Information and Communications Technology in Schools and Education:

Are Portable Gaming Platforms a Viable Learning Resource?

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Abstract

A researched look at how ICT is currently used in education. Are schools interested in using new technologies and how are they implemented, both logistically and financially? Also, what are the views of the government and the tech industry on providing schools with equipment for learning? Finally, could portable gaming platforms, such as Nintendo's GameBoy Advance, be a successful medium for delivering learning content, especially when compared to more traditional mobile computing hardware, such as laptops and PDA's?

Do Schools Want ICT?

Schools really are interested in how new technologies can help aid them around the school. This includes uses for teaching and learning as well as administration and organisation. Teachers have traditionally been wary of new technology, but are coming to realise its potential and benefits. Research also shows that the children appreciate the use of technology in their learning.

Electronic White Boards

Electronic white boards are a current hit with both primary and secondary schools around the UK. When using these devices in lessons, the following responses from the pupils (in this case primary school) are typical:

How did ICT help you learn more about Maths?
- "Everyone had lots of ideas to share"
- "I could see what the teacher wanted me to do"
- "It was quick to see all the different kinds of graphs"

What did you enjoy most?
- "It was fun writing with the special pen"
- "Using my finger to make the computer work"
- "Having a go"

This kind of reaction definitely shows that children appreciate trying something new, having a variation in lessons and playing with technology.

Disabilities

ICT can also be used as an 'inclusive' device for getting children with learning and/or physical disabilities into the National Curriculum. Research into using various different computer and software setups can be cited, including 'image recognition and memory matching' software. This example can help link school life with home life using images and sounds from around children's homes in software they use at school.

View From The Top: The Government's Take

Connecting Students

The following is found in 'Wireless Networking in Schools: A Decision Making Guide for School Leaders,' a joint publication of the British Educational Communications and Technology Agency (Becta) and the Technology Colleges Trust. It results from a survey of schools which have been using wireless networks, some for up to three years, and is aimed at head teachers and others who might be involved in the decision of whether to 'go wireless.'
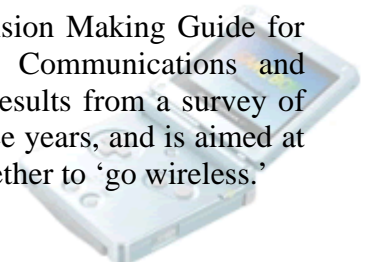
Transparent Technology

Findings have indicated that as yet, few schools have implemented the use of palm-sized devices with pupils. The slightly larger handhelds, such as devices from Psion a decade ago have been widely used for dedicated applications such as data collection for science. Windows-CE powered hardware, which came at the point between Psion and the most recent Pocket PC devices, never proved popular in the business marketplace. However, some schools are using them very effectively, either limited to the handheld's own resources or backed up by applications held on a school server. The most recent devices, such as the aforementioned Pocket PC's are still considered too expensive and are often more than over powered for the needs of young children.

Having portable machines, especially those that are wirelessly linked, the emphasis is taken away from the ICT and is kept with the main concerns of a lesson. Like textbooks, maps, a protractor or a pair of compasses, it is just another resource to draw on (though an immensely powerful and multitalented one). The technology becomes transparent, restoring the emphasis on subject content, curriculum context and skills development. Having to move a class of pupils to dedicated computer labs at only certain times of the day for set periods to have a lesson has the opposite effect.

A Helping Hand

Pioneering schools which have taken up the portable hardware and wireless network baton have been trying to assist other institutions by listing some tips on implementation:

- Small-scale pilots help identify issues and shape future use.
- Keep a curriculum focus – don't get carried away with technology.
- Make sure all staff are well informed and convinced of the value of the exercise.
- Training, training, training – technical and pedagogical.
- An Inset day to plan and practise use has been the key to success in a number of schools – with continued periodic training/development sessions.
- Consider appointing one or more technical champions – pupils and staff which assist in handing out or setting up devices when required in a class.
- Poor battery management can waste the portable computing resource – make sure chosen models have good battery life and are charged when not in use.

As noted above, batteries are still the critical factor in 'anytime, anywhere' learning, and can often be a stumbling block. For a laptop, about an hour and a half is realistic, where a palmtop or handheld PC is likely to last a school day. Smaller devices such as mobile phones or handheld games consoles have much longer battery life which may last a school week. In the survey of schools that were part of the project that led to Becta's publication, more complaints were received about the difficulty of keeping batteries charged than any other issue.

Portable Devices

In March 2003 the first detailed report from a project evaluating the use of PDAs in schools was published. This project which Becta is managing for the DfES began in April 2002 with 27 schools using Compaq iPaqs in lessons, and has been expanding from there.

The characteristics of the PDAs that met universal approval included:

- Small size – always with you
- Instant-on (no waiting for an operating system to 'boot up')

- Much longer battery life than laptops
- The quantity of data they could hold
- The currency of the data (how 'recent' information was)
- The ease of synchronisation and sharing of data by infrared or other wireless link
- The price advantage over laptops.

At their current state of development, responders suggested the following possible weaknesses:

- Small screens
- Not rugged enough for school use
- Lack of print-out capability (not applicable if networked)
- The time it takes to input data (especially free text)
- The necessity to charge batteries every night (cradles are a must)
- Costs of software and accessories
- Unstable data storage (if the battery is allowed to go flat) leading to lost work.

Overall, teachers are positive about introducing handheld devices, seeing that the advantages far outweigh the problems with the hardware. One had this to say about moving ICT out of the classroom, "We went into the school garden with the PDAs and made notes on the colours, sounds and sights of autumn... I do like the idea of using satellite navigation to find buried treasure as suggested on one [web]site. Maybe I could bury some in our local park!"

Concerns for Safety
Usually, the second concern, after costs, revealed by respondents in the report tended to be the safety of children carrying such devices. This seems reasonable when mobile phone crime – especially among children of secondary school age – has reached epidemic proportions. However, the comparison with phones is not as close as it may seem, as PDAs are more easily kept out of sight away from easy access and are not generally used in the street. Ironically, one US school has commented on the value of the cheapest, lowest functionality PDAs in this respect. They suggested that by providing units lacking some of the latest features available in portable units, (such as the MP3 playback and games,) meant that these PDAs were much less attractive items for thieves to steal. And should this occur anyway, the low cost means a smaller loss.

Low Spec is Not Low Power
Children are enthusiastic in using the hardware in a variety of ways:

> "We use it in science lessons and save things on the memo-pad."
> "I like to use it in maths, as it's got a calculator, and I like science… the teacher sent us the periodic table [for the PDA]."
> "In some lessons, if the teacher wants some homework, he can beam it to you, and you can beam it to your friends."

Observers of these schemes have speculated on the novelty or 'toy' effect and the 'grown-up' effect. Whatever does it, giving children a PDA lights up their enthusiasm, though whether this will always be the case, whether they might tire of them in time, or whether PDAs will eventually become 'yesterday's news', remains to be seen. In the meantime, there is potential here to be exploited by, for example, targeting disaffected boys.
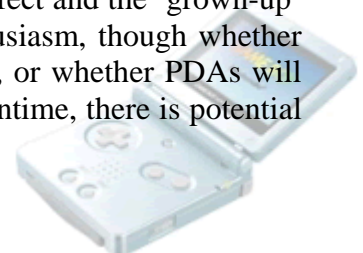
"I thought it was a bit boring when it was just an organiser… when I found out people were beaming stuff, I was very interested."

"When I found out there were games I was happy!"

"When I first started school I hated it… but then I got the PDA and it doesn't bother me now."

"When we don't have the PDAs any more, I think I'll still be more interested in computers."

"It's a very full hour… time flies with the PDAs as you are having fun."

Ambitions

When they were asked whether using the PDA had changed their plans for the future, seven out of 10 in one group of pupils said that using a PDA had made them change their ambitions. The common answer was to make more use of ICT in their future jobs.

"I wanted to be an actress, but now I want to be a teacher and use PDAs."

"I want to be a footballer, but now I want to be into computers, in case it doesn't work out."

"If you're already good at ICT now, you'll work on it and get better at it… then you can have a career."

"I'll want to do more IT at high school."

"I'll do IT at primary school, then at senior school, then I'd go to university and do IT, but you've got to do hard work."

Increased Funding

Education & Skills Secretary Charles Clarke announced new initiatives for 2004 at BETT that will see ICT transform education saying, "We have learners enthusiastic in their use of ICT, teachers with increasing levels of skills and confidence and new strategies for learning and teaching. Our challenge is to bring this great resource together with partners, industry and government to deliver an education service fit for the information age"

The Secretary of State has announced that there will be £25 million of additional funding set aside for interactive whiteboards in 2004-2005 alone.

Industry's View

Market for hardware

It is certainly in the interest of hardware developers to carefully consider the educational market if only due to the appropriateness of the size of the items and their interface to children as opposed to the many adults that find PDA screens less than wholly appropriate for their diminishing eyesight and clumsy fingers!

RM: Hardware Reseller

"ICT is to education what penicillin is to medicine"
Estelle Morris, former Secretary of State for Education, speaking at an RM conference

RM is a leading supplier of computer hardware to schools at all levels of education. In their Interim Results from March last year they identified the increasing sales of more diverse products, such as tablet PC's and interactive whiteboards. Here is a summary of the relevant points in the report:

- Mobile PC (that is laptops and tablets) business is increasingly important
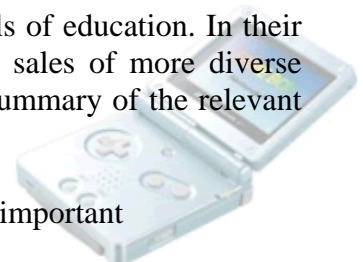
- o A four-fold increase was seen in sales volume between 2002 and 2003 in the same period
- o Supplying Tablet PC's for education positions RM at the leading edge
- Whole-class teaching products are becoming more popular, such as interactive whiteboards and projectors
  - o Order intake value is up 55% year-on-year
  - o RM now provide an innovative product range which includes Bluetooth support, ClassPad and Easiteach Studio
  - o This all means a wider variety of products are being installed and used by schools

In their Palm
palmOne, the now separate hardware arm of the Palm handheld device company, have been doing their own trials in education. One such trial was held with Manatee County Schools in Florida covering a wide age range.

"What we've seen is that the students are much more likely to do and complete their assignments using the handhelds."
Tina Barrios, Supervisor of Instructional Technology, Manatee County Schools

Advanced Distributed Learning Initiative
A US led, but worldwide, initiative to improve education and training via learning technology, called the 'Advanced Distributed Learning [Initiative]' (ADL), is working to develop a common technical framework for web-based e-learning. This is starting off with primary or elementary school content, with efforts going to extend into Medical and Higher Education later, as well as the possibility of Industrial learning. The plan is to have all of the content centralised in a flexible format which can be shared to, and viewed on, any device that connects to it, be that a desktop PC, laptop or PDA. I see no reason that this could not extend to other handheld and mobile devices, such as mobile phones, especially smart phones, and handheld consoles such as future GameBoys, the Sony Playstation Portable, or the Gametrac.

Building Schools for the Future
The 'Building Schools for the Future' program, which is initially being launched with funding for 14 local education authorities (LEA's) including Manchester, Newcastle and Bristol, is looking for architects to design some more modern visions of how a school could be built, whilst being practical in terms of cost, management and use. This has resulted in architects making some beautiful designs for new schools, in which having access to technology is an integral part.

Lack of Software
A problem one University in the US has found in researching using Pocket PC systems in their classrooms (in Physics, French, Chemistry, Health and exercise, and Sociology,) is that there is very little educational software available commercially for the PDA and so chose to develop some 80 small software applications, including:

- Interactive reference documents
- Interactive exercises
- Explanatory documents
- Annotated exercises
- Interactive quizzes.

What this Means for eLearning on the GameBoy Advance

As we have seen, ICT is highly popular in schools, with the teachers, families and the government all hoping to give their children the best possible experience during their school careers. The pupils themselves are just as keen to get their hands on these gadgets, seeing learning as much more fun.

Unfortunately a gap has appeared between the acceptance of the technology and the products available. Clearly some very clever and successful initiatives have been implemented on other delivery devices, such as television and desktop PCs, (using both CD-ROMs and the Internet,) with notable crossovers such as the BBC's 'Bitesize' program which links television, books and the Internet for exam revision. However, support is lacking for handheld device software. Lesson plans can therefore be difficult to create to include this new ICT. In terms of hardware, it can still be expensive, complicated and needs care in setting up and maintaining.

By using a device such as the GameBoy Advance, I believe that a lot of the problems identified by schools and many concerns raised about funding and safety can be acknowledged.

Here are some of the benefits of using the GBA within education:

- Low cost of the device – £80 for the latest GBA SP compared to £400 or more for the latest PDA.
- Easy to supply – many children will already own the console. Families are happy to supply them, taking the burden away from the school budget.
- Software cartridges are cheap – Usually around £30, if the right software were developed.
- Children see the device as a toy – the technology is transparent as well as the learning, making the experience fun for the pupils who will gain more from the lessons they are involved in.
- A robust device – the GBA was designed to survive the knocks a child inevitably gives it throughout its life.
- Less of a target for thieves – being a common item, potential theft should be kept down.

Obviously newer games consoles appear on the market every 5 years or so, which means that more and more possibilities become available to developers, with the same benefits as outlined above. The Gametrac, from Gametrac Europe Ltd., (a UK based subsidiary of Tiger Telematics Inc., a large electronic game and toy producer,) is one such device which subsidises software with advertising. It also has a GPS unit in it to track where a user is, (good for concerned parents, and also useful for developers for implementing software which takes your position into account,) a GSM unit for sending and receiving SMS and MMS messages, (which is how advertising comes through) though not phone calls, (which again keeps the thieves at bay,) and it handles media playback. I'm sure a device such as this would love to have a great launch pad for getting a large install base by targeting schools to help sell their products, (which then brings other developers onboard to support it by making games and other software, further heightening popularity of the hardware.) Sony's Playstation Portable is expected to be much more similar to Nintendo's GBA, but with much more processing power, equivalent to the current home console, and wireless link built in. Nintendo have recently released a wireless addon for the GBA in Japan, eliminating the need for wires to connect multiple users consoles together in compatible software. The dongle has a surprising amount

of functionality and is already being used in innovative ways, including beaming data to unlock items in certain games from pods in Nintendo stores. This could be an excellent way of collecting data on a field trip, for example, when answering a generic question on map reading whilst on a visit to a farm, (e.g. place the barn icon at the correct grid reference,) a response specific to this particular farm could be downloaded and a mark given. This allows generalisation during the software development phase and also saves the teacher's time in checking everyone's screen.

We have also seen that parents are keen to encourage use of technology, understanding that it is now vitally important for future use in the workplace. Games are understood to be a good form of entertainment for their children but concerns have be raised at the amount of time exposed to 'mindless shoot-em-ups' and the like. In one such example of this, I received an email whilst researching this paper from a parent of a gamer:

> "I think you have a very good idea on your hands with the educational GBA. My 7-year old son has one and he plays with it for hours, but with adventures and shoot-em-ups. I am sure he would benefit form some educational content, and his mother would be a lot happier with him using it."
> *Mark Baker*

The final hurdle is getting the educational software produced. Games development companies need to be shown evidence, such as this paper, to understand the vast amounts of money that is potentially there for the taking. (Perhaps just as important is convincing hardware manufacturers to 'open up' their hardware for easier 'homebrew' development. Huge communities are created around all sorts of devices these days, including games consoles and MP3 players as well as PDAs, all trying to develop software and increase functionality for them. All this despite having to, essentially, reverse engineer these products. Great results have been achieved, but these people are still often seen as a bad thing, as hackers, especially by the games hardware manufacturers. They need to realise that there are some very talented people willing to work for free. Not only that but they are going to do it without the manufacturers help, with great success. Imagine what could happen if they were given just a little support. Be it an API, some tools or just some technical documentation, I'm sure some amazing results could be achieved.)

Bibliography

intouch! January 2004
Department for Education in Schools

RM plc Interim Results - Six months ended 31st March 2003
Greig, Mike 2003

Use of Computer and Video Games in the Classroom
Kirriemuir, John 2003, University of Bristol

The Digital Disconnect: The Widening Gap Between Internet Savvy Students and their Schools
Levin, Douglas and Arafeh, Sousan 2002, Pew Internet & American Life Project

Handheld Computers (PDAs) in Schools
Perry, David 2003, Becta ICT Research

Wireless Networking in Schools: A Decision Making Guide for School Leaders
Perry, David 2002, Becta ICT Research

ADL/SCORM – What Does it Mean for Developers of ICT Projects?
Rehak, Daniel R. 2002, Carnigie Mellon University, Pittsburg PA.

Exemplar Primary School Design: Suburban Site
Walters & Cohen Architects 2003

http://www.dfes.gov.uk/ictinschools
http://www.gamestudies.org
http://www.gametrac.com
http://www.nintendo.com
http://www.playstation.com
http://www.palmone.com
http://www.palmsource.com

There are also many more relevant web links on my project website at:
http://www.createuk.co.uk/gba/bookmarks.htm