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New Opportunities and Directions

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Open Source Software and Schools:

New Opportunities and Directions

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Abstract

Abstract: Integrating information and communication technology into schools has been challenging. A central component of the challenge is coping with the expense and usage restrictions of software that is installed on school computers. An alternative approach to the educational software problem is, however, emerging. This approach involves making greater use of open source software. In many

cases open source software can effectively replace the proprietary or commercial software that dominates the educational computing landscape. Using this software option would result in decreased costs, increased flexibility, and increased opportunities to address social and ethical issues related to information and communication technology. In order to responsibly spend taxpayers' money and to maximize the potential of information and communication technology in education, it is important that educators learn about open source software and challenge conceptions that give priority to proprietary software.

Résumé: L'intégration des technologies de l'information et de la communication dans les écoles s'est avérée un défi. Un des éléments clés de ce défi consiste à respecter le coût et les restrictions d'utilisation des logiciels installés sur les ordinateurs des écoles. On est à élaborer une solution au problème des logiciels éducatifs. La méthode implique une plus grande utilisation de logiciels en libre accès. En effet, dans de nombreux cas ces logiciels remplacent les logiciels commerciaux et privés qui dominent présentement le monde de l'informatique en éducation. Cette option entraîne des réductions de coûts, une flexibilité accrue et davantage d'occasions d'aborder les enjeux éthiques et sociaux liés aux technologies de l'information et de la communication. Les éducateurs doivent en savoir plus long sur les logiciels en libre accès et ainsi remettre en question l'adoption des logiciels privés afin de dépenser raisonnablement l'argent des contribuables et de tirer le meilleur parti du potentiel des

technologies de l’information et de la communication en éducation.

Introduction

Schools have been under tremendous pressure to integrate information and communication technology (ICT) into teaching and learning. An unavoidable part of making ICT available in schools is obtaining and maintaining the software that is necessary to allow school computers to function. Most software that schools use is produced by proprietary software companies that normally charge considerable sums of money for their products. The cost and usage restrictions that characterize proprietary software place an enormous stress on cash strapped schools. As a result of this situation, schools are left with a serious problem: they clearly need to integrate ICT into teaching and learning but doing so requires large, ongoing expenditures to purchase and maintain ICT resources. The expenditures not only limit the degree to which schools can develop their ICT, they also negatively impact other areas of the school program. There is, however, a new development in the software area that promises to offer schools some relief. In this article, I will describe some problems associated with the approach most schools currently take to educational software and how open source software (OSS) can contribute to solving many of these.

The Cost of ICT

The staggeringly high cost of bringing ICT to schools is not a secret (Cuban, 2001; Riffel & Levin, 1997; Roberts, 1999; Twining, 2002). In the relatively short period of time that computers have emerged as an educational priority, the educational establishment, from the highest levels of government down to the schools

themselves, has worked hard to place networked computers in schools. Schools, however, have limited financial resources, so bringing ICT into schools has been a financial burden. A recent survey of nearly 6700 school principals in Canada (Plante & Beattie, 2004) reported that while 92% of principals agreed that ICT was worth the investment, nearly 67% reported that "having sufficient funding for technology was an extensive challenge to using ICT in their school" (p. 27, emphasis in original).

The funding for bringing ICT to schools tends to come either from a school's operating budget or from special, one-time or short term sources, such as government programs, grants, or school fund-raising efforts. When money for ICT comes from the school's operating budget, the zero-sum principle applies (Cuban, 2001, p.194). If more money is required for ICT, it has to come from another budget category. There are many areas from which money can be taken, but often the cuts can be assumed to translate into reduced support for optional programs areas or other areas of school need, such as building maintenance or teacher salaries (Cuban, 2001, p. 193). It is likely that most schools have had to make some sacrifice in the overall educational program in order to fund ICT. Although schools are better able to protect their educational programs when funding comes in the form of one-time cash infusions that cover initial purchases, it must be remembered that ICT has an ongoing cost. Computers and software must be upgraded from time to time, repairs must be completed, and technical support needs to be provided. Typically cash infusions do not cover the ongoing costs. Schools need to consider carefully how to best spend this type of funding so that they get the greatest initial value while limiting ongoing expenses as much as possible.

As schools make ICT decisions, they must consider all their options so that their choices maximize the impact of ICT without harming the overall educational program of the school. A necessary and important part of this decision is selecting software to run on the computer hardware. Obtaining and maintaining software has been an expensive and challenging part of ICT that ranks as one of the top difficulties identified by Canadian principals (Plante & Beattie, 2004). Some new options are emerging that may help alleviate software problems. Over the past several years, OSS has emerged as a realistic and attractive alternative to the proprietary software that dominates the educational scene. Before exploring how OSS can help schools move forward with ICT development, while reducing the need to make other sacrifices, I will discuss the current state of affairs in which most schools find themselves with respect to software.

The Proprietary Software Model

Proprietary software is well known to most computer users. It is normally developed by a company and sold to consumers. In most cases, the company that develops the software provides the consumer with a working copy of the software package in machine-readable language—that is, computers can understand the instructions the software provides but humans cannot. The conditions under which a consumer can use proprietary software are normally detailed in a software license agreement. By providing only machine-readable code and then carefully specifying conditions for use, software companies can control their products and compel consumers to pay in order to use the software.

The best known developer and distributor of proprietary software is the Microsoft Corporation (MS). MS has had a near-monopoly on the software market since the release of Windows 95—the first version of their Windows Operating System (Lessig, 2001). Since that time MS has come out with new versions of Windows. Although it is hard to find reliable statistics, some sources estimate that various versions of the MS Windows are installed on over 90% of desktop computers (e.g., Lemos, 2003). There are other proprietary operating

systems available as well, most notably the Macintosh Operating system[1]. Unlike Windows, Macintosh software does not run on the PC computer, requiring Macintosh hardware that is produced by Apple Computer to be purchased.

In addition to Windows, MS has produced some of the most ubiquitous application software in the world, including MS Office, Internet Explorer, and Outlook. Other companies have also been very successful building applications that run on Windows and, sometimes, on other operating systems as well. The massive user base of Windows provides these companies with a solid market for their products.

The power and influence of proprietary software companies has allowed them to be perceived as an obligatory point of passage (Latour, 1987), a point through which we all need to pass if we are to use ICT. This perception has been constructed through the production of good software, but also through business tactics and the development of consumer belief. Proprietary software companies do not force consumers to use their software, but have nonetheless been successful in creating a monoculture in which Windows and other proprietary software appear to be the natural choice. Borrowing a concept from the marketing field, Neal Stephenson (1999) refers this situation, from which these companies benefit, as mindshare. Mindshare is a psychological phenomenon that exists in the minds of computer users. MS and other software companies have power because users believe they do. Maintaining mindshare is less about software performance or price, but rather the maintenance of user belief. With the high degree of mindshare these companies have achieved, they gain power in setting prices and conditions of use. I will be returning to the concept of mindshare later.

Problems With Proprietary Software in Education

In education, proprietary companies have been very successful in developing a huge user base. Although MS dominates the educational software market on the strength of Windows, significant inroads have been made by other companies. In North America, there has been a reasonably strong user base of the Macintosh Operating System in schools. Where applications are concerned, MS has a large part of the market with products like MS Office being very common but many other companies have been successful getting their software onto school computers as well. This state of affairs has worked well for these companies who have been able to develop a large, stable user base. For schools, these circumstances have worked less well and need to be revisited for three reasons: cost, flexibility, and social responsibility.

The basic problem of educational ICT costs was discussed earlier. To further illustrate the issue I will briefly review the cost of conforming to Microsoft School Agreement (Microsoft, 2004), the license that governs the use MS products in schools. If a school had 400 computers capable of or actually running MS products[2], the estimated cost would be $7,200 (US) per year to run only the Windows Operating System[3] and $19,200 (US) per year if the desktop package was selected, which includes the Windows Operating System, MS Office Professional, and Core Client Access License. These costs are significant and would be incurred on an annual basis. The costs I have calculated do not include other software packages that schools may require on desktop machines nor server software.

Schools are constrained in their use of the software they purchase by licensing agreements. The agreements are normally clear enough, but administrating the use of software in schools is challenging. Schools that neglect to administer their software usage risk being forced to account their license compliance and face consequences if found in violation (e.g., Acohido, 2002; Cave, 2001; Simpson, 2002; Zetter, 2002). At a time when license compliance is becoming a serious issue for schools, using proprietary software requires a high degree of administrative accountability.

There are also a number of social issues in which schools become entangled when ICT is introduced. One important responsibility of schools is to do what they can to ensure equity of opportunity for students. The integration of ICT into schools requires attention be given to its impact on digital divide issues relating to students. Digital Divide refers to the "gap between those who can effectively use new information and communication tools, such as the Internet, and those who cannot" (Digital Divide Network, 2003). Exploration of the digital divide often focuses on how socio-economic factors such as family income, education levels and gender impact access to ICT, with access being the core issue (Digital Divide Network, 2003; NTIA, 2000). Where education is concerned, the focus is on the degree of access students have to technology in schools and at home. Because ICT is expensive and only a limited amount can be purchased, continual choices have to be made in schools about which students will have the best access to technology. Also, students from lower socio-economic home situations are less likely to have access outside of school. Schools' reliance on expensive software may well have an unintended tendency to perpetuate the digital divide problem.

Another issue of social responsibility that receives considerable attention is the school's complicity in exposing students to commercial products and corporate interests (e.g., Apple, 1993; Wilcox, et al., 2004). The potential harm to students may be even more serious when it comes to ICT than it is when, for example, a corporate logo is displayed or advertisements are shown. When schools select commercial software packages, the students are not only exposed to the logos and products of a company, but they are also trained in how to use the software. In this sense, schools are a highly efficient marketing opportunity for software companies as they train the future users of the product while paying the company for the right to do so. Ideally, the focus when teaching students about software should be on the concepts involved, rather than simply teaching them how to use a particular product. This approach, however, would require the schools to provide multiple examples of software packages and this could be expensive.

Proprietary software companies have been instrumental in providing the innovation and leadership that has played no small part in shaping the ICT revolution that has been occurring over the past twenty-five years. My argument in this article, however, lies in the recognition that proprietary models present some problems as an approach to integrating ICT in schools. Although proprietary software is likely to retain a presence on school computers for the foreseeable future, OSS can provide schools with relief from some of the challenges they currently face.

The Open Source Alternative

In stark contrast to proprietary software development models are those of the OSS movement. While proprietary software companies do not distribute the human-readable programs or source codes from which their machine readable software is compiled, OSS does make the source code available. To be certified as open source by the Open Source Initiative, "the software must be distributed under a license that guarantees the right to read, redistribute, modify, and use the software freely" (OSI, 2004). When programmers can read, distribute and modify software, a large community becomes involved in the development effort, allowing bug fixes and enhancements to occur rapidly. OSS has become more available and successful in the last decade largely due to the growth of the Internet which has provided the medium for the collaboration and sharing on which open source models are built.

OSS is often referred to as free software. This is somewhat misleading as there is no requirement that OSS be provided free of cost. It is, however, true that most OSS can be obtained for little or no money. The free software reference does not relate to a monetary cost of the software but, rather, to the freedom with which is

can be obtained, used, distributed and modified. For schools, and other enterprises, this normally means the software can be downloaded and installed on as many computers as desired. If changes are required in a piece of software, the school is free to make modifications or have third parties do it for them. Schools can also burn OSS on to a compact disc and give it to staff and students to take home and do what they wish with it. A detailed analysis of license terms clearly demonstrates that a typical open source license is substantially more flexible than the typical MS End User License Agreement (Zymaris, 2003). Lawrence Lessig (2001) referred to resources like OSS as an innovative commons. Anyone is free to use it for their own purposes. OSS is a resource for innovation and, in the case of schools, a basic resource for teaching and learning.

When one encounters the concept of OSS, a first concern is often that the software may be of inferior quality as compared to proprietary software. There is a vast quantity of OSS available and, as one might expect, it varies in quality. The more popular examples of OSS are highly regarded as mature, very stable and of high quality (Wheeler, 2003a). My own experience, alongside that of others experienced with OSS, leads me to believe that high quality OSS is available to meet most needs of schools. To show how OSS can meet the most common educational needs I will provide a few brief, illustrative examples.

The main challenger to the domination of Windows these days is Linux (Lessig, 1999), an open source operating system

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. Linux is best known as a robust and stable server operating system, but has been making headway demonstrating its potential on the desktop. A number of companies produce their own version of Linux and, depending on the precise needs of the school, the Linux Operating System can be obtained either free of cost or for a modest fee. If schools are uncomfortable going it alone with a free downloaded version of Linux, they can easily purchase various support options from one of the Linux companies. Linux can be installed on most any PC or Macintosh computer. Even older PCs that are unable to run current versions of Windows can often run recent versions of Linux due to its lower hardware requirements. A desktop user who is new to Linux would notice some differences from a Windows environment, but would have little trouble adjusting to Linux desktop environments. In fact, newer Linux desktops tend to be very similar to a Windows desktop. One important difference that would be immediately noticed with most any Linux distribution is that they not only provide the operating system but also most of the applications that would be needed.

On the application side of things, there is proven and reliable OSS that can be used for most educational applications including word processing, spreadsheets, presentations, email, scheduling, web browsing, and image manipulation, to name a few. Some of these applications require the Linux operating system, but many can be run on proprietary operating systems. One of the most exciting of these applications is OpenOffice (OpenOffice.org, n.d.). OpenOffice is a full-featured office suite that is comparable to MS Office (Olavsrud, 2003). The package contains a word processor, spreadsheet, presentation manager, and drawing program. It can be run on Linux, Windows or Macintosh. It saves documents in its own file formats[5] and can also work with other formats, including those used for MS Office documents[6]. OpenOffice is appropriate for most all school purposes, with all the functionality normally be found in any serious office suite. The fact that it can be run on a number of operating systems and works with documents that have been created with MS office, makes it a versatile package that can be deployed in a wide variety of ways. It can be downloaded free of cost and would be an easy transition for students and staff who are familiar with other office suites.

Technical Support

So far, the focus in considering cost of ICT that uses OSS has concentrated on the initial cost of software and upgrades. When considering the cost of ICT, decision makers are often encouraged to adopt a broader perspective on costs using a concept called total cost of ownership or TCO. Although it is generally acknowledged that moving towards OSS can bring about substantial savings over time as compared with full reliance on proprietary software (Cybersource, 2002; Wheeler, 2003b), the TCO of OSS is still significant. TCO usually looks at a number of factors in the total cost of ICT systems. One significant cost arises from the fact that all computer systems need technical support; software and hardware experts must be available to support users and to carry out system maintenance.

When it comes to technical support, schools are somewhat different than the business contexts from which data is normally drawn. Schools may have individuals available who offer support as part of their job, but it is also common that staff members or people from the community who are accomplished with computers will volunteer to assist (Riffel & Levin, 1997). Because this help is provided on an informal basis, it may not be fully accounted for, even though it is likely quite important in supporting a smooth functioning ICT system. This local help would likely be available in a similar way if a school where to switch to OSS but it may be that the helpful staff members are not familiar with OSS. In such cases it would be necessary for schools to invest in some training or provide some exploration time for their support people as part of a move to OSS.

One thing that has clearly emerged from case studies in OSS implementation is the necessity of knowledgeable technical support (e.g., Canada's SchoolNet, 2003). The degree and complexity of OSS related support required depends greatly on the extent to which a school has deployed OSS. Regardless of the choices a school makes, they will be able to take advantage of several helpful characteristics of OSS development processes and communities. The development style of OSS allows it to be very responsive to software flaws and to incorporate new features into software rapidly. Software updates appear more frequently than is the case for proprietary software and are easy to monitor and apply. A further benefit of using OSS for those who support the school's ICT is that they will have access to one of the most helpful and knowledgeable support systems in ICT—other OSS users on the Internet (Foster, 1998). Using the available online resources, it is likely that most any problem can be quickly solved by conducting a quick search or posing a question in an OSS discussion group. OSS processes and community would be valued source of support for any educational OSS initiative.

Social Issues

Beside the cost savings and flexibility gained from the use of OSS, schools will find themselves in a position to show leadership in addressing some problems relating to social and ethical issues. The corporate involvement problem associated with exposing students to, and training them on, a particular company's software product is immediately diminished. Student exposure to proprietary software is reduced as OSS alternatives that do not have a corporate connection gain a higher profile. This is done without eroding student skills in working with software. Indeed, working with OSS helps ensure that students are exposed to multiple software systems. This experience combined with that from using proprietary software that is available would lead to increases in ICT literacy.

OSS also helps to address digital divide issues. Because schools would be less encumbered by costs and license restrictions, ICT could be made more available. Schools would be better able to create ICT environments that

meet the needs of greater numbers of students. Additionally, it places schools and communities in a position to assist students and families without computer access at home. Schools can, for example, legally provide the same OSS that is being used at school to all students for the price of the compact disc on which it is placed. Because the hardware requirements to run that software are modest, the software can be installed on older computers that can be obtained cheaply. The potential to enhance students' overall access to ICT as a result of using OSS is an exciting possibility.

Making the Move

It is common these days to see reports of decisions to make increased use of OSS. Countries such as Korea, Mexico, Brazil and Israel; cities such as Munich; states such as Massachusetts; and companies such as Ford are among the groups that have recently made commitments to using OSS. The reasons for doing so frequently have to do with software costs but also involve security, performance and public interest. Schools need to investigate using OSS for similar reasons.

Although there is a lack of organized information on the subject, it is clear that there are schools that have began to implement OSS software (e.g., Canada's SchoolNet, 2003; K12LTSP, n.d.; NETC, n.d.). For example, Schoolforge (n.d.) has compiled a list of case studies on the implementation of OSS in schools. The case studies are self-reported and, not surprisingly, positive. Over seventy contributions have been entered varying in scope from the very large, involving large regional projects, to the very small, involving several computers in a given school. Six of the contributed projects come from Canadian Schools. One of the most impressive Canadian projects has been taking place in British Columbia's School District 73--Kamloops/Thompson (Canada's SchoolNet, 2003). In this project, two schools were converted completely to the OSS based on the Linux operating system, with plans to convert most schools in the district in the future. Despite evidence that there is considerable activity involving using OSS in education, there is also a clear need for formal research on such initiatives to learn more about the viability of OSS.

The process of moving toward greater use of OSS may seem drastic and intimidating to educators. Implementing OSS could proceed on a large scale such as in the case study described above, but this would carry with it the need to address issues such as compatibility with existing software and ensuring that sufficient software is found to meet all the educational needs within the school. Many of these problems could be reduced, however, if the shift was approached in a more gradual way. A school could immediately realize significant cost savings by strategically substituting OSS application packages for proprietary packages, while still using a proprietary operating system, such as Windows, and other proprietary applications. The practice of substituting one software application for another in such a way that it has only a minor impact on users is referred to as a low threshold opportunity (NETC, n.d.). For example, in the office suite category, OpenOffice could easily replace MS Office. OpenOffice runs on the all operating systems commonly used in schools and has lower hardware requirements than MS Office. Immediate savings would result on software costs and hardware costs. The OpenOffice program is widely regarded as high quality and user-friendly, so training needs would be minimal. Later on, if a school decided to phase in the Linux OS, for example, there would be little or no change in the OpenOffice application that users would encounter on their Linux desktop. At a given time a school could have up to three operating systems running on its computers, yet have everyone using the same office suite applications. Any documents that had been created in MS Office in the past could be opened and edited in OpenOffice. Similar moves can be made with respect to browsers, electronic communication and

other applications.

This illustration of incorporating OSS begins to show how a process could proceed. Schools that plan to use OSS need to work out a plan that makes sense for all involved. A gradual process accompanied by a significant reduction in costs and licensing worries makes OSS use possible and attractive. Perhaps one of the most important advantages of using a gradual process is allowing users to make a comfortable transition. The impact on a school's computer users would be less severe than it would if their software environment changed dramatically and quickly. The slower pace of change also allows the real benefits of OSS to become apparent to the users and this may be a key to creating support for a more extensive shift to OSS. The importance of attending to what the users of a school's ICT systems are thinking cannot be emphasized enough and this brings us back to the notion of mindshare.

Interestingly, the main obstacle to making the transition to OSS has little to do with the software itself. The mindshare that MS and other proprietary companies enjoy needs to be challenged. This is not necessarily easy to do. To quote Lawrence Lessig:

A time is marked not so much by the ideas that are argued about as by the ideas that are taken for granted. The character of an era hangs upon what needs no defense. Power runs with ideas that only the crazy would draw into doubt. The "taken for granted" is the test of sanity; "what everyone knows" is the line between us and them. (2001, p. 5, emphasis in original)

The time in which we now live is characterized by a particular conception of what software is necessary for ICT and this is reinforced by the marketing efforts of powerful corporations. Suggestions that run contrary to this conception may seem, to use Lessig's word, crazy. Most people do not know a great deal about OSS and are likely to question it as a valid replacement for software that has come to be taken for granted. School staff, students, and parents need to change their minds about software. This is an area where a great deal of work will need to be done. Overcoming proprietary software's mindshare will require leadership, planning, and a willingness to support and educate staff, students, and parents.

Conclusion

In final analysis, deciding to move to OSS comes down to schools making better decisions about spending taxpayers' money and setting new values in place for educational ICT. Schools strive to ensure that students have the appropriate exposure to ICT and that the negative impact of the investment in ICT has minimal impact on the overall health of the school and its programs. Schools have worked hard to achieve their current ICT infrastructure but, given the challenges they face, it is now time to re-evaluate the approach that has been taken to software. Fortunately, in the past several years OSS has matured to the extent that it is now an excellent candidate for most school computing needs. Given its clear advantages over proprietary software in the areas of cost, flexibility, and ability to address some ethical and social, OSS should be given careful consideration by all schools. This does not mean that proprietary software should no longer be used in schools, but rather that its use should be justified on a cost-benefit basis against OSS and any other software alternatives that may exist. It is, however, clear that increased use of OSS will most certainly provide schools with an invaluable resource as they strive to take full advantage of ICT in teaching and learning.

References

Acohido, B. (2002, May 13). Microsoft pitches schools new licensing option. USA Today. Retrieved January 15, 2004, from http://www.usatoday. com/tech/news /2002/05/13/schools-microsoft.htm

Apple, M. (1993). Official knowledge: Democratic education in a conservative age. New York: Routledge.

Canada's SchoolNet. (2003, July). Considering changing your school's computer system to open source software? One school's conversion to Linux has been a complete success. Retrieved February 15, 2004, from http://schoolnet.ca/today/article_2003-06.asp

Cave, D. (2001, July 10). Microsoft to schools: Give us your lunch money! Salon.com. Retrieved January 15, 2004, from http://dir.salon.com/ tech/feature/2001/07/10/Microsoft_school/ index.html

Cuban, L. (2001).

Oversold and underused: Computers in the classroom

. Cambridge, MA: Harvard University Press.

Digital Divide Network. (2003). Retrieved February 10, 2004, from

http://www.digitaldivide network.org /content/sections/index.cfm

Foster, E. (1998). Best technical support. Infoworld. Retrieved July 15, 2004, from http://www.infoworld.om/cgi-bin/displayTC.pl?/97poysupp.htm

K-12 Linux Terminal Server Project. (n.d.). Retrieved February 1, 2004, from http://k12ltsp.org/contents.html

Latour, B. (1987). Science in action: How to follow scientists and engineers through society. Cambridge, MA: Harvard University Press.

Lemos, R. (2003, October 9). Reliance on Microsoft makes firms vulnerable says Gartner. Silicon.com. Retrieved January 15, 2004, from http:// www.silicon.com/software/os/0,390 24651,10006340,00.htm

Lessig, L. (1999). Code and other laws of cyberspace. New York: Basic Books.

Lessig, L. (2001). The future of ideas: The fate of the commons in a connected world. New York: Random House.

Microsoft Corporation. (2004).

Microsoft school agreement

. Retrieved May 21, 2004, from

http://www.microsoft.com/Education/SchoolAgreeme nt.aspx

National Telecommunications and Information Administration. (2000, October). Falling through the net: Toward digital inclusion. Retrieved February 10, 2004, from http://www.ntia.doc.gov/ntiahome/fttn00/ contents00.html

Northwest Educational Technology Consortium. (n.d.). Open options: Making decisions about open source software (OSS) for K-12. Retrieved February 10, 2004, from http://www. netc.org /openoptions/

Olavsrud, T. (2003, October 1). OpenOffice.org renews battle for productivity suite. Internetnews.com. Retrieved January 15, 2004, from http://www.internetnews.com/ent-news /article.php/3085941

OpenOffice.org. (n.d.). Retrieved February 10, 2004, from http://www.open office.org

Open Source Initiative. (2004). Retrieved February 10, 2004, from http://www.opensource.org

Plante, J., & Beattie, D. (2004). Connectivity and ICT integration in Canadian elementary and secondary schools: First results from the information and communications technologies in schools survey, 2003-2004 (Catalogue no. 81-595-MIE—No. 017). Ottawa: Statistics Canada. Retrieved July 5, 2004, from http://www.statcan.ca/cgi-bin/downpub /listpub.cgi ?catno=81-595-MIE2004017

Riffel, J. A., & Levin, B. (1997). Schools coping with the impact of information technology. Educational Administration and Management, 25(1), 51-64.

Roberts, G. (1999). Lessons from Sisyphus in a technological age.

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,

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(5). 75-77.

Schoolforge. (n.d.). GNU/Linux case studies. Retrieved July 15, 2004, from http://casestudy .seul.org

Simpson, L. (2002, June 29). It’s time to break the Microsoft monopoly. Network IT Week. Retrieved January 15, 2004, from http://www. networkitweek.co.uk/Features/1132228

Stephenson, N. (1999). In the beginning was the command line. New York: HarperCollins. Retrieved January 15, 2004, from http://www.crypto nomicon.com/beginning.html

Twining, P. (2002). ICT in Schools: Estimating the level of investment, (meD8 Report No. 02-01). meD8. Retrieved January 15, 2004, from http://www.meD8.info/docs/pubs.htm

Wheeler, D. A. (2003a, October 27). Generally recognized as mature (GRAM) OSS/FS programs. Retrieved January 15, 2004, from http://www.dwheeler.com/gram.html

Wheeler, D. A. (2003b, December 31). Why open source software / free software (OSS/FS)? Look at the numbers! Retrieved January 15, 2004 from http://www.dwheeler.com/oss _fs_why.html

Wilcox, B., Cantor, J., Dowrick, P., Kunkel, D., Linn, S., & Palmer, E. (2004, February 20). Report of the APA task force on advertising and children: Summary of findings and conclusions. Washington, DC: American Psychological Association. Retrieved March 20, 2004, from http://www.apa.org/releases/childrenads_summary.pdf.

Zetter, K. (2002, June 4). Schools cry bully over Microsoft licensing fees. Computerworld. Retrieved January 15, 2004, from http://www.com puterworld.com/softwaretopics/os/ windows/story/0,10801,71690,00.html?nlid=PM

Zymaris, C. (2003). A comparison of the GPL and the Microsoft EULA. Cybersource. Retrieved January 15, 2004, from http://www.cyber source.com.au/cyber/about/comparing_the_gpl _to_eula.pdf

Notes

1 Although OSX is proprietary its core is based on the Darwin project which is Open Source. More on both OSX and Darwin is available on the Apple Website at http://www.apple. com/

2 The Microsoft School Agreement requires an institution-wide commitment. This means that a school must include all PCs that are Pentium machines, Power Macs, iMacs or better regardless of whether they will run MS products. Older machines are included if they run MS software.

3 These figure was obtained using the Microsoft School Agreement Estimated Retail Price Calculator that can be found at http://www.microsoft.com/ education/default.asp?ID=SACalculator#Estimate

4 Linux is more properly referred to as GNU Linux as what most people call “Linux” is in fact the Linux kernel, the program in the system that allocates the machine’s resources to the other programs that you run, that runs with the GNU operating system. For a more details explanation see http://www.gnu.org/gnu/ linux-and-gnu.html

5 The document format for OpenOffice is open source as well. Proprietary companies generally have closed source document formats, which limit the ability of other programs to work with them.

6 While the MS Office file format is not made available by MS, OpenOffice programmers have been able to engineer the ability for OpenOffice to open and save in MS Office document formats, however imperfectly

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