"But the Screen Is Too Small…"

Sorry, "Digital Immigrants" – Cell Phones – Not Computers – Are The Future Of Education

By Marc Prensky

[1710 words]

"The future is here. It's just not evenly distributed".
– William Gibson

I have seen the future of education, and it looks a lot (though not exactly) like the new, recently announced, n-Gage mobile phone/gaming platform from Nokia.

Like the n-Gage, it is a phone, with the ability to connect to over 1 billion other people, one-on-one, one-on-many, simultaneously or asynchronously through email and text messages. Like the n-Gage, it has a high resolution color screen, plus built-in Bluetooth and USB, enabling it to connect to peripherals from folding screens to full keyboards, to coke machines. Like the n-Gage, it has a built-in mp3 player and FM Radio, removable storage on tiny smart cards, and the ability to run any program written in Java ME (micro-edition), which means it can control any other device, like a projector or robot. Like the n-Gage, it has a browser and can search and surf the internet, (at high speeds under certain conditions). Like the n-Gage, it can read a novel to you out loud through

speakers or headphones. Like the n-Gage it can play video. And like every cell phone, it has GPS (or cellular) awareness of its own global position.

But unlike the n-Gage, the future student learning device also has a thumb keyboard (see the Nokia 6800 for a great example), a camera (as do most other new models from all manufacturers), and addable (and upgradeable) external microprocessors and hard drives. It has built in Wi-Fi. It has a thumb print reader to make it usable only by its owner. It has a text reader to optimize using text on the screen, presenting it in a variety of formats, including at any rate you choose (most people read 4 times faster this way.) And let's give the other phone makers their due. The device also has all PDA functions, 3D graphics, infrared, and is a full midi synthesizer. And it accepts all sorts of attachments and plug-in devices (did I already mention Bluetooth?).

This device costs under $200 at retail, under $100 in bulk. (Nokia hasn't announced the n-Gage's price point, but this is the likely one, and will certainly be the case in a year.) It fits in a student's pocket. Not a big pocket, *any* pocket. A student can lose, it, abuse it, replace it. But like the cell phone they probably *already have* if they are students, they mostly don't. They just never leave home without it.

What will kids do with their pocket learning devices? Of course they'll play games, make calls, and instant message their friends. And (sorry, industry) they'll readily share and enjoy songs, video clips and humor. But the kids will also use the device to prep for Bush's standardized tests, using fun games designed to prepare them (not "drill and kill," but fun ways to practice), that they and their friends actually like and *choose* to compete with, as it's a lot more fun than what happens in class. These games will be made both by teachers for free, and by vendors for sale.

In fact, the device will totally empower interested teachers, because through simple, specialized, free, downloadable templates (many of which teachers will, in fact, create) it will allow them to prepare materials that will work without the need for impossibly expensive (at least in education) "eye-candy."

Inside those classrooms run by teachers who are willing (and even eager) to work with the tools of their times, students – Kindergarten though University – will use the devices in an amazing variety of ways. There will be software – again mostly teacher-written – for practice in any subject at any level, and for collaboration (and competition) in pairs, small groups, whole classes, whole schools and even whole nations and groups of nations. A simple radio transmitter in a teacher's pocket (cell phones *are* radios, of course) will let the entire class be in synch on certain things, like answering questions, and seeing the results (answers to individual problems or the histograms of the class's responses) displayed on their screens.

Almost all homework will be done directly on the device – it will come to students via text messages from the teacher, and will be submitted the same way, either using text, images and voice (say in language class or English). The devices have browsers, hence search and access to the world's libraries. They can create written work, spoken work and

multimedia work. The devices will have standard word processors, and a standard presentation package optimized for both multimedia and small file sizes, as well as lots of other Java software, all downloadable. Kids will "learn" this software initially in minutes, but refine their use of it (and the skills it allows them to express) over years with their teachers' help. Teachers, as they are already doing, will use the phone and its data-enabled capabilities for administration, for contacting and reporting to parents and to school administrators. As teachers and others invent, parents will be hooked in automatically to both their children's work and the teachers' comments.

Digital divide? Can't afford one? The devices will be given out by the school for use for the year, just like a textbook (although most kids will already have their own). Remember, these devices cost less than $100 and will be probably be highly subsidized even further by industry and government – they are likely to be free for kids who meet certain requirements. This business model (with Sony PS1's) has been used successfully by Lightspan. Cellular carriers will have special school-use plans, which they also can choose to subsidize. Any non-school use will have to be pre-paid.

Each new school year will mean a new, upgraded device, with new features. Every student will be required to have this year's model or last year's, guaranteeing consistency (remember, it costs less than their sneakers, and may be free for some). There will be a constantly rolling minimum standard feature set that manufacturers must adhere to. This is no problem because the manufacturers roll out new models every six months, and all will certainly offer models that widely surpass the minimum specs at increasingly lower price points. As most usage will be voice, text and Java based, device operating system compatibility will not be a big issue. If there is system convergence, it will only help.

If you think this is a pipe dream, please note that all of the technologies and things described exist or are doable today. Pilots of many already exist at universities in the US, Japan and Europe. The work of integrating this device – which obviates the expensive hardware and software issues that come with the "bigger" computers – can begin today, in those high schools and colleges with close to 100 percent phone penetration and willing teachers. There are legions of useful educational things that can be done even with the phones students already have in their pockets. Successes can be passed down (and the failures eliminated) through web sites, and later though teacher training and education schools (if God is willing that they be part of the future!) And I haven't even gotten to *new* possibilities yet, most of which will be invented by Digital Natives, and quickly integrated.

One reason these devices will thrive is that not only are they inexpensive and easily upgradeable, they can do everything from education past – i.e. reading (to you and by you), writing, and 'rithmetic – to education future, i.e. global collaboration, scientific experimentation, accessing the world's literature and libraries, and world exploration.

Also, unlike the "bigger" computers, these are inherently voice-based devices. That lets us teach everything from reading, to drama, to foreign languages more naturally and easily. Text-to-voice and voice-to-text applications will thrive. A new era of "Digital

native" -oriented educational technology invention will begin, just as it has in the mobile games world. Because the devices run software which is downloadable and upgradeable over-the-air (OTA), students and teachers can use any programs, developed by anyone anywhere, and they can change each semester, as improvements emerge. Since most educational software will become, I predict and hope, free open source, no investment will be required. Maintenance – the biggest hidden cost of today's school computers – will no longer be a problem: if a device breaks, just throw it away and get a new, better one, probably at a lower price.

While most K-12 computing won't require enormous processing power (certainly not more than a plug-in Pentium 4), for the really hard stuff, and the really immersive 3D stuff, we still don't need the "bigger" computers – the upcoming few-hundred-dollar PS3 and XBox2, with their multiple processors and wideband connectivity, will be available. But these platforms will remain hugely expensive to develop for, and Sony and Microsoft are likely to continue to resist most educational "titles" as anathema to their games business. Besides, in a school environment, size and portability trumps just about anything else.

Still, if you are a "digital immigrant" reading this, born before the digital revolution, approaching presbyopia and holding menus at arm's length, you may be thinking "it won't work – the screen is too small." You are wrong. As you may have noticed, today's "Digital Natives" do just fine with the Game Boy, thank you, without complaining – and there are 150 million of those devices around the world. Having grown up with this size, they think it's the way screens are, and should be. (An analogy is that people who grew up in small apartments consider 5,000 sq ft houses nice but unnecessary, and 10,000 sq ft houses useless "rattle cages"). The screens in today's phones are QVGA, the same number of pixels as a Pocket PC, but smaller, clearer and sharper, and they will only get better.

But if need be, you can plug into a TV. And, if you really feel you need it, you can always USB to a big flat panel screen – or Bluetooth to a pair of wireless screen-projecting reading glasses. :-)

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