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Emergent Literacies: Raising Questions About the Place of Computer Technologies in Education and Society in a Developing Country: The Case of Zimbabwe

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Abstract

This article discusses the meaning of literacy in a technologically changing world. The rapidly expanding use of computer technologies in society has prompted calls for the re-orientation of education and training curricula. This article critically examines what it means to be literate in the computer age and assesses the feasibility of setting 'computer literacy' as an educational goal. Throughout the discussion, the term 'computer literacy' appears in quotes to make the point that its meaning is both contentious and fluid. It is contended that Zimbabwean policy makers have tended to presume the value of computers, without critically examining how the technologies relate to education and society.

The Origins of Computing Technologies

Computer technologies emerged from the information and analytic requirements of advanced industrial societies during and after the Second World War. Computers were the perfect answer to the increasing demand for enhanced data processing capabilities. According to Berman,

> Wartime national mobilization, the Cold War, the rapid post-1945 expansion of the welfare state, and the growth of more interventionist state policies of economic planning and management in 'mixed' economies all led to the rapid growth of the state bureaucracies, civil and military, and an increasing burden of 'number crunching' tabulations.[1]

The first electronic computer was commissioned in 1946 at the University of Pennsylvania. It was called the ENIAC (Electronic Integrator and Automatic Computer), and it filled a room the size of a small two-bedroom house. ENIAC's memory was tiny and could only hold twenty 10-digit numbers. By 1960, developments in microelectronics, and in particular the

1. B. J. Berman, 1992, 'The state, computers, and African development: The information non-revolution', in S. Grant Lewis & J. Samoff eds, *Microcomputers in African Development: Critical Perspectives*, Westview: Boulder, & Co.: 218.

development of integrated circuits, made it possible to make more compact and powerful microcomputers. Since then, progress has been phenomenal and each decade has produced unprecedented achievements.

The 1980s were notable for the emergence of compact desktop sized microcomputers. Previously, ownership of computers had been confined to large companies, but now a whole range of institutions, households, and individuals could own them. In recent years, the most dramatic breakthroughs have been in software development. Corporate empires that are entirely devoted to research and development of software products have been built. The most powerful is Bill Gates' Microsoft.

At the beginning of the 21st century, it can be said, with certainty, that computer technologies are now fully integrated into the fabric of society and economy. Computers are arguably the most dominant tools of organisational management. As Merrill *et al* point out, it is 'hard to imagine an organisation, whether large or small, that does not or could not advantageously use a computer in its operations'.[2] Computer technologies have become the foundation of what has been called the post-industrial economy. National economies and, indeed, the global economy, have shifted from the industrial age, dominated by mechanical systems and power, to the electronic age. If the dominant symbol of the industrial age was mechanical power, that of the new age is the high-speed microprocessor.

These developments notwithstanding, there is a wide gap in the application and use of computers and information technology between developed countries that are considered to have entered a new age of information and Third World countries that have not. In recent years, this gap has been used as 'an index of backwardness'.[3] Many projects funded by international development agencies now routinely include microcomputers to improve planning and information management in donor recipient countries.[4] As Berman has noted:

> The role of computers as an essential component of development has been strongly promoted by international development agencies which have accepted whole-heartedly the premise that information technology must be applied and developed in Third World countries if they are not to be left behind.[5]

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2. P. Merrill *et al*, 1992, *Computers in Education*, Boston: Allyn and Bacon: 1.
3. Berman, 1992, 'The state, computers, and African development': 214.
4. C. Calhoun and P. F. DeLargy, 1992, 'Computerization, aid-dependency, and administrative capacity: A Sudanese case study', in S. Grant Lewis & J. Samoff eds, *Microcomputers in African Development: Critical Perspectives*, Westview: Boulder & Co.
5. Berman, 1992, 'The state, computers, and African development': 216.

It is presumed that the gap between poor and affluent societies is primarily a gap in technology and that infusing new technologies will assist in bridging the gap. Berman is sceptical. He argues that computers in Western societies emerged as a consequence, rather than a cause, of development. In other words, computer technologies were designed to 'solve problems rooted in existing institutional structures and practices and [were] intended to preserve rather than transform their fundamental characteristics'.[6] This is a critical point to ponder because there is a school of thought that argues that the introduction of computer technologies in poor societies will spur development. Currently, the spotlight is on the Internet, an application that has a short but explosive history.

Internet Technologies and the Rhetorics of Development

It was only in the 1990s that Internet applications became widely available, initially in universities. The use of the Internet has grown most rapidly in Northern Industrialised Countries. A 2000 study by the US based Internet Council found that, 'In just the last seven years since 1993, the number of people world-wide who use the Internet on a regular basis has grown from fewer than 90 000 to more than 304 million in 2000'.[7] It has been predicted that the number of Internet users in the world will exceed the 1 billion mark by 2005. Conducting online research was the leading online activity for some 92 percent of American users in 2000. The impact on commerce has been dramatic. An estimated 44 percent of US business sold their goods over the Internet in 2000. It has been estimated that the use of the Internet accounted for more than 25 percent of the economic growth of the US economy in the 1990s. Projections indicate that this trend will strengthen. There are, however, concerns that the gap between the rich and poor is widening.

The inequitable access to computer technologies between rich and poor societies is called the 'digital divide'.[8] The divide refers to demographic and regional differences in Internet access that reflect economic disparities between groups and regions. The term has been used to describe the separation between those who have access to online information and opportunities and those who do not.[9] The 'digital divide' is expected to

6. *Ibid*, 217.
7. US Internet Council, 2000, 'State of the Internet Report 2000', Washington D.C.: US Internet Council: 1, [Online: www.usic.org)
8. US Internet Council, 2000, 'State of the Internet Report 2000', 'Online content for low-income and underserved Americans: The digital divide's new frontier' (The Children's Partnership, Santa Monica, California, March 2000), [Online: www.childrenspartnership.org].
9. The Children's Partnership, 'Online content for low-income and underserved Americans: The digital divide's new frontier'.

widen further as individuals lacking computer skills lag behind and do not receive necessary training so that the poor become poorer'.[10]

The idea of breaking down the digital divide has captured the minds of politicians in search of a great cause in the post-Cold War era. This became evident when the issue was taken up at the Group of Eight (G8)[11] Economic Summit held in Okinawa, Japan in July 2000. The summit issued the *Okinawa Charter on the Global Information Society*, which affirmed the importance of bridging the international information and knowledge divide (otherwise known as the digital divide), as a priority development issue. The opening statement of the Charter reads:

> Information and Communications Technology (IT) is one of the most potent forces in shaping the twenty-first century. Its revolutionary impact affects the way people live, learn, and work and the way government interacts with civil society. IT is fast becoming a vital engine of growth for the world economy.[12]

In a world where poverty and suffering have persistently co-existed with affluence, G8 leaders believe that information technologies promise a new beginning.

> IT represents a tremendous opportunity for emerging and developing economies. Countries that succeed in harnessing its potential can look forward to leapfrogging conventional obstacles of infrastructural development, to meeting more effectively their vital development goals, such as poverty reduction, health, sanitation, and education, and to benefiting from the rapid growth of global e-commerce. Some developing countries have already made significant progress in these areas.[13]

G8 leaders called for universal access to information technologies: 'Everyone should be able to enjoy access to information and communications networks'.

The Okinawa Charter called for a 'continued drive toward universal and affordable access' to information technologies and for 'IT literacy'. It stated:

> We are committed to provide all our citizens with an opportunity to nurture IT literacy and skills through education, lifelong learning, and training. We will continue to work toward this ambitious goal by getting

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10. US Internet Council, 2000, 'State of the Internet Report'.
11. The G8 is an economic forum made up of eight industrialised countries namely the United States, France, Germany, Japan, United Kingdom, Canada, Italy, and most recently, Russia.
12. G8 Research Group, July 22, 2000, 'Okinawa Charter on Global and Information Society', University of Toronto. [Online: http://www.library.utoronto.ca/g7/summit/2000okinawa/gis.htm]
13. *Ibid.*

schools, classrooms and libraries online and teachers skilled in IT and multimedia resources.[14]

The Okinawa Charter indicates a persistent tendency to explain underdevelopment in terms of gaps in technology. In this instance, the digital divide has come to be seen not only as a sign of underdevelopment, but also as a cause of it. The provision of computer technologies to poor countries has, therefore, emerged as an important rhetorical issue in developmental assistance. Thus, the dominant conception of the digital divide has been in terms of access to hardware (e.g. lack of computers), and connectivity (shortage of telephone lines, satellite links, and so on). The question of content has been, at best, peripheral. This is a major oversight, as the digital divide is also a content divide.

The Digital Divide is a Content Divide

The problem of content barriers has been persistent, as Lewis and Samoff noted in 1992. Writing about the growing role of microcomputers in international development, they argued:

> Often, this general faith in the use of microcomputers to manage information is not accompanied by specific attention to exactly what information is flowing and in which direction . . . Consequently, although, clearly, microcomputers are capable of facilitating the management of information, they may prove to be quite unsuitable for managing the particular information that is most important to those who acquire the microcomputers. Similarly, in the absence of specific attention to the directions and pathways of the flow of information, microcomputers may, in practice, render more, not less, difficult the control of the information flows deemed most important and may, indeed, institutionalize particular transfers of information that are quite inconsistent with the goals of those who acquire the microcomputers.[15]

Lewis and Samoff have reminded us that content matters. There is need for online resources that serve low-income and underprivileged groups, with limited education, who live in rural areas, or who are members of racial or ethnic minorities.[16] The specific areas of concern are:

— Lack of information: Much of the information on the Internet is produced by large institutions, commercial companies, and overseas

14. *Ibid*

15. Grant, S., Lewis and J. Samoff, 1992, 'Introduction', in S. Grant Lewis & J. Samoff eds, *Microcomputers in African Development: Critical Perspectives*, Westview: Boulder & Co: 8.

16. W. Lazarus and F. Mora, March 2000, *Online Content for Low-Income and Underserved Americans: The Digital Divide's New Frontier*, Santa Monica, CA: The Children's Partnership.

sources. It tends to be of a general nature. Communities need information that is locally relevant, and that addresses local issues and problems.

— The literacy barrier: Online content has been primarily designed for an audience that reads at average or advanced literacy level. There is need for information that can be clearly understood by limited-literacy users. In the US, roughly 22 percent of the adult population do not have the reading and writing skills necessary to use the online sources.[17]

— The language barrier: English is the dominant language on the Internet. An estimated 87 percent of documents on the Internet are written in English.[18]

— The cultural barrier: There is a lack of material generated by minority communities.

Technological barriers exacerbate content barriers. The barriers reinforce flows of information that are uni- rather than bi-directional, from the centre to the periphery. This is a problem in many African countries, which are characterised by 'a wide gulf of knowledge and competence between the state apparatus and the surrounding population'.[19] The introduction of computers in state agencies can, therefore, reinforce bureaucratic authoritarianism. Lewis and Samoff, who have described microcomputers as 'the latest development fad, one in a long line of such technological fads',[20] reflect some of the disillusionment with narrowly construed technological solutions. We should, therefore, be more critical of proposals that give unqualified support for computerisation as a developmental tool.

What then is the way forward? In pondering this question, this article focuses on the role of educational institutions. These, more than any other institutions, are facing increasing demands to produce intellectual skills that meet the challenges and goals of a rapidly changing and globalized world order. In Zimbabwe, the Education Commission of 1999 starkly put the challenge, noting:

> Zimbabwe will soon enter the third millennium, which is dominated by economic competitiveness and information and communication technologies. These forces challenge the nation to revamp its curriculum [and to] provide . . . relevant technological equipment to enable students to develop the skills that are essential for a technological age.[21]

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17. *Ibid.*
18. *Ibid.*
19. Berman, 'The state, computers, and African development: The information non-revolution': 225.
20. Grant Lewis and Samoff, 'Introduction': 8.
21. 'Report of The Presidential Commission of Inquiry into Education and Training': 19.

Zimbabwean society will be well placed to respond to this challenge if it reflects on lessons from the past, especially those from other countries that have a longer history of computers in education.

Computer Technologies in Education: Acknowledging the Past

Arthur Luehrmann and Herbert Peckam's book, *Computer Literacy Survival Kit*, which was published in 1984, indicates an important stage in the debate on computers in education.[22] The book was written in the early and heady days of microcomputers when the Apple computer stormed American classrooms with loud promises of a new age of learning. Luehrmann and Peckam saw a new 'computer literacy' curriculum as education's response to a new Age of Information. They contended:

> By the end of this century, four-fifths of us will be information workers, not manual workers. Put simply, our jobs will be to receive information from others, to process information in various ways, and to pass information to others.[23]

The teaching of computer skills was a matter of survival. Schools were urged to take up the responsibility to 'prepare children to become fully functioning, productive members of society'. Luehrmann and Peckam added:

> We encounter computers in banks, grocery stores, department stores, offices, libraries, and practically everywhere else in society. We purchase and use appliances, toys, and automobiles designed with microprocessor technology. Simply put, we *live* with computers. It is obvious that we need to acquire some fundamental level of understanding of these electronic wonders which make our lives simpler and more enjoyable.[24]

The answer to these changes, they argued, was 'computer literacy', which was compared to traditional literacy in reading and writing.

> Computer literacy is to have as big an impact on career opportunities in the future as ordinary literacy did in the past, when farm mechanization drove millions of workers into the cities in search of factory work.[25]

They defined literacy as the skill to control computers through programming in order to put one in control of the technology, for 'the main value of any kind of literacy is that it puts one in direct control, without having to depend on experts'.[26] In other words,

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22. A. Luehrmann and H. Peckham, *Computer Literacy Survival Kit*.
23. *Ibid*: ix.
24. G. C. Bitter and R. A. Camuse 1984, *Using a Microcomputer in the Classroom*, Reston, Virginia: Reston Publishing Company: 21.
25. Luehrmann and Peckham, *Computer Literacy Survival Kit*: ix.
26. *Ibid*: 358.

> When you become computer literate, you will know two important things: (1) what things a computer can do and (2) how to tell a computer to do the things you want it to do. This therefore gives you freedom. You don't have to depend on others to read street signs for you, or to tell you the latest news . . . You do not have to trust experts: You are literate . . . You are in control.[27]

In a note towards the end of their book, Luehrmann and Peckam remark to the student, who has presumably gone through the book, that:

> You now have a solid understanding of what a computer can do. You also know how to tell a computer to do some of the things you want. As we said on page 1, the purpose of literacy is to set you free. You no longer need a computer expert to solve all your computer needs. You can do many things for yourself.[28]

The rhetoric of individual freedom was persistent, for as they insisted:

> Your new program writing abilities will allow you to do things on your own for which no program exists. Your skills will also make it easier for you to judge the quality of programs you buy.[29]

Luehrmann and Peckam were writing at a point in time when young entrepreneurs on small budgets were able to build computers and write hugely successful programs. Large corporations now dominate software production. The development of computer software has changed from craft work, done by individuals, to an industrial process, undertaken by teams of specialists. In the industrial production of software, individual experts work in specialised teams and no one person is in control of the whole process. The promise of control has therefore been elusive.

For the ordinary user today, the goal is not to make software, but to use it, in the same way that people use cars with very little understanding of how they are made. Programming skills are now, more than ever, an aspect of computer skills and are primarily associated with the work of information technology professionals. Computer technologies are more diverse than in the 1980s. They have changed from a medium primarily used for programming, to a multi-dimensional medium that affords the use of text, graphic images, video, and sound in complex interaction with each other. There is no one type of computer technology, but a range of technologies and applications. It is in this context that Kern has posed the question, 'What does it mean to be 'literate' in an age of electronically meditated communication?'[30]

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27. *Ibid*: 1.
28. *Ibid*: 361.
29. *Ibid*: 359.
30. R. Kern, 2000, 'From guest editor', *Language Learning and Technology*, 4 (2): 2.

The advent of computer technologies has not made traditional skills of reading and writing redundant. They continue to exist, integrated within the new technologies. For example, the research for this study was conducted, partly, on the Internet, while a word processor was used to produce the article. Both these activities involve the traditional skills of reading and writing, but reading and writing in different ways, using different tools and platforms. The changeover therefore involves some transformation of traditional skills, some continuity of traditional skills, and the acquisition of new skills that were not part of one's training before encountering computers.[31] Murray's analysis of these changes comes close to the argument being advanced here. She argues that:

> The introduction of writing did not replace oral communication, the advent of print did not replace writing, electronic communication has not replaced print. Each exists as part of the complex of the communication forms available for human beings to use, depending on the context of the communicative event.[32]

At a more profound level, the debate on literacy reflects tensions between alternative visions of society and societal change, as will be shown below.

Discourse on Literacy as Alternative Visions of Education and Society

The vision of literacy advocated by Luehrmann and others is essentially a call for a curriculum that adapts and fits learners to new societal and workplace realities. The 'computer literacy' that they advocated was, therefore, intended to give students functional skills in response to new societal demands, and, in particular, to changes in workplace skills. This raises important questions about the appropriate goals for education. What is the appropriate relation between the world of work and education? Should education merely prepare students for the world of work, or should its mandate be broader?

Strong arguments have been made for a broader view. Buchmann and Schwille, for example, argue that, 'Education that merges the immediate goals of the world of work with those of education limits people's awareness and their choices'.[33]

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31. I have analysed changes in knowledge and skill in contexts of transition in K. Hungwe, 1999, 'Becoming a Machinist in a Changing Industry', PhD dissertation, Michigan State University. There I have described changes in knowledge and skill in contexts of transition in terms of continuity, transformation, and discontinuity.

32. D. Murray, 2000, 'Changing technologies, changing literacy communities?', *Language Learning and Technology*, 4 (2): 55.

33. M. Buchmann and J. Schwille, 1993, 'Education, experience, and the paradox of finitude', in M. Buchmann and R. Floden eds, *Detachment and Concern: Conversations in the Philosophy of Teaching and Teacher Education*, New York: Teachers College: 28.

In other words, education should not be narrowly construed as a tool for adaptation, important as that may be, but of transformation as well. Societal dynamics are complex, and are characterised by both continuities of knowledge and practices, and transformations as well. Indeed the rate of change has been accelerating in recent decades. Education must therefore prepare societies for both continuity and change. Accordingly, literacy education should be responsive to societal and individual demands, and at the same time, and perhaps more importantly, it should provide an intellectual resource that empowers individuals and societies to manage and change their own situations.

There is a perennial tension between education construed as adaptation and education for transformation. Luehrmann and others emphasised the adaptive function. This assumes a world that, once it became computerised, remained static. The missing story is that computer technologies have continued to change rapidly. Furthermore, this perspective is based on an inadequate understanding of the impact of computer technologies on work and workplace skills. There is an assumption that computerisation of work necessitates a universal increase in computing skills. Studies of the impact of computer technologies on work have indicated a complex pattern of skills change.

One example is machining work in a US automobile plant, where a study conducted over a number of years revealed that a corporation had trained some of its skilled machinists to become machinist-programmers. The machinist-programmers were employed to codify (or programme) the knowledge and skills needed to machine complex parts. Using these programmes, machining work could be automated. With automation, work that was historically done by skilled artisans could now be performed by unskilled substitutes at lower rates of pay. In computerising machining work, the organisation upgraded the skills of machinist-programmers. At the same time, the organisation could now employ unskilled machine operators, with no knowledge of machining or computers, to monitor automated processes.[34] The overall picture was therefore mixed.

Given such findings, it is problematic to make general claims that computerisation will raise the demand for computer skills. That is true for some jobs and job categories, and not for others. The balance has tended to tilt towards loss of skill as corporations seek to maximise profits by reducing the proportion of skilled workers. Computerization and automation have,

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34. At the time of the study, the organisation was still employing skilled machinists as machine operators. This position, which was negotiated by the union, was intended to preserve jobs. These working conditions were short-lived because the plant was closed some months after the study, and the workers were re-deployed to other plants.

in fact, become important labour issues. The International Association of Machinists and Aerospace Workers (IAMAW) has responded by proposing a 'Technology Bill of Rights'. The preamble to the Bill of Rights reads, in part:

> Powerful new technologies are being poured into the workplace at a record pace . . . While such technologies offer real promise for a better society, they are being developed in a short sighted and dangerous direction. Instead of benefits, working people are seeing jobs threatened, working conditions undermined, and the economic viability of communities challenged.[35]

One of the recommendations of the Bill of Rights is that:

> New technology must be used to improve the conditions of work. Rather than using automation to destroy skills, pace work, and monitor workers, it can be used to enhance skill and expand the responsibility workers have on the job . . . Production processes can be designed to fully utilize the skill, talent, creativity, initiative, and experience of people — instead of production designs aimed at controlling workers as if they were robots.[36]

The Technology Bill of Rights is indicative of the recognition by the IAMAW that computer systems are not autonomous, but are embedded in contexts that define specific production structures and power relations. The exercise of computer skill is not independent of the societal reality (be it economic, political, or cultural), in which the technologies are embedded.

What is often missing is the recognition that uses of computers reflect human choices and they are generally appropriated in contexts of asymmetrical power relations where there are winners and losers in the process of technological change. Human action is both constrained and extended by the computerisation of work, depending on the structure of the hegemonic forces at play. Technology is not therefore an autonomous social entity. In view of the above, what then are the possible policy options for a country like Zimbabwe?

Toward a Sustainable National Policy on Computers in Education in Zimbabwe

Zimbabwe needs a clear and sustainable national policy on computer technologies in education. Such a policy is currently lacking. In framing a policy, a number of pitfalls should be avoided. The first is to assume that teaching computers and technology will alleviate the problems of poverty and unemployment in the country. This assumption is based on the premise

35. H. Shaiken, 1984, *Work Transformed*, Lexington, Mass.: Lexington Books: 272.
36. *Ibid*: 273.

that the current economic problems and unemployment crisis has been caused by lack of relevant skills. The link between education and work is more complex than that. While education is necessary for development, it is not a sufficient condition. A whole range of other issues needs to be factored in, for example macro economic policies, political dynamics, and investment.

The second critical issue is to make a clear distinction between what is desirable and what is achievable. The Education Commission of 1999 envisaged universal access to computers in Zimbabwe. That is desirable, but clearly not achievable. There are, currently, too many other competing basic priorities facing the nation, in the education sector, in health, transportation, housing, and sanitation, to permit universal access to computer technologies.

Third, it is important to be critical about what can be achieved by investing in computer technologies. Too often, claims have been exaggerated. What the new technologies offer are only possibilities. Technology does not have agency independent of the users and their context. With the above caveat in mind, the article will now outline a modest framework to guide the incorporation of computer technologies in education, focussing, initially, on the education of young children and then on high school, and post-secondary education.

Computers in the Education of the Young

Several observers have expressed concern about what might be termed the 'irrational exuberance'[37] of educators in the face of computer technologies. It has been argued that today's society is in too much of a rush to develop children, to push them to get ahead, and that this may have detrimental effects on their development.[38]

> Childhood is a critical phase of life and must be protected to be fully experienced. It should not be hurried. Each child deserves deep respect as an individual. Each needs help in developing his or her own unique capacities and in finding ways to weave them into a healthy social fabric.[39]

Rather than 'overwhelming' children with 'electronic stimuli that outstrip their sensory, emotional, and intellectual maturity', there should be an

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37. I find the term 'irrational exuberance' apt. It was coined by Alan Greenspan, chairman of the US Federal Reserve, in describing the unprecedented bull run on the US stock market.

38. H. K. Cuffaro, 1985, 'Microcomputers in education: Why is earlier better?', in D. Sloan ed, *The Computer in Education: A Critical Perspective*, New York: Teachers College Press. A. Zajonc, 'Computer pedagogy? Questions concerning the new educational technology', in D. Sloan ed, *The Computer in Education: A Critical Perspective*.

39. C. Cordes and E. Miller eds, 2000, *Fools Gold: A Critical Look at Computers in Childhood*, College Park, MD: Alliance for Childhood, Online: wwwallianceforchildhood.net: 1.

emphasis on traditional forms of child activity, and most importantly on a greater use of play.

> Few parents, policymakers, or school administrators seem aware that a voluminous body of research over the last 30 years has decisively demonstrated that play — especially make-believe play — contributes in unique and critical ways to children's intellectual, social, and emotional development. In contrast, studies over the same time period have failed to demonstrate that computers in elementary education make any critical contribution to children's development. Yet playtime in many classrooms is being sacrificed, as computer time increases. Play also, of course, contributes to children's physical health.[40]

It is true that parents worry that their children will lag behind in technological skills and will be disadvantaged for life. Parents, in short, want to maximise the advantages that their children have, and if that means early exposure to computers, then so be it. The advantages of early exposure are, however, questionable:

> Parents who worry about their child's typing, word processing, spreadsheet, and Web search skills (the underlying fear, of course, is about earning a decent living), should consider what every experienced technology instructor knows: all of these skills can be taught in a one-semester course for older students.[41]

As children mature and move up the primary school, there is scope for introducing them to computer technologies. However, it is contended here that this is not an essential investment, particularly in Zimbabwe, which has limited resources. Exposure can be postponed until the secondary school unless the school can comfortably meet the financial demands of funding the required resources.

There are questions about the benefits of introducing computers in early childhood education. Furthermore, in poor countries such as Zimbabwe, computer technologies can be a threat to quality education by diverting scarce resources from critical resources such as books. There is much to be gained from building a strong teaching and learning foundation based on traditional teaching approaches. Local schools have not performed well because they lack basics, such as textbooks, chalk, exercise books, pencils, pens, desks, classrooms, and qualified teachers.

Questions of access to technology, rather than questions about content and pedagogy have dominated the Zimbabwean debate on computers in education. There has been a tendency to assume that schools know what to

40. *Ibid*: 51

41. *Ibid*: 69.

do with computers, if only they could get them. However, a closer examination reveals that schools are not clear as to why they need computers. That is so in the primary school, as well as the secondary school.

Computers in the Secondary School Curriculum

In the first two years of high schools, Zimbabwean secondary schools that have computers follow a skills oriented curriculum. A detailed discussion of the evolution of that curriculum is beyond the scope of this article.[42] However, the process has been led by a number of government and private schools that acquired computers in the mid-1980s. The curriculum has the support of the Ministry of Education, but has not been recognised for purposes of official certification. The focus in the first two years is on keyboarding skills, the use of word-processors, and spreadsheet packages such as Microsoft's Word and Excel. Computer specialists teach computer skills but these skills are not linked to other areas of the curriculum. For example, students are generally not expected to use the computer skills that they have acquired to write papers, or to conduct research.

A typical example is a Harare private school that has set up a computer room equipped with state of the art computers. Each class is timetabled to visit the computer room twice a week. The teacher makes up class exercises without reference to any subject area or to any problem or issue of interest to the broader school curriculum. When asked to describe the content of the tasks that they were assigned, students had difficulties remembering them. Nevertheless, they liked the computer classes because they were an easy option and a welcome distraction from other schoolwork.

In the third year of high school, some schools have introduced Computer Studies, a subject recognised by the Ministry of Education. The curriculum focuses on programming skills. This course of study is normally offered to a small number, usually less than 30 students. The rest of the students do not have access to computers after the first two years of high school.

The picture that emerges is that Zimbabwean schools that have invested in computers are not realising the full benefits of the technology. In considering the way forward, educators would do well to consider what has been learnt from the teaching of literacy in the language arts. Literacy in reading and writing has come to be considered in relation to specific areas of the curriculum such as history, science, and not as an isolated skill.[43] In other words, literacy is considered in terms of specific specialised discourses, within the school curriculum. If this principle is applied to computer skills,

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42. See K. Hungwe, 'Issues in computer oriented innovation in Zimbabwean Education'.
43. A. Webster, M. Beveridge and M. Reed, 1996, *Managing the Literacy Curriculum*, London: Routledge.

it means that they should be taught and learned for use in specific contexts, for example, in doing writing, mathematics, or conducting research. Students should learn to use technology to solve specific problems that are relevant to their needs, rather than learning technology divorced from situations and practices. It is important to:

> make the computer available to students as a serious tool, in their lives right now, not as something they will need later. Probably the most important example of this is word processing. Students have to write papers, for English teachers, History teachers, and so on. Word processing can make the mechanics of this task much easier . . .[44]

For Zimbabwean secondary schools, access to computer technologies has been a major constraint. One way of beginning to address this is through resource sharing. A number of donor-funded models of resource sharing have emerged in the last few years. Schools have been clustered to share scarce resources. The existing models are the Better Schools Programme, the Creating Learning Networks for African Teachers (CLNAT) pilot project, the SEITT project, and the World Links Programme.[45] The World Links Programme has set up 42 computer centres at rural and urban secondary schools across the country. Secondary schools in Binga, Tshololotsho, Sanyati and other areas normally considered as 'remote' are currently online. World Links has also set up a 'Mobile Computer Classroom', which moves from school to school, camping at each site for a week at a time to give teachers and students training in computers.

While these projects have made some impact, it is worrying that they are donor-funded as it raises questions about their national impact and long term sustainability. There is scope for state participation to increase impact and ensure long term sustainability. While computers are a new innovation in the school system, their use in post-secondary education has a longer history.

Computers in Post-secondary Education

When computers were first introduced to universities, they were strictly used for programming and teaching programming skills. Over time, the nature of computers has changed, raising new questions about traditional notions of computer skills. Technologies that have separate histories such

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44. B. Harvey, B1983, 'Stop saying 'computer literacy!', Online www.cs.berkeley.edu/~bh/stop.html

45. The Better Schools Programme was funded by the Dutch government and has targeted schools. The CLNAT is a UNESCO project for computerising and networking teachers colleges. The SEITT project is an in-service programme for secondary school science teachers.

as video, audio, telecommunications, and text are increasingly integrated. The world is now in the age of hypermedia, which is a convergence of historically distinct technological trajectories. Some post-secondary institutions, especially in the industrialised North, have been taking advantage of these developments to make computer technologies a major platform and medium for the design and delivery of instruction across the curriculum. The response in developing countries has been slower.

In Zimbabwe, the curriculum focus is still on programming applications. Even local teachers colleges (with a few exceptions), follow computer programming curricula. Nevertheless, there have been some promising new initiatives. Since year 2000, the University of Zimbabwe began setting up a campus-wide network to be used for communication, teaching, and research, across the curriculum. European Union countries provided funding. The reliance on short-term donor funding is, however, worrying because computer technologies require regular maintenance, upgrading, and replacement.

Access to the Internet has given a new dimension to the concept of lifelong and open learning. Individuals can extend their horizons and broaden their learning experience by accessing global resources. The enthusiasm for the growth of online resources has been tampered with concerns about the quality and suitability of content. Among those expressing concern are Altbach[46] who has noted a rapid growth of market driven courses of study on the Internet, raising questions about the wisdom of basing the development of education on the vagaries of the market. It is, thus, vital that, as local educational institutions expand their uses of computer technologies, infrastructural developments should be complemented with the production of quality content.

To summarise, it is the contention of this article that there are no compelling pedagogic reasons for introducing Zimbabwean children in the primary school to computer technologies. There are, in fact, reasons to believe that such a course of action is pedagogically inadvisable in the early years. While computer technologies may be desirable in the higher grades of primary education, it is questionable whether that is an appropriate goal at this stage of development of the country. The position in the secondary schools is different and, there, the uses of computer technologies should be encouraged. There is, however, a need to use the technologies across the curriculum, as tools for solving authentic problems, rather than teaching isolated skills that have no clear applications.

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46. P. Altbach, Summer 2002, 'Academic freedom: International warning sign', *International Higher Education*, 24.

The provision of adequate resources is a challenging problem. Models of resource sharing that have emerged over the years need to be explored and expanded. This calls for greater state commitment. In both secondary and post-secondary education, there is need to integrate computer technologies across the curriculum so that they are not only used by specialists in computing, but are employed as work tools in all disciplines. It is critical that adequate attention be given to content. There has been a tendency to define access to technology narrowly in terms of hardware, rather than content.

Conclusion

The cost of computer technologies has decreased dramatically over the last 50 years. At the same time, there has been a change in their uses, which can be broadly characterised as a swing from information and data processing, to tools for communication. Wider access and greater affordability have, paradoxically, brought the question of equity to the fore. As long as the ownership of computers was the preserve of large institutions and corporations, and their uses were restricted to information and data processing, equity was not an issue. Computer technologies have not been the cause of socio-economic inequities. Rather, their pattern of diffusion has drawn attention to socio-economic disparities between rich and poor societies.

The adoption of microcomputers in the Zimbabwean educational sector is a good example. Microcomputers are found in less than 2 percent of Zimbabwean schools that represent the most privileged sector of the society. The pattern of adoption of the technology has therefore served to entrench unequal societal relations. In this case and elsewhere in the world, the exclusion of the poor has manifested itself in two ways: as lack of access to hardware and software, and as content barriers. The Internet is a case in point.

When analysed in terms of content, language, direction of flow, genre and style, the information on the Internet is dominated by a global elite whose interests rarely coincide with those of the poor and marginalised.[47] The exclusion of the poor is not a unique feature of the computer age. Lack of access to resources is a defining characteristic of the world's poor and marginalised people. To this day, there are significant segments of the global population that do not have access to books. The relatively higher costs of the new technologies have merely aggravated an existing crisis for the world's poor.

47. The Children's Partnership, 'Online content for low-income and underserved Americans: The digital divide's new frontier'.

The 'digital divide', which has, in recent years, become an important developmental concern, is primarily a rich/poor divide that manifests itself as a divide in skills, and access to technology. While some have argued that injection of new technologies in poor societies will spur economic development, others are sceptical.[48] A whole range of factors needs to be in place for technology to make a difference. Some of the factors are technical. Calhoun and DeLargy[49] have cautioned that:

> computerization makes significant demands on environments. Unfortunately, the planning of many systems presumes settings like the United States, Western Europe or Japan, where a high level of environmental support can be taken for granted.

In the limited cases where donors have provided hardware and software, there are problems of sustainability. As the Internet Council has observed, 'The monthly connection cost for the internet in Africa exceeds the monthly income of a significant portion of the population'.[50] The obstacles can be insurmountable, particularly outside the main urban areas. What has been accomplished is testimony to the enterprising spirit of a few.[51]

The state can contribute to the development of pro-technology environments through policy and legal frameworks. The telecommunications infrastructure in African countries has been described as 'sadly inadequate' this being 'due to under-investment and strong government control'.[52] A case in point is the development of the telephone system in Zimbabwe. A state-controlled corporation dominates this sector. The participation of the private sector is restricted to mobile telephone networks, and this limited

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48. See for instance B. J. Berman, 1992, 'The state, computers, and African development: The information non-revolution', in S. Grant Lewis & J. Samoff eds, *Microcomputers in African Development: Critical Perspectives*.

49. C. Calhoun and P. F. DeLargy, 1992, 'Computerization, aid-dependency, and administrative capacity: A Sudanese case study', in S. Grant Lewis & J. Samoff eds, *Microcomputers in African Development: Critical Perspectives*, Westview: Boulder & Co: 35.

50. US Internet Council, 'State of the Internet Report 2000': 16.

51. See for example J. Chiguma, 1999, 'The Role of the Computer in the in-service Training of A-level Science Teachers', Diploma in Educational Technology Research Project, Centre for Educational Technology, University of Zimbabwe. Y. Mudavanhu, 1999, 'An Analysis of the Problems Experienced in the Implementation of the Creating Learning Networks for African Teachers (CLNAT) Pilot Project', Diploma in Educational Technology Research Project, Centre for Educational Technology, University of Zimbabwe. B. Chimbo, 1999, 'A study of Computer-based Instruction in South African Schools: A Case Study of the Gauteng Province', Diploma in Educational Technology Research Project, Centre for Educational Technology, University of Zimbabwe.

52. US Internet Council, 'State of the Internet Report 2000'.

concession was only won after several years of court battles culminating in an unprecedented intervention by the Supreme Court.

The lack of appropriate infrastructure and technology is one problem that needs to be addressed. However, even if that issue were to be resolved, it would still be necessary to consider how the educational system should respond to the growing importance of computer technologies in society. The idea of 'computer literacy' has been the dominant metaphor informing the education sector's response. If it is accepted that computer skills constitute a literacy skill, in the same manner that reading and writing are literacy skills, then the teaching of those skills should be mandatory. Harvey illustrates the powerful effect of using the literacy metaphor as follows:

> Any educator who suggested eliminating reading from the curriculum would be laughed at, if not tarred and feathered . . . One practical result of the literacy metaphor is that many decisions about computer education have been made in a kind of panic. Parents call up the school committee to ask why their children are not being trained for the vital computer skill. These parents may not know just what that skill is, and neither does the school committee. But they do know that the private schools down the road have computers.[53]

The literacy metaphor provides a very powerful legitimisation for computer-oriented investments in education. This is true at the local level, as well as the district and government levels, especially since there are international conventions that obligate governments to provide for universal literacy. The United Nations periodically published indices of literacy across the globe. There is a danger, however, that the literacy metaphor can be a trap, especially in the context of the fact that there are serious problems with the cost-effectiveness of universal computer literacy programmes, especially in poor societies. A study sponsored by the Department for International Development is illuminating, especially its key observation that,

> Experience with the application of new technologies to education over the past decade has been limited and difficult to evaluate. The evidence is that computers in schools appear to be most effective at the higher levels of the system. Where there has been dramatic improvement, it has been with established technologies, including radio. One key issue is that new information technologies can involve significantly higher recurrent costs, which has clear implications for affordability.[54]

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53. B. Harvey, 1983, 'Stop Saying "Computer Literacy"', Online www.cs.berkeley.edu/~bh/stop.html

54. Department for International Development, 2001, *The Challenge of Universal Primary Education*, London: DFID: 19.

Thus, an adequate conception of literacy in this day and age must take into account a number of issues, including, first, the multiplicity/diversity of uses that the new technologies afford users. Computer technologies have evolved from a medium that was solely used for programming to become a multi-functional tool. New forms of use are being developed all the time. Secondly, since the uses of computer technologies are continually changing, the skills base required to use them is dynamic, rather than static. This requires users who are adaptable and are continual learners. Literacy can not therefore be defined in terms of a fixed set of skills.

Thirdly, changes in technology have broader societal implications because they enable corporations and institutions to restructure and redefine work roles and job content. In this process, there are winners and losers, and one consequence of computerisation has been job losses. A broad understanding of the impact of technology on society is therefore an important aspect of literacy.

Lastly, literacy education should nurture a citizenry that is both critical and creative. In other words, it should enhance the societies' capacity to explore a range of options and make decisions on reasoned ethical considerations that advance negotiated societal values. What this all means is that entry into literacy does not merely entail a mastery of existing technologies. That is only a part of it. More importantly, it means creating the capacity to generate and consider scenarios for action, and an active critique of dominant paradigms of use of technology.

This study is, therefore, calling for a curriculum that empowers individuals and societies to contemplate and act on alternative scenarios and futures. If Zimbabweans are to be masters of their destiny, then the goal of education should be broader than teaching specific technical skills. The process of change should not be driven by technology but should be rooted in the cultural, economic, intellectual and spiritual resources of communities.

In view of the above, it is, therefore, proposed that there should be a shift from the rhetoric of *computer literacy* (or IT literacy, as the G8 has called it), to that of *literacy in the computer age*. In addition, the specific skills that are relevant for survival, productivity, creativity, and sustainable development in today's world have to be clearly defined. Some of those skills are quite traditional. They are reading text, writing, verbal skills, and comprehension skills. It is contended here that it is a mistake to narrowly focus on practical skills, such as the use of a word processor or the Internet.

A five-year old boy may be able to turn on a computer, insert a CD-ROM, and play a limited repertoire of computer games but he cannot be regarded as literate because he is underdeveloped in some key areas that are essential to function effectively in this age. Among the areas where he is lacking are reading, writing, and verbal skills. He also needs to develop in the areas of

creativity, critical thinking, and judgement. Much of what has been called 'literacy', with reference to computers, is, thus, merely a limited repertoire of skills, many of which are transient because of the changing nature of the technology. They are hardly an adequate preparation for the challenges of the age, which is precisely what an adequate educational programme of literacy should address.