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Electronic nomads?

Implications of trends in adolescents' use of communication and information technology

Glenn Russell and David Holmes
Griffith University (Gold Coast), Queensland

Adolescents' increased use of electronic over print-based information technologies is radically accelerated today by the rapid development and convergence of interactive technologies. Enhanced interactivity via communication technologies or personalised (wearable) information technologies effectively releases adolescents from the need to consume institutionally controlled "broadcast" technologies such as the textbook or the educational video. Adolescents are able to become nomadic in the way they can traverse culture, time and space, hitherto impossible within institutional boundaries. This paper reports adolescents' use of information technology at home, in a study of three groups of year eight students, in three private schools. The patterns of information technology consumption revealed are compared with findings published in *Metro* in 1990. The study extrapolates from the trend emerging from this comparison to argue that the high levels of personalisation, mobility and global reach associated with adolescents use of communications and information technologies constitute a paradigm shift which will increasingly characterise popular culture and educational practices.

Research into adolescents' use of *communication and information technologies* (CITs) in Australia remains relatively under-examined. As with most kinds of research dealing with communications and the educational implications of contemporary CITs, researchers are in a situation of catching up with the speed of historical developments and their social and educational implications. Increasingly, the availability of technology which allows adolescents to communicate with little regard to geographical or temporal constraints highlights wider educational and social issues.

Recent theorists of new communications media argue that we are entering an era in which interactivity is replacing broadcast as a primary mode of social integration (Gilder 1993, Poster 1995). This so-called 'second media age' of interactivity is rapidly establishing itself in information rich

countries where the rise of the Internet and interactive television, mobile phones, and fax machines is both a measure and a cause of profound cultural changes. Increasingly, we are all being asked to 'learn the electronic life' (Scwoch et. al, 1992), a process which is highlighted by the differential rate of take-up between different age groups. Research coming out of the Consumer Telecommunications Network and the Telecommunications Needs research group at RMIT (Gillard, Bow, and Wale, 1994) has pointed to inequities in this take-up. An important finding that emerges is that CIT cultures are changing at a rate that far outstrips generational change, which highlights the importance of understanding adolescent take-up of CITs, as it is primarily from this generation that we glean a cultural reading of CIT futures, and form perspectives on the developing characteristics of technologies in education.

At the same time however, we need to understand the more generic change in social relations that is brought about by interactive CITs. Recent literature attempting to outline a sociology of cyberspace and information culture (Shields 1995, Jones 1996, Poster 1994) has suggested that information-mediated social interaction has proven to be a seductive form of communication because of the way in which it radically enhances the mobility of individuals in manifold ways. This mobility can be seen to be derived firstly from the technological possibility of being 'lifted out' from the physical constraints of being embodied (having to be in the one place at the one time for example), and secondly, being socially lifted out of the confines of an institutional world, be this the family, school, the workplace, or even the cultural limits that can be set by broadcast media. A third kind of mobility is produced by the social honour and status of not being bound to the parochial. Taking *computer-mediated-communication* (CMC) on its own, Steven Jones (1995) summarises these processes usefully:

> The importance of CMC and its attendant social structures lies not only in interpretation and narrative, acts that can fix and structure, but in the sense of mobility with which one can move (narratively and otherwise) through the social space. Mobility has two meanings in this case. First, it is clearly an ability to "move" from place to place without having physically travelled. But second, it is also a mobility of status, class, social role, and character.(p. 17)

Jones' understanding of mobility with CMC is further enhanced by an appreciation of the even more extended nomadic potentials of wearable and portable technologies CITs. Whereas means of connectivity such as the Internet are typically experienced as modes of travel by way of *disembodiment*, equating and substituting our corporeal identity with a cyberspace identity, portable information and communications technologies *intensify* embodiment. What becomes important is that our bodies become the locus of mobility. Whereas on the Internet our body is substituted by a cursor, with physical mobility, our bodies become redefined by the technology that locates us, the mobile phone, the laptop

etc. Learning the electronic life and living on the information 'superhighway' means not having to negotiate 'cartesian' space. In a recent article dealing with the convergence between these two senses of 'travel' Mark Nunes (1994) has suggested that if the spatial metaphorics of the Internet (information 'superhighway' and cyber 'space') were to become our most familiar mode of engaging with the world, they would also become our meta-psychological foundation for re-experiencing physical motion, speed and travel. Negotiating Cartesian space would become mediated, even eclipsed, by technological simulation (Nunes, 1995).

New mobilities between the global and the personal

The significance of the growth of technologically-mediated mobility in information societies can be further seen in the context of how we are presently witnessing a massive withdrawal of contemporary urban identity into the privacy of the household, while at the same time, the individual is increasingly compelled to reach out to a global level of consumption (Gill, 1991). According to Gerry Gill, this process requires that we understand how new informational and communication technologies are re-urbanising community in technologically-extended ways. Through such extension, the connection between the individual and the social whole becomes increasingly personalised according to the use of commodities and devices which facilitate this connection. Social integration and the formation of community occur abstractly when connectivity and segregation increase at the same time. The possibility of being connected to others increasingly comes down to technologies which presuppose a single user, with the personal computer and video-game machines that demand 'face-to-screen' interaction representing the most widespread precursors to disembodied social relations. The relationship of CIT consumers to a social milieu become intensely privatised through the particular technology, but also globalised insofar as such use becomes generalised throughout information cultures.

This movement in two directions, towards the global and the personal, is magnified even further by the increased take up of personalised information technologies. Such technologies represent an extraordinary contradiction in contemporary social life. On one level they are extremely social in allowing connectivity to a global arena, whether this be real time connection to another person, listening to globally sourced music on a personal music device, personal digital assistants (PDAs) or connecting to the Internet remotely; but at the same time they are anti-social insofar as face-to-face communication, as one mode of human interaction, becomes an attenuated level of association and no longer valued in cultural representation.

Yet equally paradoxical is the way that collective uses of personalisation technologies result in the very fragmentation we momentarily overcome in our individual use of them. The logic is seductive. Geographic forms of association, integration and solidarity are both weakened and strengthened by technological and communicational extension. They are weakened because our life world no longer involves negotiating physical spaces with the same proximity that occurred before the rise of technological extension. And they are strengthened in that we can simulate the properties of those spaces with ever greater control. But because the tendency for fragmentation always outruns the opposing tendency, we are forever seduced into greater and greater dependence on technologies of extension at the same time as the desire for ever greater mobility increases.

Trends in adolescents' use of information technology

One implication of adolescents' take-up of CITs is that school-age students are able to wander electronically with minimal control by traditional socialising influences such as parents and teachers (Katz, 1996).

Trends towards electronic nomadism and the decline of existing barriers to communication will gain further significance if it can be shown that adolescents readily adopt CITs. In broad terms, the identification of an increased trend to adopt CITs by the overall population would suggest at least some adolescent use of the technology. It is likely that changing broadband infrastructures will affect adolescents' take up of the electronic life. Australia seems to be regularly breaking records for its high take up of leading edge CITs. There are now more than a million mobile phone users in Australia, with estimates of that doubling by the end of the century. Concurrent with this exponential increase of mobile phones are estimates of 347,000 paging services in operation in 1993, and projections from Telstra of an annual growth rate of household fax machines of 27.5% (Le Blanc, 1994).

On the home computer front, it is estimated that at the end of 1993 there were 3.7 million personal computers in Australia. 873,000 PCs were sold in 1993 costing a total of $2.5 billion. The Australian Bureau of Statistics (1994) reported that 23% of all households frequently used a computer at home. Of households in which a computer was used, 41% had a member of the household who had undertaken computer training from a primary or secondary school. A significant background figure for the current study is also that 3.6% of Australians have domestic access to the Internet.

Given this background of increasing levels of CIT take-up by the general population, it becomes more important to find out if groups of adolescents are adopting the technology which is available in many homes. Further, to understand the impact of CITs on the nature of students which teachers

encounter in school, and the cultural shifts which are likely to occur as a result of this adoption, it is necessary to identify changing patterns of CIT adoption.

In 1990, an article in *Metro* reported on adolescents' use and consumption of information technology (Sachs, Smith and Chant, 1990). The study, of 1,024 students in three Australian states focused on understandings of popular culture including the use of television, radio, video, cinema, computers, video games, records/tapes, magazines and books. The researchers concluded that information technology consumption was an important part of the leisure time activities of adolescents, and that there were important implications for schools in the identified trends. That study provides a snapshot of adolescents media usage. However, as with any photograph, the reality framed by the picture selects from the elements available. Some aspects must necessarily be overlooked, and changes must inevitably have occurred since 1990. The present article examines trends which emerge from a comparison between 1990 and a more recent study, and explores the resulting social and educational implications.

Trends in students' home use of information technology

The present study reports more recent data from a small sample of school students, using intact year eight English classes in Queensland secondary schools. This study, which is referred to in this article as the Queensland study, argues from a comparison with data from the 1990 research that some trends in students' use of information technologies at home can be identified which were less apparent in 1990.

The Queensland study involved a short questionnaire administered to 100 students in four classes in three schools. The class teachers confirmed the average age of the subjects as thirteen years. The schools were an all-girls' school, a coeducational school, and an all boys' school, and these are referred to as schools A, B and C, respectively. All three schools were private fee-paying schools, where the students attending would normally be regarded as possessing considerable cultural capital, and many of the parents or guardians would be drawn from higher socio-economic groups. It is not argued that these students were randomly selected or that they would be representative of all Australian students. However, it is suggested that as the technologies become cheaper, more accessible and more ubiquitous, future groups of students throughout Australia will exhibit similar trends in their consumption of information technologies. Historically, reflection on the past spread of new information technologies suggests that growth will continue. An example can be seen in the gradual spread of telephones. Marvin (1988) notes that in the USA in 1900, there were only 17.6 telephones per thousand of population. Clearly, telephones are ubiquitous today. Usage levels of particular communication

technologies tend to increase unless obsolescence or economic and social upheavals intervene.

The survey in the Queensland study contained questions relating to electronic and print technologies. Administration of the survey was accompanied by whole class and small group discussion. A summary of the responses to the question: *Which of the following have you actually used in the last week, (at home, or where you live during term?)*, can be seen in Figure 1. Presented in this table are student responses, expressed as a percentage, concerning their home use of technologies.

Home technology type	School A (girls' school) 1994, Semester 2	School A (girls' school) 1995, Semester 1	School B (coed school) 1995, Semester 2	School C (boys' school) 1995, Semester 2
Television	100	100	100	93
Telephone (ordinary)	84	100	100	79
Radio	79	95	90	79
CD-Player	68	95	80	79
VCR	63	95	74	86
Computer	63	95	90	93
Walkman	53	80	58	50
Telephone (mobile)	42	65	53	50
Computer game machine (eg Nintendo, Sega)	21	75	47	57
Fax	10	46	42	21
The Internet	0	35	42	14

Figure 1: Responses to the question, "Which of following have you actually used in the last week (at home, or where you live during term)?"

What is most notable about this table is the breadth of use of CITs, which re-affirms the idea that they are not merely informational tools but environmental conditions making possible electronic lifestyles. In a way that is much more visible in this study than in 1990, possibilities of convergence in the daily use of these technologies are evident. For instance, the category of computer is now supplemented by dedicated computer game machines and by the Internet. Similarly, there are several technologies which will allow students to hear pre-recorded music, including a CD-Player, and Walkman. A future survey could now include cable television: technologies used by students are not restricted to a small static list which can be measured at regular intervals. For Negroponte (1995), an increasingly digital world means a congruence of media, with television and other media being combined in the computer. The fact that students in this study used a range of pre-interactive and interactive technologies on a regular basis points to a convergence process at the level of cultural practice. To this degree the rapid move toward technological

convergence merely makes more material what is already being put together at a cultural level. For example a multi-media computer does not necessarily increase use of media immersion technologies, it just puts them together in the one commodity.

In cases where the same individuals are putting together a range of technological worlds in constructing their own lifestyles, a concentration of leading edge technological competency occurs. The resulting lifestyles, characteristically, are likely to show high levels of nomadic behaviour in their use of CITs. The Consumer Telecommunications Network, Canberra, has suggested a range of criteria by technologically advanced telecommunications usage can be mapped. In the report from this group, Le Blanc (1994) argues that these criteria include:

- the capacity to send, receive and move/control data and images instantaneously;
- interactivity with computing and broadcasting functions,
- mobility, that is, freedom from the constraints of location;
- unlimited domestic and global reach;
- a high level of user control and flexibility; and
- in general, anything which creates new human communication and information exchange possibilities which are not available through a "plain old telephone service" (POTS).

The high take-up of the Internet leads the field in satisfying the preceding criteria. This is because it represents a comprehensive CIT world, and because the Internet stands out in its ability to lift adolescents out of family and classroom contexts (Holmes, 1996). However, this 'lifting out' process can be attributed to an entire fabric of electronic culture that is produced out of simultaneous use of interactive and pre-interactive CITs.

An identifiable characteristic of the topography emerging from this survey is an increased take up of leading edge technologies, which enable high levels of personalisation, mobility and global reach. These qualities of emerging CITs are important in that they enhance independence of the users and learners from institutional constraints, which in this case are family and school. For Sobcheck (1995) the result is a transformation of temporality, spatiality, embodiment and subjectivity. Where technologies are personalised, such as in the use of Walkmans and mobile phones, users are provided with enhanced autonomy over what they consume or who they interact with. The music or the conversation is scaled to their own bodily control and exclusive experience. Similarly, the mobility that these technologies offer means that property control that has traditionally been exercised over the use of technology by adolescents rapidly disappears. But even technologies which cannot be personalised in a mobile sense are able to supply similar kinds of autonomy because of their interactivity. Thus computer games, video games and the Internet, which entail screens of interaction rather than passive viewing, become personalised to the

user. These technologies are the CITs least familiar to pre-interactive media users. They promote forms of self-construction in adolescence that are heavily related to their technological competency with CITs. Moreover, broadband interface technologies such as the Internet also enable the universal autonomy of global reach. Here we refer to another kind of mobility which can be achieved without personalisation, the ability to 'go anywhere', or as the Microsoft advertisement puts it, 'Where in the world do you want to go today?' The rapid take up of Internet capabilities invariably leads to equally rapid identifications with international and globalising forms of citizenship rather than the narrow rigidity of family norms. These trends are observable in a comparison of adolescents' use of technologies over time.

Comparisons with the 1990 research: Electronic information technologies

In 1990, nearly 100% of the sample of students had television at home. In the Queensland survey, nearly 100% of the class groups had watched television in the previous week, at home. Follow-up interviews with students indicated that most students watched it daily. The class discussions which accompanied the administration of the questionnaire made it clear that television watching was still seen as important for most students.

Virtually 100% of the students in the Queensland survey had also used a telephone in the last week, a question which students were not asked in 1990. Some students had ready access to both a conventional telephone and a mobile phone. Of interest is the mobile phone usage. The usage rate in School A, the girls' school, climbed from 42% to 65% within a year, and the minimum rate in any of the schools during 1995 was 50%. Leonard (1991) was able to comment that Australia had one of the highest ratios of residential phone lines to dwellings in the OECD. Australians have already indicated a willingness to install and use telephones, so it is not surprising that mobile phones would find ready acceptance. Yet mobile phones do not require conventional telephone lines. As Don (1991) suggests, telephones can be one of a number of media which are used for the construction of self. Adolescents can use mobile phones to speak to each other, with adults having limited ability to monitor their behaviour. By making it increasingly possible for adolescents to talk to anyone, anywhere, mobile phones encourage alternative social constructions and change the nature of the learner in schools.

In 1990, 97% of the sample owned a radio. In the Queensland survey, most students owned or had ready access to a radio, but the percentage of students who had listened to it in the last week varied from 79% to 95%. With minimum usage levels of 79%, it is clear that radio is still an important technology which is regularly used by most of the adolescents in this group.

CD-players were not surveyed in 1991. In the Queensland study, the use of compact disks was clearly established. Of interest was the increase from 68% to 95% in School A, the Girls' school, in two successive cohorts from 1994 and 1995. During 1995, a minimum of 79% of the students reported the use of CD-players in the last week. Class discussion which supplemented the administration of these questionnaires indicated that "vinyl" records and audio tapes were less common. As the statistics indicated, these students adopted new technologies enthusiastically and rapidly.

In the 1990 survey, 68% of students owned or had access to a video, and these were watched regularly. In the Queensland survey, the students who had used a VCR in the last week varied from 63% to 95%. There are considerable fluctuations in these figures which can be attributed to the relatively small sample and to considerations such as the day of the week when the surveys were undertaken. The 1990 survey indicates that the majority of video viewing takes place at weekends, and a questionnaire administered in class on Monday might give different results to one used on a Friday. Nevertheless, the majority of students had watched videos during the last week, and this remains a major media source to be considered.

The 1990 study reported that home computer ownership was 39%, which the authors considered to be very high. In contrast, 63% of the adolescents in the 1994 group involved in the Queensland study had used computers at home in the last week, and in 1995, the minimum usage in the three groups was 90%. This level of computer use is much greater than the most recent national data relating to overall computer use for Australia, where 23% of all households in Australia frequently used a computer (Australian Bureau of Statistics, 1994). There are expectations that the use of computers will continue to increase.

The students in the Queensland group not only have higher levels of computer use than in Australia overall, they are more likely to have used computers at home than many teachers. In recent studies, Russell and Bradley (1995) reported that, in Queensland, 46.3% of teachers owned their own computer, while 52.6% had access to one. Similarly, in Victoria (Shears, 1995a; Shears 1995b), research indicated that 42% of teachers owned or leased a computer. Adolescents in lower socio-economic groups doubtless have less access to computers than in the Queensland sample, but their use can be expected gradually to increase. Overall, adolescents' access to computers must be seen as a significant influence on the ways in which they construct their identities.

The 1991 survey did not ask about adolescent use of wearable music technology such as the Walkman. A minimum of 50% of the students in

the four groups surveyed in the Queensland study had used a Walkman in the last week. As with the use of mobile phones, adolescents readily adopt technologies which free them from the spatial constraints of their home, and the supervision of parents. Increasingly, it becomes difficult to ask about questions of home use of technology when the technology itself is sufficiently portable to be used both inside and outside the home, and also brought to school. For cyberpunk writer Bruce Sterling (1990), the Sony Walkman is a symbol of science and technology surging into culture, where street-level technology has slipped control. Along with other technologies such as the soft contact lens, the Walkman sticks to the skin and radically redefines humanity. As the 1990 survey indicates, music consumption is an important part of youth culture, and a significant amount of adolescents' leisure time is spent listening to popular music. The Walkman use identified in this survey highlights adolescents' ability to surround themselves with music during their leisure time. It also provides evidence that adolescents are becoming nomadic, in the sense that much of what is important can be carried around with them, regardless of geographic constraints.

Dedicated computer game machines, such as those produced by Nintendo and Sega were not surveyed in 1991. However, it is likely that they constitute an important but neglected area which assists in adolescents' construction of self. As Provenzo (1991) argues, "video games are part of an invisible culture that receives little attention from the adult world." (p.101). In the Queensland survey, each class group reported some use of dedicated computer game machines. There was considerable difference between groups, with both the minimum of 21% and the maximum of 75% being reported by different cohorts from the all-girls' school. Some groups of both boys and girls had used computer game machines in the last week, as distinct from using games on computers. Suggestions that girls are not interested in games such as Nintendo and Sega are not supported from this data. However these figures do reflect levels of access to dedicated games machines which are higher than in the general community, where 18% of Australians had a dedicated games machine which is regularly used by persons in the household (Australian Bureau of Statistics, 1994).

The 1990 survey did not address the question of adolescents' use of fax machines. Clearly, there is some use of this technology, but there is considerable variation between groups. Those groups who most frequently reported use of a fax machine in the previous week included the all-girls school, School A, where 46% of the students in 1995 had used them in the previous week, and the coeducational school, School B, where 42% of the students had used them. This level of fax use is far greater than the 4.4% of all households in Australia who reported having a fax in the

survey by the Australian Bureau of Statistics (1994). Demographically, Queensland's Gold Coast, where this survey was undertaken, includes considerable numbers of business entrepreneurs However, even allowing for unusual characteristics among the surveyed groups, the data suggests that adolescents are able to readily adopt and use a variety of information technologies.

The use of the Internet was also not addressed by the 1990 survey. The Internet, including the World Wide Web and E-mail had not been significantly taken up by the one class surveyed in 1994, but during the next year, some students in each group had used it, with the highest figure of 42% being reported from the coeducational school, School A. Whole class and small group discussion of the Internet involving two different cohorts from the same school indicated a remarkable increase in understanding in less than one year. The Report by the Employment and Skills Formation Council (1995) *Converging Communications and Computer Technologies - Implications for Australia's Future Employment and Skills*, has noted that some 90 countries, just under 5 million machines, and some 50 million users world-wide were connected to the Internet in 1995. Inter-connected machines in Australia numbered around 160,000 in 1995, (or about 1.6 million users) which is an increase of over 400 per cent in the previous 3 years. This can be regarded as an exponential rather than arithmetic increase, and highlights the importance of studying adolescents' adoption of new information technologies.

Adolescents' use of print-based technology

The 1990 survey pointed out that adolescents continued to use a wide variety of printed materials, including books, magazines and newspapers. The authors of the 1990 survey published additional data (Sachs, Smith and Chant, 1991) which allows for comparisons between adolescents' use of print-based technology in 1991 and in 1994. A summary of the results for 13 year old adolescents from the 1991 survey is presented in Figure 2.

Print Media type	print media items read by girls in preceding month	print media items read by boys in preceding month
Magazines	1.2	1.0
Books	2.0	1.1
Newspapers	0.06	0.5

Figure 2: Print material consumption by adolescents in 1991, based on reading in the last month.

These figures are derived from questions which asked how many magazines, books and newspapers had been read during the last month.

As the authors suggest, these figures indicate that in 1991, assertions that children no longer read could not be supported from the data provided. In this year, girls were reading more print materials than boys, and overall, most adolescents were reading some print materials each month. It should also be remembered that print consumption is additional to electronic media usage reported earlier. That is, many students used a diverse range of electronic and print-based media in 1991.

In the Queensland survey, a shorter time period of one week was used, as it seemed likely that adolescents might not accurately recall their reading over a longer period of time. A summary of the findings for students' consumption of print-related media is presented in Figure 3.

Print Media type	School A girls' school (1995)	School B coed school (1995)	School C boys' school (l995)
Magazines	4.5	1.2	2.7
Books	2.0	2.0	3.9
Newspapers	1.3	0.8	2.4
Comics	2.5	0.9	0.6

Figure 3: Numbers of print media, including unfinished examples, read by the classes surveyed in the previous week, in the three year eight classes surveyed in 1995.

The monthly totals of print media read by these students would be much greater than a weekly total. A comparison with 1991 indicates that although the students in the Queensland survey consume a variety of electronic media, their use of print-based media is still high. For these students, access to television, computers, games and other electronic media does not automatically mean a drop in conventional print-based literacies. Indeed, it is characteristic of the newer media such as the Internet that words on the screen still have to be read, and picture-word combinations still constitute meaning systems for adolescents, as with magazines and newspapers.

Discussion

This study has argued that CIT consumption has become an increasingly important part of the leisure time activities of adolescents in early years of secondary school. A comparison of media consumption patterns with an earlier study in 1990 indicates that students are increasingly involved with a broad range of technologies, which are taking a more dominant role in their self-construction. Some of the technology use reported in this study, which is distinctively interactive, including examples such as mobile phones, the Internet and faxes have received little prior attention in research because they were new, or inaccessible to students. The significance of these can be found in the way they cohere to consolidate

electronic or technologically-extended environments as the primary contexts in which leisure and education are experienced. More notable still however, are the changes to pedagogical relations brought about by the de-institutionalisation of leisure and education. This change can be considered to be part of the general 'crisis of boundaries that results when the sense of self that is formed by parochial face-to-face contexts and open ended virtual worlds intermingle. As Shields (1996) suggests, interactive technologies, exemplified by the Internet create

> a crisis of boundaries between the real and the virtual, between time zones and between spaces, near and distant. Above all, boundaries between bodies and technologies [and] between our sense of self and our sense of our changing roles are altered. (p 7)

The other side of this crisis is that CITs enable *independence* from institutional constraint. Their characteristic *personalisation, mobility and global reach* signal a sea-change in the ability of adolescents to form their own identity rather than conform to institutional socialisation. The availability and adoption of CITs which free adolescents from such constraints also permit them to become nomadic. The ability to surf the Internet and contact distant friends on a mobile phone are examples of this. Interestingly, however, students surveyed in the Queensland study did not abandon print-based literacy, despite their involvement in electronic technologies. Although there were clearly individual exceptions, the reading of books, magazines, newspapers and other print based materials was seen as a necessary source of information in these adolescents' daily lives.

To understand the challenges which CITs pose for schools and families, consider the hypothetical situation of "Jenny", a year eight student several years hence. In the playground, at some distance from any monitoring adult, Jenny can use the Walkman and a mobile phone which she wears on her belt. Her school bag contains a notebook computer with an integrated phone. This mobile technology allows her to play the music of her choice with little interference from adults. If she is not convinced that her teacher is correct in the previous lesson, she can search the World Wide Web and email a professor in New York. She can watch video clips on the Internet, view pornography, or contact friends on the other side of the world. Jenny is an electronic nomad, able to roam the steppes of cyberspace with little effective control by parents or educators. Although Jenny may not yet exist in our schools, the technology required for her to accomplish these tasks is currently available. For instance, mobile phones are now available which double as a wireless computer capable of surfing the Internet (Bertolus, 1996). It would be wise to consider how institutions such as schools and families are going to cope with adolescents' use of CITs, rather than reacting with surprise later. An anecdote reported to the writers from a student teacher returning from her practicum in a private Gold Coast primary school supports this view. Her grade was about to leave on a school excursion, but one of the boys had forgotten his permission form.

The student took his mobile phone from his school bag and rang his mother, who faxed the form to the school in time for him to board the bus.

Superficially, the illustrations in the preceding paragraph appears to signal a challenge to traditional print. However, the current research does not indicate the immediate eclipse of print media, which continue to remain important as one of a number of sources of adolescent information and influences on adolescent culture. Despite this observation, the novel interactive form of CITs will increasingly permit cultural and educational changes. Adults raised in a tradition which valorises the printed word do not always understand such changes. Although adolescents can be observed using comics, magazines and cyberpunk novels, the print media are not the sole determinants or inspirations of youth sub-cultures. Increasingly, examples including music media, Internet surfing and even computer hacking are becoming more important. As adolescents attain autonomy in technological mediums which make redundant the division between the public and the private sphere, family and school, general legitimation crises of normative cultural values are possible and likely in more and more systemic ways. It is the responsibility of educators and parents alike to take up new CITs as adolescents take them up, if educational models, adequate communication, pedagogy and reciprocity are to be maintained. In understanding the educational cultures of their pre-interactive generations, adolescents or "electronic nomads" of today are at least able to reflect on the meaning of their own electronic life. They are able to assess for themselves where in the world they want to go today.

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Glenn Russell, School of Education, Faculty of Education and the Arts, Griffith University, Gold Coast PMB 50, Gold Coast Mail Centre Queensland 4217, (07) 5594 8618, Fax (07) 5594 8634, email G.Russell@eda.gu.edu.au

David Holmes, School of Arts, Faculty of Education and the Arts, Griffith University, Gold Coast PMB 50, Gold Coast Mail Centre Queensland 4217, (07) 5594 8631, Fax (07) 5594 8634, email D.Holmes@eda.gu.edu.au

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