# Open Education

http://www.apoplous.org | Newsletter # 8 | July 2006 |

## One Computer Per Child: Are We There Yet?

Thin Clients are an oustanding solution for lowering the Total Cost of Ownership of computers. For replacing normal 'fat' computers in labs, with some exceptions, they are the best possible solution. But, when we start talking about the 'one client per child' classroom, thin clients stand to show their weaknesses.

Laptops, at least as we know them, are still far from being the ideal solution for a 'one to one' scenario. We take an in-depth look to all these technologies in order to figure out the best possible solution for education.

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**In this issue:**



## From Classroom to School of Tomorrow

Education is changing rapidly. Technology is a major factor in this change. We need to re-examine how we use technology in the classroom, and get a clear picture of how all components can blend together to form the perfect educational system. We take an in-depth approach in this issue.

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## Visit by the Minister of Education & Culture

The Minister of Education & Culture, mr Peykios Georgiadis, visited Dasoupolis Primary School where he participated in a Geography class. The fifth grade he visited uses equipment funded by the Research Promotion Foundation, as part of the Thin Client research.

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Contact Information:
Alexandros Kofteros
13 Pindou Str., Flat 203,
2035 Strovolos,
Nicosia, Cyprus

alexandros@apoplous.org

www.apoplous.org

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# Visit by the Minister of Education

*A very important point in the research on Thin Clients was the visit by the Minister of Education & Culture. He participated in a lesson of Geography, where he experienced the use of Thin Clients.*

**The 'Classroom of Tomorrow': each student has his/her Thin Client, all running Linux, StarOffice 8 and OpenOffice 2.0 (Greek).**

*Our Thin Clients were purchased with government funding by the Research Promotion Foundation (www.research.org.cy). The Minister of Education & Culture visited Dasoupolis Primary School to observe the way we use this technology to support learning.*

## The Visit

Nicosia, June the 7th, 2006. The Minister of Education and Culture, mr Peykios Georgiadis, visited Dasoupolis Primary School to observe a lesson of Geography, inside the 'Classroom of Tomorrow', a very ambitious research project that integrates technology in everyday school life. The Minister was accompanied by the head of the Department of Primary Education, mr Savvas Nicolaides and two Chief Inspectors, mr Stelios Stylianou and mr Antreas Kanaris.

The children worked on their own Thin Client, on software developed by the 'Apoplous' team using Macromedia Director and running under WINE on Linux. The teacher, along with one of the students, introduced the subject (Geography of Spain) using an interactive whiteboard.

The lesson was followed by a thorough discussion between mr Alexandros Kofteros, teacher and head of 'Apoplous' and the Minister of Education and his officials. Concluding the meeting, the Minister asked mr Kofteros to present his suggestions in writing, so that he could forward them to the next Ministry Assembly for further discussion.

The Minister was also shown an Apple eMate, a machine used to demonstrate the potential that inexpensive tablet PCs can have in education. The eMate, as well as other laptops, are presented in this issue of OpenEducation Report.

We are quite confident that the Minister will make good use of all the conclusions of this research.

# The Thin Client Solution

*Our research has been investigating thin clients in primary education for two full years. The results can be seen in this report. However, thin clients are not the ideal solution for the 'one client per child' school.*

The Minister observes the Interactive Whiteboard. Google Earth was used to view Spain from above, revealing many details for both its position on the map as well as the lakes, rivers and cities of this country.

The program we developed using Macromedia Director. It run under WINE.

From Left: Mr. Skouroumounis, head of the school, mr Nicolaides, head of Department of Primary Education, the Minister mr Georgiadis and mr Alexandros Kofteros of 'Apoplous' and teacher of the school. In the photo below: the Apple eMate after its presentation.

## Demonstrating Possibilities

The Minister showed great interest in the need for developing educational content. A thorough discussion that followed after the lesson showed that the Ministry is interested in developing high quality software that will be used effectively in the classroom. Specifications were asked for the costs involved in developing this content, as well as training educators in using it.

We also demonstrated the importance of Portable devices, using an Apple eMate, a discontinued and quite old machine that was build specifically for education. Its robust, modern design, along with its long battery life, wireless connectivity, tablet PC functionality and more, managed to make its own point in the conversation that followed. It was also agreeable that a monopoly in software used in schools cannot continue, and that Thin Client technology is a very important step in moving forward with technology in education.

# One PC Per Child

*With the rising complexity of PCs, along with the need of increasing the number of computers per classroom, can we ever hope to reach the 'one client per child' school? We take a look at what is ahead!*

**Normal PCs are oustanding for most tasks at home. However, they are far from perfect for everyday use at schools that require the machines to be available at all times with almost 0 downtime.**

*The 'traditional' PC is outstanding for most tasks: it can be the center of entertainment for the entire house, host the latest and greatest 3D game, or even be used to deliver that important document or school project. But, despite of all these benefits, are PCs as we know them the best solution for schools?*

## More than you trade for

For years, books have been the best tools for learning. They have come far from the old days of boring text books- books today feature colorful pages with nice pictures, even comic strips when they seem to be appropriate. But their greatest benefit is their efficiency- their information is almost always available once we get them out of that bag and we turn to a certain page. Unfortunately, the same cannot be said for computers. Computers tend to break down, suffer crashes and have a need for constant maintenance and upgrading. A single hard-drive crash would mean the loss of valuable information and data for the student. Of course, backups are always necessary but this adds another level of complexity to an already complex system, even by today's standards of 'user friendly' operating systems.

Normal PCs also tend to generate lots of noise, due to the built-in fans they have. They also generate heat, and any lab of 15+ computers brings the necessity of air conditioning units, a luxury that will probably not make it in public schools in Cyprus for the next 10-15 years (if ever). Power consumption is another very important factor, since the rising oil price causes a massive increase in electricity costs. Last, but not least, even the latest and greatest PC technology with small footprint cases and TFT screens still require lots of space on the desk, and classrooms, in the majority of schools, where never designed to have a large number of computers installed.

## Maintenance & Upgrade

By far the most costly aspect of PCs are their maintenance and upgrades. Even with a conservative upgrade plan, the Ministry -any Ministry- will have to replace the entire equipment every 5 years. Not only this brings an incredible cost for education, it also causes problems with the disposal of huge quantities of discontinued computers (eWaste).

The maintenance of these machines is also problematic. Unless specialised personnel is assigned to schools in order to take care of maintenance, we can expect computer labs to start failing or have a rapid increase of running costs due to the need to outsource their repairs. It is unthinkable that Primary Schools in Cyprus will have, by the year 2008, at least 30 computers each, with absolutely no support personnel! And we are talking about 3 in every classroom, not 20+ in every classroom!

# The Thin Client Solution

*Our research has been investigating thin clients in primary education for two full years. The results can be seen in this report. However, thin clients are not the ideal solution for the 'one client per child' school.*

*Thin Clients are outstanding for replacing normal computers inside the classroom. However, they are not the perfect solution for the one client per child classroom.*

## Benefits of Thin Clients

Thin Clients tend to have an initial high cost, at least compared to what a normal entry level non-brand PC costs today. This cost is made quite high because of the need to introduce a server- otherwise the Thin Client has little if any value. It is this server that introduces the greatest benefit of thin clients.

A normal computer lab needs to have its equipment (all computers) replaced every 3-5 years in order to be competitive. Also, during this period, the machines will have to undergo maintenance at least every 6 months to one year. Thin clients, on the other hand, require little to no maintenance. As a matter of fact, only the server requires maintenance. Thus, instead of replacing/updating/upgrading every single computer inside the lab, with thin clients we only need work with the server. Install or update a software on the server and instantly all clients have access to it. Upgrade the server to a faster model after 3 years and what you get is an increase in performance for all clients connected to that specific server.

Thin clients also tend to be much smaller and thus require much less space in the already crowded classrooms. They also generate far less heat and noise and they consume less electricity. These characteristics make them the ideal machines to have running almost all day long inside the classroom.

## Disadvantages of Thin Clients

Having a computer lab inside a classroom requires heavy wiring. Because of that, children will have to be seated in specific places inside the classroom. Every educator knows that in normal classrooms we need to be flexible in where we place our students. For some lessons it makes sense to form groups of 2 or 3. In other lessons it would make sense to have the entire classroom -including teacher- just sit on the floor and have a discussion. Both Thin Clients and normal PCs cannot give us that luxury yet.

Another disadvantage of thin clients is the way we input information- the keyboard might be ideal for most adults, but for children, especially in the K-6 sector, is far from the best input device.

**Performance not a (serious) issue**

Even the lowest PC today has some form of 3D graphics support. Thin Clients tend to resort to their server for all the graphics handling. For university students studying graphic design or engineering this might cause a serious problem. In Primary Education we have more modest needs and the cheap Dual-core servers of today can more than cope with our needs.

Eventually, we will get to the point where some of the graphic handling will be done internally by the client. At this point, we have to use the CPU power of our server.

# One Laptop Per Child

*This product, the brainchild of former M.I.T. professor Nicholas Negroponte, is causing great changes in the educational world. Could this be the answer we were looking for?*

**The original green machine prototype has been replaced with this orange model. Notice the antennae on the sides of the machine that also reveal the USB slots. The hand crank is long gone, however we should expect some innovative way of charging the battery.**

*The prototype OLPC or $100 Laptop has changed color and looks- it is now orange and it features a working version of a modified Fedora Core Linux distribution.*

## The Laptop for All?

The Laptop - at least according to Nicholas Negroponte- is approaching release time. Both Intel and Microsoft have been expressing negative comments about the machine, much to the amusement of Nicholas Negroponte ("they are so negative about it, so it means we must be doing something right!"). The Laptop will be officially launched in 2007. It is already running on prototype AMD motherboards and the operating system, as shown in various shows, is based on the OpenSource Fedora Core Linux distribution. Fedora runs off 512MB of Flash memory, and first tests show quite a long wait for the operating system to give the user full control. OLPC is promising this to be corrected before launch, so it remains to be seen how much time it will take to boot the system in the final version.

The hand crank has been dropped, since, according to the developers, it would put too much pressure on the sensitive chassis of the machine. It is still expected to be able to offer some alternative means of increasing the battery life of the machine. In order to succeed, this unit will have to be able to run for more than 6-7 hours especially in areas with little to no availability to electricity.

Even though the Laptop will require little to no maintenance, it will be stuck with the same software and OS unless people figure a way to upgrade it without exceeding the rather little amount (512MB) of storage space the machine has. This will not be a major problem for most people, especially since the OpenSource Community will be supporting it.

# Promising Design Features

*The technical characteristics of the Laptop might not be jaw-dropping by the do offer some really exciting features. We take a closer look at what the Laptop has to offer.*


**The Laptop is running Fedora Core. This comes to no surprise, as Red-Hat officially supports the OLPC project.**

**The versatility of the Laptop is phenomenal- it can be used almost as a Laptop, a Tablet PC, a Media Center and an eBook. We hope the actual shipping product is not a Jack-of-all-trades.**

*Price alone cannot justify the mass purchase of any kind of machine. It all comes down to features.*

## 'Dressed' for Success

You cannot accuse the OLPC people for not offering some great advantages to their machine. First of all, it appears to come in an extremely drop-resistant case, it will be very light (thus making it suitable for children to carry with them), it will offer eBook functionality, tablet PC functionality as well as internet connectivity via a mesh network.

To top it all, the Laptop is based on a Fedora Core 5 Linux distribution and the 'Apoplous' team really loves this! We believe that the Gnome interface of the Fedora Core distribution is by far the most user friendly of all, mostly because of the tight integration between the included applications and the GUI itself. How much of this will fit into the tight 512MB of space inside the machine remains to be seen, but so far videos of the Laptop show it running perfectly (albeit slowly).

The flexibility of the design allows its use in many different ways. For example, if we want to use the Laptop for displaying information in a way that mimics normal books, we can just flip the screen and we end up with an eBook. Similarly, the Laptop can be used for displaying movies (through the network) as a small, cut-down version of a Media Center PC.

For those who are not that good in touch-typing (and K-6 students aren't supposed to be), the Laptop has some form of Tablet PC functionality. We are quite curious to see how this works, since the Linux platform with some slight exceptions, has not been rich with such developments.

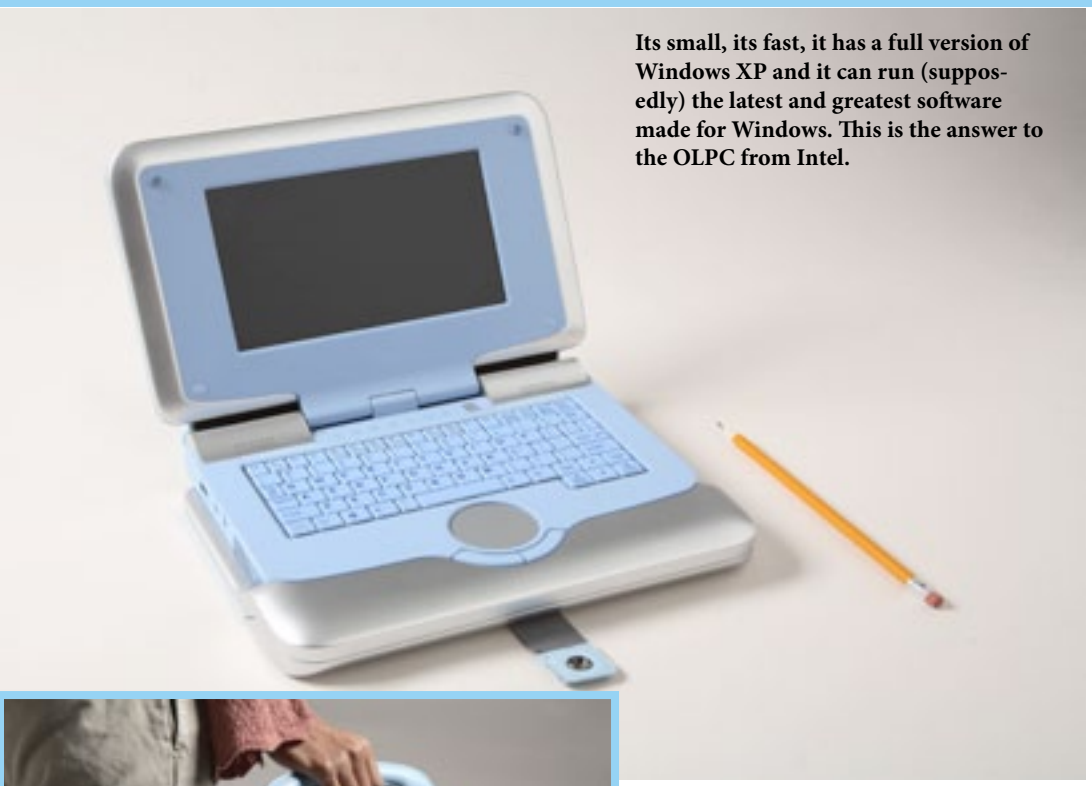
## Not All Perfect

The pricing of the Laptop might seem quite promising, but when we look at a complete solution for the 'one client per student' school, this project is still far away from achieving just that. Maybe in places -and this is the intention of its developers- it makes perfect sense. Especially in countries that require technology but have little resources to cover that need, the Laptop will (maybe) have a strong impact. For developed countries, we will need to look a bit further than this.

First of all, it still is a computer with some installed software. At some point or another, we will need to update the software, either the OS itself or the Office suite. We don't quite think this will be very straightforward, at least not for most children. The small form-factor might make this machine quite ideal for carrying around. However, when compared to the viewing space offered by traditional books, this machine poses a heavy compromise. We desperately need more viewable space! But, this Laptop, regardless of its commercial success, it will (and already has) cause an avalanche of similar and even better products!

# Intel EduWise: Gloves Off!

*Trying to sell an inexpensive machine running Linux and based on AMD hardware to millions of people all over the world , definitely causes concern for Intel and Microsoft. The answer was the EduWise project!*



**Its small, its fast, it has a full version of Windows XP and it can run (supposedly) the latest and greatest software made for Windows. This is the answer to the OLPC from Intel.**

**Yes, it does have a handle! And the machine resembles more a purse than an actual laptop!**

*Regardless of (a possible) success by the OLPC, the greatest advantage of Negroponte's machine is the effect it has on the industry: unreleased yet, still it causes many companies to announce similar -and even better- products that have an acceptable for most European countries cost. Intel's Otellini himself announced the new product named EduWise.*

## Intel Vs OLPC

When you are the world's largest chip manufacturer, you cannot allow someone else to come and steal your (laptop) marketshare overnight. When the EduWise laptop was introduced by Intel's Otellini, a lot of heads in the industry and the educational world were turned. The machine is quite small, so that children can easily carry them around, is housed in an attractive silver-blue case that is especially built to withstand abuse, and it features built-in WiFi, an integrated Intel graphics chipset and of course (no surprises here!) the Windows XP operating system (or whatever they end up shipping it with once it becomes officially available).

The pricing of $399 (final pricing pending) is reasonable enough for most developed countries. However, it is still at least 3 times (we expect an initial price of $150) more expensive than the OLPC.

The OLPC's charm does not rely only on the price. As we mentioned in previous pages, the same machine can be used in many different ways: as an eBook, a Tablet PC, a MediaCenter. How well it works with all these roles remains to be seen, but we have to give it the benefit of the doubt. The EduWise is a more 'traditional' laptop, in a smaller form-factor at a friendlier price. The good news is that competition has already started bringing out new models, and the consumer is the one benefiting from all this.

## Conclusions

Intel has taken a very dangerous but understandable approach. This machine might cut into the actual laptop market share, where they are making lots of money. What might protect that sector from being cannibalized by the EduWise laptop is that Intel offers much more advanced computers with larger screens for more demanding users.

# Tablet PCs: Prospects For Education

*Both the EduWise and the OLPC (as well as all the other unannounced products from various vendors) are not going to be here for some time now. Tablet PCs are here, and they are already been used in education*

*Tablet PCs are not rare these days. Prices are continuously coming down while specs are going through the roof. Windows Vista is also expected to integrate Tablet PC functionality in a much better way than previous versions of Windows. But why exactly do we need Tablet PCs and not ordinary laptops?*

## The Write Way

Touch-typing is a much faster way of creating large documents. Nobody can argue with that. Also, touch- typing directly into a word processor is far more flexible than using a traditional pen and paper approach to write formal letters or essays. When we need to take notes instantly, or communicate instantly using a combination of drawings and text, nothing can beat the pen and paper approach.

In K12 sector, especially in the lower grades, it is not expected for children to be able to type fast, or at least fast enough in an acceptable rate. Also, we need to teach them hand-writing, therefore the pen and paper (or pencil and paper) approach is extremely important. A Tablet PC brings the best of both worlds. Children (and adults) can type using the keyboard, but at the same time they can use the pen (and in some instances their own hand!) to enter information into the computer. They then have the option to either store the hand-written information as an image, or to translate it into actual text (and text recognition is getting better all the time). What used to be an awakward way of working some years ago, has become almost totally transparent today thanks to smaller form factors of Tablet PCs and some ingenious design that allows the screen to cover the keyboard, essentially giving us an almost identical experience to writing on actual paper.

An added benefit is the immediate interaction with content, since children are using their own hands (or pen) to 'touch' information (be it text, images etc) instead of using a mouse as an intermediate device. Unfortunately. most Tablet PCs today are far too fragile, expensive and require too much maintenance to be used effectively in large numbers, at least in K12..

**The IBM/ Lenovo X41. At just over 1.5 Kgs and with an estimated battery life of more than 6 hours, it is essentially one of the best tablet PCs in the market. Unfortunately, the design of the machine, even though very good for normal use, is not suitable to take the abuse of long use by students.**

**Defining Abuse**

Our experience with using technology in the classroom over the past 4 years has shown that children take great care of their equipment. The few cases where something was damaged was done by accident and never deliberately. However, when we start talking about lending or giving computers to children for long use (several years), these machines are prone to 'accidental' abuse. If you are a parent, just think of how many times your child dropped his/her bag on the floor, or accidentally poored water on a book. Some children might never do that, but accidents such as these are quite normal.

# Credit Goes...

*Sometimes a technololgy appears that is so far advanced for its time, it either becomes the de facto standard or it dies altogether! The Apple eMate is such an example, featuring most of the technologies we seek today.*

**On the left: The Apple eMate, discontinued 7 years ago after a major crisis at the company.**

**On the right: the prototype of the OLPC.**


**The eMate was doomed by Apple at the same time it was beginning to prove its value. Some of its features, like the translucent plastics, made it to the iMac, the machine that saved Apple.**

*An ultra-modern, green semi-transparent almost unbreakable case with a carrying handle, wireless connectivity to other laptops, hand-writing recognition, battery that lasts for more than 10(!) hours of continuous use, PCMCIA slot for expansion, weight under 1kg, and instant-on operation from the second you open the lid- this is the tremendously amazing eMate, a machine DISCONTINUED by Apple more than 7 years ago!*

## The Future Is The Past

The world of technology, from time to time, witnesses moments where truly aspiring technology that is years ahead of its time disappears almost without a trace. Such is the case of the Apple eMate. This amazing machine had -almost a decade ago- all the features we seek today (with the exception of color screens, of course!). Unfortunately, Apple Computer at that time was so much in trouble they had to discontinue almost every single project they had, with the exception of some software suites and -of course- their Macintosh division.

The eMates are now a part of history, however we decided to put them to the test even today so we brought some units from eBay to test how they work even after so many years.

The first thing we did was replace the batteries, and yes, we do get more than 10 hours of continuous use! However, what we truly wanted to see was how children react with them. So we just gave them to students to take home and bring back to class with them. We were amazed to see fantastic works of art created using the built-in software. Needless to say, students were thrilled with the machines and they got onto them almost instantly.

The eMate can be seen as the ancestor of the OLPC and any similar project. Obviously, even if it was not the prime inspiration, it did have all the features we would like to have on our computers today. And the fact that they are ultra reliable makes them the basis for the ultimate school client. So... credit goes where credit's due and we have to salute the original creators!

# Maintenance Issues

*Every kind of computer that has a built-in operating system needs maintenance every now and then. Also, all software have to be upgraded at some point, in order to remain competitive.*

**Maintenance issues can make or break any strategy of introducing technology int othe classroom. Even the OLPC project does not offer a clear solution of how we are going to deal with updates, upgrades or maintenace- unless Negroponte wishes us to stick with the same software for many years.**

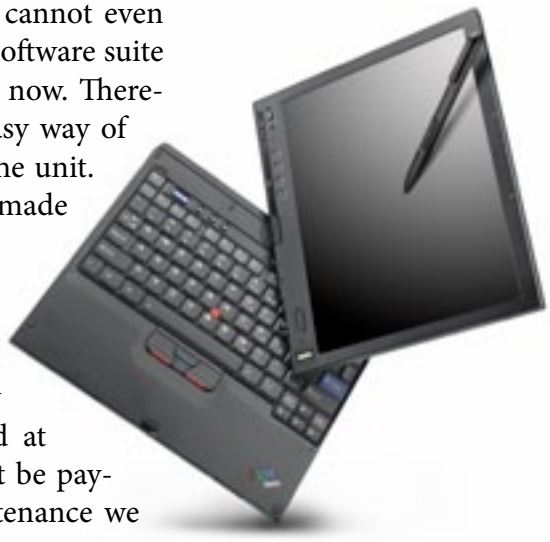
*Imagine the scenario: thousands of students, even in a small country like Cyprus, receiving a laptop from the Ministry in order to use it for the next 5-6 years. A nightmare of maintenance issues will arise, since we would expect the machines to be readily available on a daily basis!*

## Machines at the ready

The main idea behind donating (or lending for extended periods of time) laptops to children, is to complement and at a later stage substitute, books. One of the many benefits of books is that they are readily available whenever we need them- actually, books are the most crash-proof information 'devices' available in the market! When we use computer labs or even laptops that are property and permanently stored at schools, we can be sure that, with the right personnel, we can keep them ticking without problems. When we get to lend them to people to take them home, that is where problems start surfacing.

Our experience as educators show that not all children (not to mention parents) are extremely considerate. Yes, our experience has shown that children tend to look after the technology we have at school, but the same cannot be said for sure for anything we lend them for long periods of time. We can also not expect them to do maintenance work or even updates to the machines on their own. Not only that would cost money, but it would require great care from the part of the parents in order to keep the unit in shape during the school years of its use.

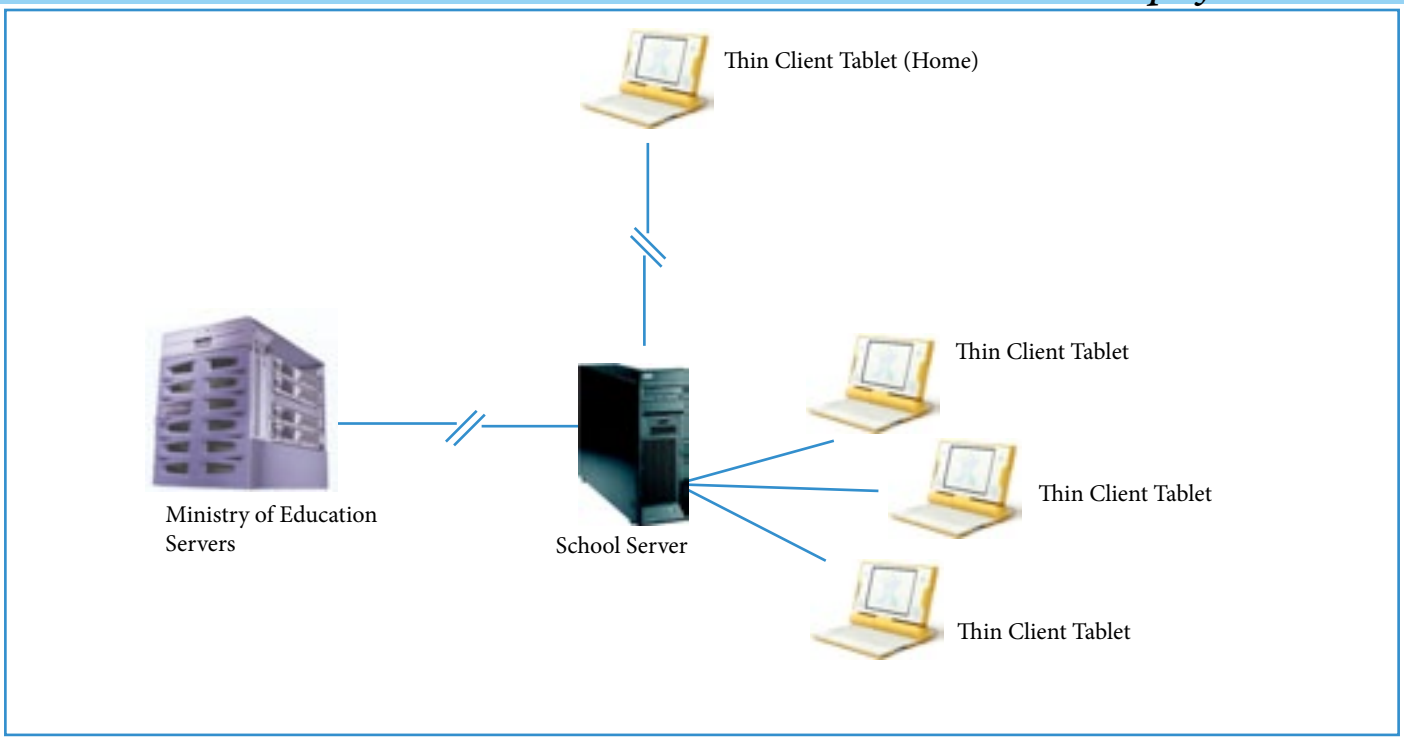
Software -and content- updates are another major issue. There is no reason why we should stick with version 2.0 of OpenOffice for 4- 5 years. We cannot even imagine how this (or any) software suite will look like 4 years from now. Therefore, there should be an easy way of updating the software on the unit. Content delivery should be made as easy as possible, too.



These are major issues that have to be taken into account. Parents are already paying taxes so we should at least ensure that they won't be paying more money for maintenance we can avoid.

# Thin Client Tablet

*Thin Clients make a lot of sense for lowering the Total Cost of Ownership and increasing productivity. Tablet PCs work best for children and education. Can we combine the two in one perfect solution?*




*Thin Clients need minimum maintenance. They can also be used for many years without becoming obsolete, and we are still able to run the latest and greatest software by just upgrading the server. Can we combine the benefits of thin clients and tablet PCs and come up with a really revolutionary solution for education?*

## The Best of Both Worlds

Any kind of laptop that the Ministry purchases and gives to children, has to undergo maintenance, upgrades and replacement almost constantly. This is something no Ministry will be able to afford, especially when a laptop is given to every child attending school. Taking into account the needs of education, along with findings in our research on thin clients, we can conclude that it is possible to use a product that is both a tablet PC and a thin client.

Such a product would not even require a hard drive or other storage device- everything would be handled by the server. That means the machine will be far lighter and require much less power than any other laptop. Processing power will be handled by the server, virtually offering a machine that is constantly at the edge (or at least as far as possible) of technology. Using WiFi technology, these clients would be able to run wireless when at school. When at home, they could use the internet to remotely connect to the school's server. Ideally, broadband would give the necessary bandwidth for something like that, even though compression technologies used in Thin Clients today (ie SRSS, Citrix) would give acceptable performance for one client even over dial-up.

This scenario is not far-off. We have already received a SunRay Thin Client that directly connects to a remote server over broadband, without a local server. This means that the technology is already here.

# The Best of Both Worlds

*Is the time right to move back to a thin client model for our schools? They do look promising, but are there any heavy compromises?*

*The best way to change education tomorrow is to prove that it works today. The 'Apoplous' team, along with the Chemistry Department of the University of Cyprus, the Greek Ministry of Education, the Cyprus Ministry of Education, eMedi8 (Mandriva Linux) and Inteliscape, IBM's business partners, have filed a proposal for researching the impact of Tablet PCs that also function as Thin Clients.*

## Reducing the Costs

By using our tablet PCs as thin clients, we are going to tremendously reduce the costs of maintenance and upgrade. By simply upgrading the servers, more processing power will be available to handle even the most difficult tasks. This doesn't mean that these machines will be able to handle the latest 3D games- far from it! It will allow, however, the delivery of an almost perfect setup where all children have access to an extremely reliable computer that is almost always on, faces the minimum or no technical issues and it is constantly updated with the latest and greatest software (at a conservative pace so that users can get used to the new applications).

## Connected Servers

To maximise productivity and minimise downtime, school servers can be connected to a central server farm at the Ministry of Education of each country. This server will form the backbone of all operations, hosting the content used by schools and also the content uploaded by teachers and students. That way, teachers will not have to worry about backups of assignments. At the same time, content that is delivered to the children can rely on the school's server so that it can be transferred to student's machines over the wireless local network.

The Ministry's servers will act as an emergency Terminal Server when a school server is down for any reason. We do not wish to do that, at least not until broadband reachers a more advanced level, but it is a fail-safe measure that will guarantee, under almost all conditions, that clients used by children will be constantly on.

## To Embed or Not to Embed

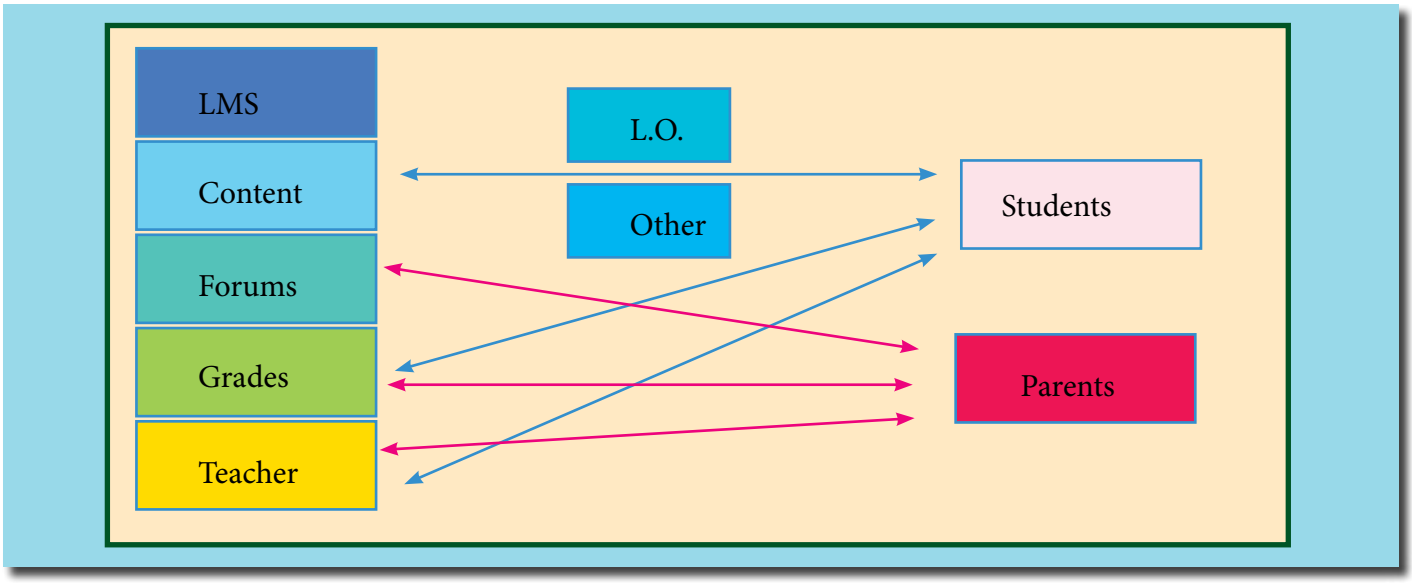
Emdedded Operating Systems (ie Windows XPe) have the benefit of offering a workable environment even when there is no server. They still require updates and upgrades and at some point they become obsolete (imagine, for example, having a thin client with Windows 3.1 Embedded). Outside the classroom, and within the area of the school, WiFi can be used to offer connectivity to the school's server. For environmental studies outside school, the teacher could use a portable server that offers connectivity to student's clients, similar to the mesh network proposed by OLPC.

Ideally, at some point, we expect to have wider WiFi coverage so that we get access to the network in almost all places.

We are confident that Thin Client technology, along with tablet PC technology, is the ideal solution for education and probably -at least until something new and exciting comes up- it will enable the full implementation of computers in education in true 'one laptop per child' fashion.

# From Classroom to School of Tomorrow

*Making sure you have the technology (hardware, network) is not enough. We propose a complete learning system for education of the future.*




*Learning today is not THAT much different that it used to be. More or less the teacher is the center of knowledge and learning is totally dependent on the teaching style of educators and not on the learning style of students.*

## Role of the teacher

An essential part of ANY educational system is the teacher. There is no question about it and we cannot see him/her replaced by a machine, regardless of the 'intelligence' it might acquire over time. But, in a modern system, the teacher has to be a part of the learning process and not the center of it. In the proposed system (diagram above), the teacher is a part of a rather complex model. He is there as coordinator of knowledge. Administration of content is done through a Learning Management System such as Moodle, Lotus LMS or WebCT. The content is delivered to students according to their level. In countries like Cyprus where we have mixed ability classrooms, we expect to have at least 5-6 different levels of students. We have to work with them according to their level. Part of the content is developed as Learning Objects. The benefits of the Learning Objects approach is covered later in this document.

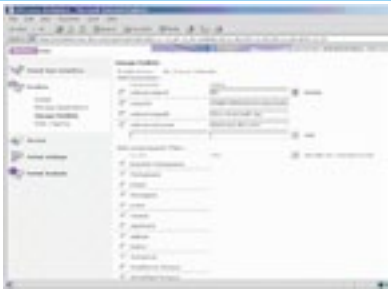
Forums are extremely important because it is part of the binding blocks between students, teachers and parents. Parents can post questions or have discussions with both the teacher and other parents, not excluding students themselves. Grades are an important aspect of any learning system, and by using an LMS we can have direct assessment that can be viewed- on a daily basis- by parents.

Finally, the last part of the system is the teacher, responsible for managing the content, communicating with both students and parents, grading progress and of course delivering personal assistance whenever and wherever this is needed.

Such a system is quite revolutionary as it engages students of all levels and brings parents in line with education.

# The Learning Structure: LMS

*There is no point in just giving content to students- we have to deliver what is needed, where is needed, and have a clear way of managing the learning outcomes of the entire process.*



LMS running off the servers of the Ministry of Education.

Student Laptop (Connection from Home)

School Server (Delivery of 'heavy' content via the Local Area Network of the school)

Student Laptop (Local Area Network of School)

*Management & Delivery of content is essential in the proposed System. We take a look how this could work.*

## Serving the LMS

Any LMS requires huge amounts of space, since material will increase over the years. There is no need to decentralize this content, since this material can be more easily managed and shared when running from just one server setup.

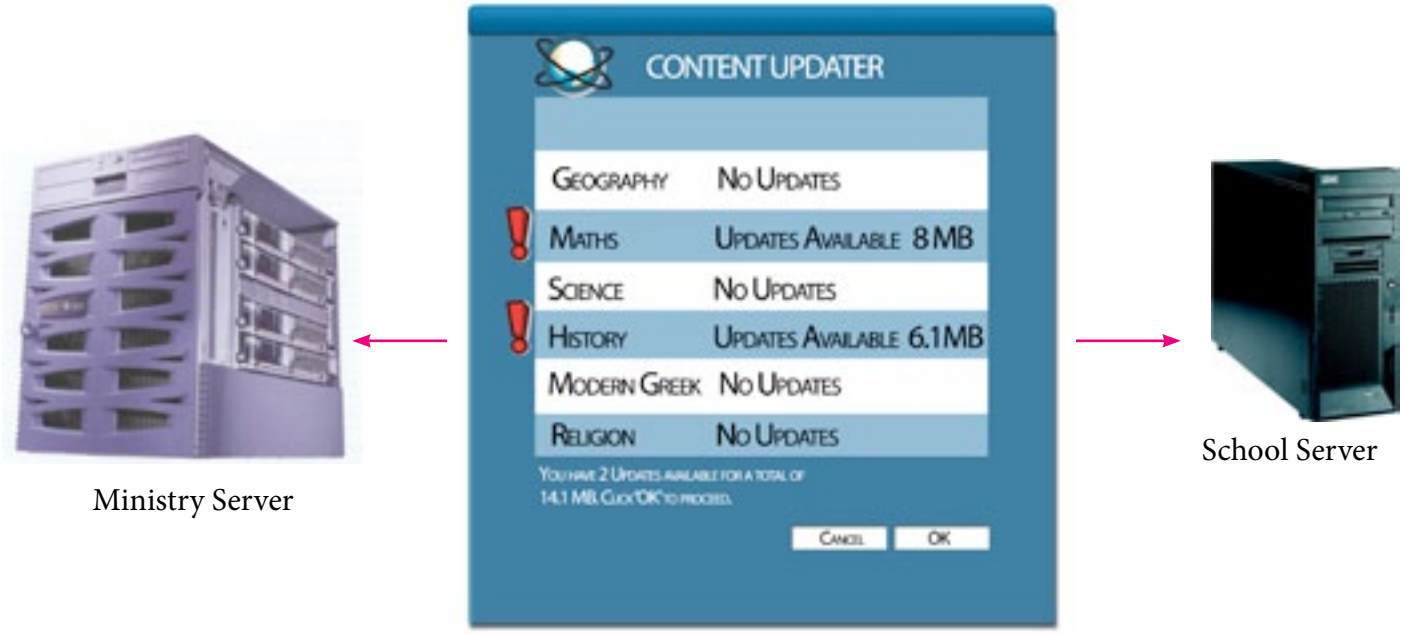
For content that is quite large, transfer of data can be done through the local area network of the school, as long as the required material has already been transferred to the school's local server. Since most Learning Objects are extremely small in file size, moving these files through the web should not pose a problem. Of course, any good educator is always prepared for a given lesson and he/she does not wait till the last moment to fetch the proper equipment or content needed!

A big plus of this approach is that students can make the maximum use of the network resources, even in the event that the school server is down for some reason. As long as the connection to the Ministry's server exists, student clients will still be able to run a remote session and have access to the material. Since the LMS used is always stored centrally, students can have total access to their accounts even from home.

We should expect that all schools will be connected with fast lines (1.5+ Mbps) to the Ministry of Education, so that we can get maximum performance. We expect the benefits of this approach to really start appearing when all schools are connected to the internet with even greater speeds.

# Automatic Content Update

*School books tend to become obsolete quite soon. With automatic content updates, we can be sure that we have the latest versions of our eBooks and content at all times.*




*Information changes rapidly and books need constant revising on an almost yearly basis. However, with costs involved for revising and printing, this is not always the case. Availability of books is also another concern and this is something we have to deal with in Cyprus on a yearly basis*

## Automatic Updating

Most complex software packages (ie Office Suites etc) usually come with an automatic software update feature. This enables the updating of the application whenever an update is made available on the internet. A similar approach is used by OS vendors (ie MacOS X, Windows) to update their operating systems and plug possible holes or bugs in the systems.

The System we suggest for delivering content, allows for the centralised storage of information. Whenever a change is made in some of the books or the content we use, the Updated could alert us and request we update this content. This can be done using an 'information pull' solution where we receive the new updates only if we need them. For example, if we have already covered the chapters that have been changed, and we do not wish to download the new information, we can skip this procedure for a later date. A similar approach could be used by children for their own computers, especially if we end up using computers with local storage. This Updating Mechanism could also be used for updating almost anything, including the Operating System itself. However, large files should be transferred only during weekends or school holidays, a task that can be quite easily managed automatically.

This is possible the most practical, efficient and fast way of keeping content up to date across the entire educational system. No more book shortage problems, no more working with books that have obsolete content (for example, our Geography books in Primary Schools still have no mention of Cyprus being a member of EU!)

# eBooks: Is There Any True Value?

*Generation 'P' (see our OpenEducation Report #1) is radially different than previous generations. They also tend to learn differently. It is time we revised our approach in education.*


*The Book is dead- long live the (e)Book! We need to clarify that we do not necessarily mean the complete removal of books from schools. but rather to start using technology more efficiently in changing the role of books as learning tools.*

Today's generation is brought up with computers, game consoles and cellular phones. This is truly the digital age, and maybe -for the first time in ages- we have to re-evaluate traditional books and their uses in schools.

"With 2 TerraFLOPS of performance in their hands, it is madness to assume old tactics are still the most effective"

## The New Generation

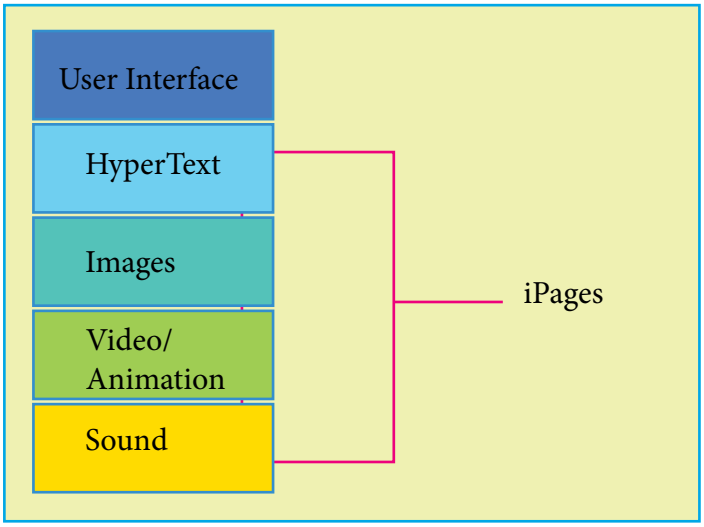
Contrary to how their parents grew up, children today, especially in developed countries, have access to tremendous technology. One can only look at game consoles used (or going to be used) by 6-15 year old in the next few months: more than 1 TerraFLOPS of raw power into the hands of young children with magnificent virtual worlds and totally interactive environments. At the same time we ask the same children to 'turn their text books on page 28 and read the passage'. This does not work, and more often than not we are faced with bored children (not to mention equally bored teachers).

We need to re-evaluate our approach. Children need an interactive environment, one that can actually give them 'something more' than a static picture of (sometimes) bad quality. Definitely, there are many guidelines that have to be taken into consideration when a school books is made, but all the same we can do so much with traditional books.

By no means we encourage 'art for art's sake'. That is, we do not believe in using interactivity when it is not necessary. But, an eBook 'done right' is the best way to start, especially when the content is delivered in such a way that promotes critical thinking and interaction with the actual information.

# Designing eBooks

*The term 'eBook' here is used to describe the digital content that can be used within a technology- rich environment to supplement or even replace normal paper-based books.*




**An eBook can consist of iPages: interactive content that is suitable for a subject tought for a specific day. All the components can be selected by the teacher from a large library of contentn.**

**A custom program we used for teaching Geography of Italy. It is divided in 5 sections and features all the components of an iPage. However, due to its complexity, it is not the best possible solution.**

*Information changes rapidly and books need constant revising on an almost yearly basis. However, with costs involved for revising and printing, this is not always the case. Availability of books is also another concern and this is something we have to deal with in Cyprus on a yearly basis.*

"We must not replace books with digital equivalents but rather to create a totally new tool for learning"

## Learning Blocks

A decade ago, multimedia was little more than long pages of text on a CD-ROM with basic hyperlinks, images that most of the time had little to no value and videos that looked out of place. This unfortunate part of computer history, along with other (later) developments have lead to the almost total abandonment of eBooks as real supplements or even substitutes of traditional textbooks.

For technology to have a real impact in education, many factors must be taken into consideration. If either one of these factors is left out, then the results will (probably) not be satisfactory. First of all, we need good teachers that will handle the proper use of technology through a modern curriculum. We need the actual content in digital form, and in such a way that can be easily handled by both students and teachers. This content must have a real, added value to the learning process and not just replace books for the sake of replacing them.

We need a way to deliver and administer this content, as we have proposed in previous pages. Lastly, we need the infrastructure to use, as we have also demonstrated (Thin Client Laptops).

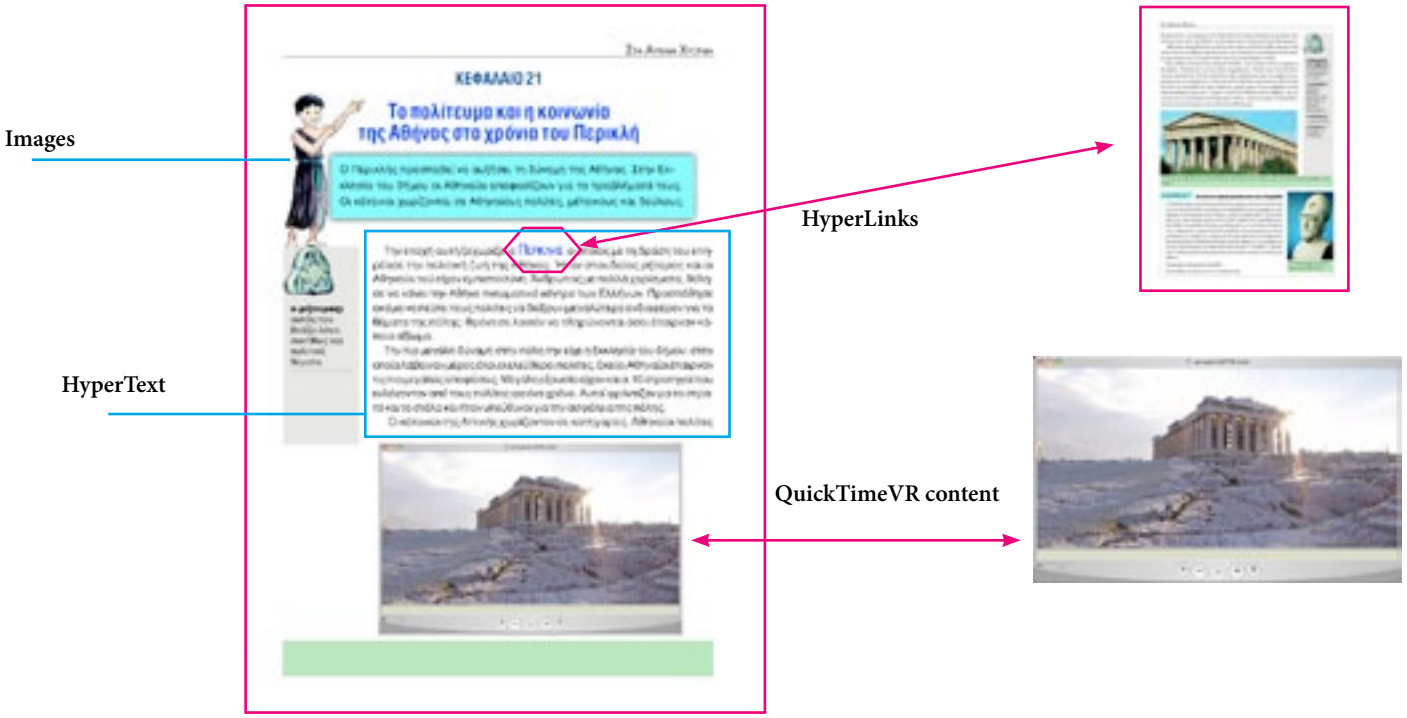
## Designing eBooks

By the term 'eBooks' we don't necessarily mean a full body of text that covers all chapters of a given lesson (ie a 200-page history book). In this document we refer to 'eBook' as the actual content we intend to use for a given lesson throughout a school year. As shown in the diagram above (left), an eBook is made of Content that resides within an intuitive and easy to use User Interface (UI). This content can be made of Text with HyperLinks, Assignments, Images, Animation, Digital Video.

In the next few pages we shall take a more closer look at the parts of an eBook, called 'ePages' or 'iPages' (Interactive Pages).

# Disassembling eBooks: iPages

*An eBook is made of many individual iPages. What kind of information and content we use is primarily up to us (the educators) to decide, based on the level of our students.*




*Every educational system has its own curriculum and every school uses books to teach the curriculum content. At the same time, every teacher is encouraged (and in some cases required) to use additional sources of information. On the basis of this we are constructing our iPages.*

## Templating Education

In education we have as much flexibility in how we teach as possible, as long as we cover the actual content of the curriculum. This might (and is) sound as a contradiction, but it also serves as a guiding rule for all educational systems.

For iPages, we could work with basic Templates- the core information required by us to use (ie the actual text). On top of that, we could use Supportive material (images, sound, etc). Assignments & exercises are a trickier part of iPages, and we shall cover those in the next page.

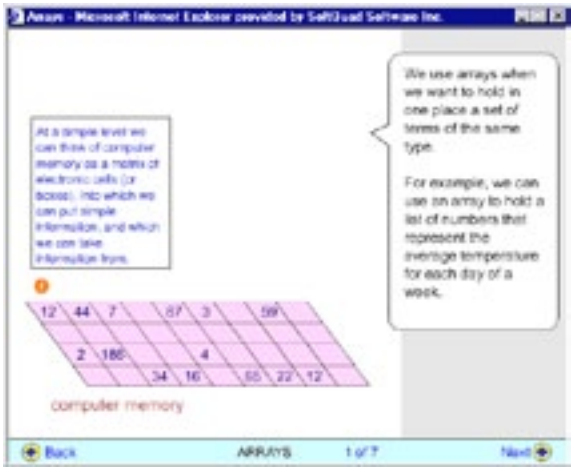
The main difference between iPages and web pages is that the former is not necessarily in an HTML format. The text is obviously hyperlinked in such a way that allows a dynamic flow of information - we just click on specific text to show some more information (ie biographies).

In order for such a system to work, we would need to have lots of supportive material, depending on the actual lesson at hand. Usually a book cannot contain many images (and we are not even discussing about videos or animation). This is due to restrictions in the number of pages to be printed. This is not the case with interactive content, as we can have as many images as we need. This need, in traditional books, is defined by the authors of the book. In this case, this need is defined by the teacher after taking into consideration the emphasis points of a specific lesson and -of course- the needs of his/her students.

The centralised approach of content, as shown in previous pages, allows for massive storage of supportive content that is readily -and always- available to the educators and students. The flexibility that this approach allows, brings a totally new dimension to the way we handle this information, especially when working with different learning style. Some students, for example, learn best when they work with text, others when they actually listen to the information while others tend to learn better when they are engaged with the actual content. Teachers will have the option to use the proper content with the right group of students.

# Learning Objects: The Ideal Development Model?

*Learning Objects and iPages are not necessarily the same thing. In some cases, an iPage can be one or a number of LOs put together. In other cases, an iPage can consist of various type of content and at least an LO.*




**Example of Learning Objects for teaching programming**
**http://www.londonmet.ac.uk/ltri/learningobjects/intro.htm**

*Creating digital content is extremely time consuming and expensive. Therefore, a model for rapid development of content should be used that allows the reuse of this content under various environments as well as the ability to easily update them.*

## LOs for assignments

Usually, Learning Objects are small, independent modules of information, reflecting a specific piece of information. Even though this model has great value and potential for a vast majority of material, it is also limiting our ability to effectively replace all types of content. Proponents of LOs will argue with the above statement, however we are very interested in using the advantages of both traditional content creation and the benefits of LOs. As such, when faced with information contained in textbooks, we would rather use a more conservative approach, like the one described in the previous page, with the ability to choose the supportive material. At the same time, we need to use LOs both as supportive material (in some cases) but also -and most importantly- for creating small, interactive applets within the iPages, that engage the student in the actual pursuit -and construction- of his/her own knowledge. LOs here can be seen as mini-assesment tools that give direct feedback to the child while at the same time keeping him/her focused on the subject.

LOs, when used in this context, provide the glue that keeps together all the parts of an interactive lesson. Otherwise, a student might get overwhelmed with all the information presented to him/her during the course of the work. Our research so far has proven that, if the student has no clear indication of where he/she is going, then technology fails to give results and in some cases can have negative impact on the learning experience.

## Our Definition

In our proposed System, Learning Objects are small, individual applications, that perform specific functions and can be used to serve the aims of a lesson. They are structured in order to fulfill specific goals, they are totally interactive, they have absolutely no connectivity to any other type of information, and they constantly give back feedback to the user.

By clear definition, LOs as we see them do not deviate from the broader definitions of similar activities used or developed by others. In fact, we base our concept on the work and theories of both David Wiley and Tom Boyle.

Our intentions are to develop and use LOs as added value in our content. The very fact that they are independent entities, allows the teacher to use just the proper LOs for the right situation and children. Especially in Maths we can see a tremendous benefit for children of various levels that require differentiation in the way we handle them and the way they handle information. This unique flexibility is the key that will allow the teacher to be more selective on which content to deliver to the right students, in order to improve the learning results of the classroom.

# Presenting Information to Students

*We might be able -at some point- to replace books, and also to completely change the role of the teacher. There is one thing that will probably never go away- the Whiteboard!*

**Interactive whiteboards are a must for any digital classroom. The benefits offered by the technology are tremendous, both for students and educators. Some of the functions are especially time saving.**

*So far we have covered the hardware used by students, the server infrastructure, the delivery of content and of course content itself. The final building block of the system is the Presentation System used by teachers, the Interactive Whiteboard.*

## Revolution on the Board

One of the most powerful tools at the hands of a teacher is definitely the whiteboard. Regardless of technique, method or teaching style we use, the whiteboard is essential in the classroom. Fortunately, interactive whiteboards can -and have in many cases- replaced normal boards, and offer great tools that enhance the entire experience.

We had the opportunity to test such a whiteboard, thanks to a very generous donation by SMARTtech, through their local resellers, Achellec, here in Cyprus. We are also hoping that within the next few days we will have access to other similar products from other vendors. By evaluating the impact this technology has on learning, we only have to think how we could live without one all those years- it is truly an indispensable tool that can work miracles in the hands of both the teacher and students.

Thankfuly, the Minister of Education of Cyprus has committed to providing public schools with this technology. This is a tremendous move forward for our educational system, and certainly something that will enhance the use of technology in public education.

## Presenting Information

Even in an educational system like the one we promote, we need the means to present information in order to give basic guidelines and also offer advice and assistance to our students. In this respect, nothing comes even close to the help we can give using an interactive board. Some models, or even some third party software, allows the transfer of whatever information is being displayed on the board to the clients of the students. This capability can save precious time in note-taking and of course help us emphasize specific information.

Some tools even allow direct interaction between all students in the classroom with the actual content that is presented on the board. Voting tools (hardware and software) allow the participation of the entire classroom and the grading of their performance, especially when multiple- choice questions are used. We tend to be more in of open-ended questions rather than mu choice ones, but this is one benefit we ca overlook.

At the end of the day, no classroom that is puter-rich can work without an inter whiteboard. We expect a thorough presen of these technologies in a later issue of ou port.

# Editor's Notes

*I have just come from the Sun Edu Meeting FY06 in Athens, where I met some very interesting people and seen great technology in action. I also had the chance to give a presentation regarding Thin Clients and Education.*

*First of all I should thank Sun Microsystems for inviting me over to Athens in order to present our research on Thin Clients (you can download the presentation from our web site www.apoplous.org).*

## The 'Apoplous' Research

I gave two presentations during the conference, and I was glad the participants liked it (I received some great comments after the presentation and also during the dinner party the same night). The rest of the people continued partying till morning, while I had to move back to the hotel since I was too tired for partying.

While relaxing, I just started thinking about how we got involved with research and the work we have done in the past few years. Then I remembered the first time I presented the core ideas behind our research. It was during my final year of my undergraduate studies at the University of Cyprus, when I gave this presentation as part of a class. I believe the name of the specific class was 'New Technologies in Physical Science' or something-can't quite remember. The story ends with me getting a 0 (zero!) for my presentation, and a failure in the class! I am not sure but I believe I was the only one who failed that class. Of course I wasn't satisfied with the grade, especially since I did presentations for a living back then (and judging by my work now, presenting the core ideas of what is now 'Apoplous' was NOT a joke)


- Alexandros Kofteros
  B.A. Education
  Post-Graduate student, University of Cyprus,
  Curriculum Content Development

For all your comments please feel free to email me alexandros@apoplous.org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