision.or.ke