

The ‘digital natives’ debate: A critical review of the evidence

Sue Bennett, Karl Maton and Lisa Kervin

Sue Bennett is a senior lecturer in the Faculty of Education, University of Wollongong. Karl Maton is a lecturer in the Department of Sociology and Social Policy at the University of Sydney. Lisa Kervin is a lecturer in the Faculty of Education, University of Wollongong. Address for correspondence: Sue Bennett, Faculty of Education, University of Wollongong, Australia. Email: sue_bennett@uow.edu.au

Abstract

The idea that a new generation of students is entering the education system has excited recent attention among educators and education commentators. Termed ‘digital natives’ or the ‘Net generation’, these young people are said to have been immersed in technology all their lives, imbuing them with sophisticated technical skills and learning preferences for which traditional education is unprepared. Grand claims are being made about the nature of this generational change and about the urgent necessity for educational reform in response. A sense of impending crisis pervades this debate. However, the actual situation is far from clear. In this paper, the authors draw on the fields of education and sociology to analyse the digital natives debate. The paper presents and questions the main claims made about digital natives and analyses the nature of the debate itself. We argue that rather than being empirically and theoretically informed, the debate can be likened to an academic form of a ‘moral panic’. We propose that a more measured and disinterested approach is now required to investigate ‘digital natives’ and their implications for education.

The one thing that does not change is that at any and every time it appears that there have been ‘great changes’.

Marcel Proust, *Within a Budding Grove*

Introduction

Commentators on education are arguing that a new generation of learners is entering our educational institutions, one which has grown up with information and communication technology (ICT) as an integral part of their everyday lives. It is claimed these young people’s use of ICTs differentiates them from previous generations of students and from their teachers, and that the differences are so significant that the nature of

education itself must fundamentally change to accommodate the skills and interests of these 'digital natives' (Prensky, 2001a). We shall argue that though such calls for major change in education are being widely propounded, they have been subjected to little critical scrutiny, are undertheorised, and lack a sound empirical basis. There is thus a pressing need for theoretically informed research.

In this paper, we bring together educational research and the sociology of knowledge to provide an analysis of the current state of play in the digital natives debate. We begin by setting out the main claims made in the debate. Second, we explore the assumptions underlying these claims and the consequent arguments for educational change, highlighting the limited nature of the research evidence on which they are based. Third, we consider why such poorly evidenced claims have gained widespread currency by analysing the nature of the debate itself. This highlights how principal positions have created the academic equivalent of a 'moral panic' that restricts critical and rational debate. Lastly, we argue that the debate as currently formulated is at an impasse, and the way forward requires a research agenda capable of providing a sound basis on which future debate and policymaking can be founded.

Claims about 'digital natives'

The generation born roughly between 1980 and 1994 has been characterised as the 'digital natives' (Prensky, 2001a) or the 'Net generation' (Tapscott, 1998) because of their familiarity with and reliance on ICT. They are described as living lives immersed in technology, 'surrounded by and using computers, videogames, digital music players, video cams, cell phones, and all the other toys and tools of the digital age' (Prensky, 2001a, p. 1). Social researchers Howe and Strauss (2000, 2003), labelled this generation the 'millennials', ascribing to them distinct characteristics that set them apart from previous generations. They offer a positive view of this new generation as optimistic, team-oriented achievers who are talented with technology, and claim they will be America's next 'great generation'.

Immersion in this technology-rich culture is said to influence the skills and interests of digital natives in ways significant for education. It is asserted, for example, that digital natives learn differently compared with past generations of students. They are held to be active experiential learners, proficient in multitasking, and dependent on communications technologies for accessing information and for interacting with others (Frاند, 2000; Oblinger & Oblinger, 2005; Prensky, 2001a, b; Tapscott, 1999). Commentators claim these characteristics raise fundamental questions about whether education is currently equipped to meet the needs of this new cohort of students. Tapscott (1998), for example, described education in developed countries as already in crisis with more challenges to come: 'There is growing appreciation that the old approach [of didactic teaching] is ill-suited to the intellectual, social, motivational, and emotional needs of the new generation' (p. 131). This was echoed by Prensky's (2001a) claim that: '*Our students have changed radically. Today's students are no longer the people our educational system was designed to teach*' [emphasis in original] (p. 1).

For those born prior to 1980, Prensky (2001a) has coined the term 'digital immigrants'. He claims that this section of the population, which includes most teachers, lacks the technological fluency of the digital natives and finds the skills possessed by them almost completely foreign. The disparity between the technological skills and interests of new students and the limited and unsophisticated technology use by educators is claimed to be creating alienation and disaffection among students (Levin & Arafeh, 2002; Levin, Richardson & Arafeh, 2002; Prensky, 2005a). Prensky (2001a) characterises this as 'the biggest single problem facing education today' (p. 3). To address this proclaimed challenge, some high-profile commentators are arguing for radical changes in curriculum, pedagogy, assessment and professional development in education.

The debate over digital natives is thus based on two key claims: (1) that a distinct generation of 'digital natives' exists; and (2) that education must fundamentally change to meet the needs of these 'digital natives'. These in turn are based on fundamental assumptions with weak empirical and theoretical foundations, which we will explore in the next sections.

On the distinctive characteristics of 'digital natives'

The claim made for the existence of a generation of 'digital natives' is based on two main assumptions in the literature, which can be summarised as follows:

1. Young people of the digital native generation possess sophisticated knowledge of and skills with information technologies.
2. As a result of their upbringing and experiences with technology, digital natives have particular learning preferences or styles that differ from earlier generations of students.

In the seminal literature on digital natives, these assertions are put forward with limited empirical evidence (eg, Tapscott, 1998), or supported by anecdotes and appeals to common-sense beliefs (eg, Prensky, 2001a). Furthermore, this literature has been referenced, often uncritically, in a host of later publications (Gaston, 2006; Gros, 2003; Long, 2005; McHale, 2005; Skiba, 2005). There is, however, an emerging body of research that is beginning to reveal some of the complexity of young people's computer use and skills.

Information technology use and skills amongst young people

One of the founding assumptions of claims for a generation of digital natives is that young people live their lives completely immersed in technology and are 'fluent in the digital language of computers, video games and the Internet' (Prensky, 2005b, p. 8). Frand (2000) claims that this immersion is so complete that young people do not even consider computers 'technology' anymore. Personal testimonials (eg, McNeely, 2005; Windham, 2005) depicting young people's online lives as constantly connected appear to confirm such generalisations.

Recent research into how young people in postcompulsory education access and use technology, however, offers a more diverse view of the role of technology in the lives of young people. For example, a survey of 4374 students across 13 institutions in the United States (Kvavik, Caruso & Morgan, 2004) found that the majority of respondents owned personal computers (93.4%) and mobile phones (82%), but a much smaller proportion owned handheld computers (11.9%). The most common technology uses were word processing (99.5%), emailing (99.5%) and surfing the Net for pleasure (99.5%). These results do demonstrate high levels of ownership of some technologies by the respondents and high levels of some academic and recreational activities, and their associated skills. The researchers found, however, that only a minority of the students (around 21%) were engaged in creating their own content and multimedia for the Web, and that a significant proportion of students had lower level skills than might be expected of digital natives.

The general thrust of these findings is supported by two recent studies of Australian university students (Kennedy, Krause, Judd, Churchward & Gray, 2006; Oliver & Goerke, 2007) showing similar patterns in access to ICTs. These studies also found that emerging technologies were not commonly used, with only 21% of respondents maintaining a blog, 24% using social-networking technologies (Kennedy *et al.*, 2006), and 21.5% downloading podcasts (Oliver & Goerke, 2007). As observed by Kennedy *et al.* (2006), although many of the students were using a wide range of technologies in their daily lives, 'there are clearly areas where the use of and familiarity with technology-based tools is far from universal' (p. 8). Some of this research (Kennedy *et al.*, 2006); Kvavik *et al.*, 2005) has identified potential differences related to socio-economic status, cultural/ethnic background, gender and discipline specialisation, but these are yet to be comprehensively investigated. Also not yet explored is the relationship between technology access, use and skill, and the attitudinal characteristics and dispositions commonly ascribed to the digital native generation.

Large-scale surveys of teenagers' and children's use of the Internet (cf, Lenhart, Madden & Hitlin, 2005; Livingstone & Bober, 2004) reveal high levels of online activity by many school-aged children, particularly for helping with homework and for social communication. The results also suggest that the frequency and nature of children's Internet use differs between age groups and socio-economic background. For instance, Internet use by teenagers is far from uniform and depends on the contexts of use, with widely varying experiences according to children's school and home backgrounds (Lee, 2005). This is further supported by recent research showing family dynamics and the level of domestic affluence to be significant factors influencing the nature of children's home computer use (Downes, 2002). These findings suggest that technology skills and experience are far from universal among young people.

In summary, though limited in scope and focus, the research evidence to date indicates that a proportion of young people are highly adept with technology and rely on it for a range of information gathering and communication activities. However, there also appears to be a significant proportion of young people who do not have the levels of

access or technology skills predicted by proponents of the digital native idea. Such generalisations about a whole generation of young people thereby focus attention on technically adept students. With this comes the danger that those less interested and less able will be neglected, and that the potential impact of socio-economic and cultural factors will be overlooked. It may be that there is as much variation *within* the digital native generation as *between* the generations.

Distinctive digital native learning styles and preferences

The second assumption underpinning the claim for a generation of digital natives is that because of their immersion in technology young people '*think and process information fundamentally differently from their predecessors*' (Prensky, 2001a, p. 1, emphasis in the original). Brown (2000), for example, contends 'today's kids are always "multiprocessing"—they do several things simultaneously—listen to music, talk on the cell phone, and use the computer, all at the same time' (p. 13). It is also argued that digital natives are accustomed to learning at high speed, making random connections, processing visual and dynamic information and learning through game-based activities (Prensky, 2001a). It is suggested that because of these factors, young people prefer discovery-based learning that allows them to explore and to actively test their ideas and create knowledge (Brown, 2000).

Although such claims may appeal to our common-sense perceptions of a rapidly changing world, there is no evidence that multitasking is a new phenomenon exclusive to digital natives. The oft-used example of a young person doing homework while engaged in other activities was also applied to earlier generations doing homework in front of the television. Such examples may resonate with our personal observations, but research in cognitive psychology reveals a more complex picture. For example, multitasking may not be as beneficial as it appears, and can result in a loss of concentration and cognitive 'overload' as the brain shifts between competing stimuli (Rubinstein, Meyer & Evans, 2001; Sweller, 1988).

Nor is there clear evidence that the interactivity prevalent in most recreational computer games is applicable to learning. The enthusiasm for educational games among some commentators rests on the possibility of harnessing the high levels of engagement and motivation reported by many game players to motivate students to learn. Although the idea has excited interest for many years, and there is some evidence that highly modified game-based approaches can support effective learning (Dede, 2005), research into how to design games that foster deep learning is inadequate (Moreno & Mayer, 2005). Furthermore, the substantially greater popularity of games amongst males compared to females (Kennedy *et al.*, 2006; Kvavik *et al.*, 2005) may limit the appeal of games to all learners. This is not to say that educational games might not be effective, but simply questions the assumption that their apparent popularity in everyday life makes them directly and unproblematically applicable to education.

Generalisations about the ways in which digital natives learn also fail to recognise cognitive differences in young people of different ages and variation within age groups.

Cognitive psychologists have studied the level and range of skills exhibited at different ages (Berk, 2006; Carlson & Sohn, 2000; Mityata & Norman, 1986). The notable differences identified throughout the key stages of infancy, early childhood, middle childhood and adolescence are significant for the digital native debate. For example, research findings have identified the developing capacity of short-term memory (Cowan, Nugent, Elliott, Ponomarev & Saults, 1999). As this capacity increases with age, so too do children's abilities to scan information more quickly, apply strategies to transform it more rapidly, hold more information within memory and move between tasks more easily. Thus, differences across the developmental stages need to be considered when making claims about the level of skills 'young people' have and their ability to successfully utilise these when interacting with ICTs.

Furthermore, the claim that there might be a particular learning style or set of learning preferences characteristic of a generation of young people is highly problematic. Learning style theories (cf. Jonassen & Grabowski, 1993; Kolb, 1984) do differentiate between different preferences learners might have and different approaches they might adopt, but these are not seen as static, nor are they generalisable to whole populations. Such theories acknowledge significant variability between individuals. Research also shows that students change their approach to learning depending on their perception of what a task requires and their previous success with a particular approach (Biggs, 2003; Ramsden, 1992). To attribute a particular learning style or even general preferences to a whole generation is thus questionable.

In this section, we have examined the key assumptions underlying the claim that the generation of young people born between 1980 and 1994 are 'digital natives'. It is apparent that there is scant evidence to support this idea, and that emerging research challenges notions of a homogenous generation with technical expertise and a distinctive learning style. Instead, it suggests variations and differences within this population, which may be more significant to educators than similarities.

Some commentators might still argue that regardless of whether the digital native phenomenon is a generational trait or whether it is more due to exposure to ICTs, the education of tech-savvy students is still a major issue for education. This second prominent claim in the debate, that education must fundamentally change to accommodate digital natives' interests, talents and preferences, therefore requires exploration.

On arguments for fundamental changes in education

The claim we will now examine is that current educational systems must change in response to a new generation of technically adept young people. Current students have been variously described as disappointed (Oblinger, 2003), dissatisfied (Levin & Arafeh, 2002) and disengaged (Prensky, 2005a). It is also argued that educational institutions at all levels are rapidly becoming outdated and irrelevant, and that there is an urgent need to change what is taught and how (Prensky, 2001a; Tapscott, 1998). For example, Tapscott (1999) urges educators and authorities to '[g]ive students the tools, and they will be the single most important source of guidance on how to make their schools

relevant and effective places to learn' (p. 11). Without such a transformation, commentators warn, we risk failing a generation of students and our institutions face imminent obsolescence.

However, there is little evidence of the serious disaffection and alienation among students claimed by commentators. Downes' (2002) study of primary school children (5–12 years old) found that home computer use was more varied than school use and enabled children greater freedom and opportunity to learn by doing. The participants did report feeling limited in the time they were allocated to use computers at school and in the way their use was constrained by teacher-directed learning activities. Similarly, Levin and Arafeh's (2002) study revealed students' frustrations at their school Internet use being restricted, but crucially also their recognition of the school's *in loco parentis* role in protecting them from inappropriate material. Selwyn's (2006) student participants were also frustrated that their freedom of use was curtailed at school and 'were well aware of a digital disconnect but displayed a pragmatic acceptance rather than the outright alienation from the school that some commentators would suggest' (p. 5).

This evidence points to differences in the ways young people use technology inside and outside of school, and suggests that school use of the Internet can be frustrating, but there is little basis to conclude that these differences are causing widespread and profound disengagement in learning. Rather, they tell us that technology plays a different role in students' home and school lives. This view is supported by research in postcompulsory education, indicating that students are not clamouring for greater use of technology (Kvavik *et al.*, 2004; Lohnes & Kinzer, 2007). These studies demonstrate the need to be much more careful about the views we ascribe to young people about technology.

Furthermore, questions must be asked about the relevance to education of the everyday ICTs skills possessed by technically adept young people. For example, it cannot be assumed that knowing how to look up 'cheats' for computer games on the Internet bears any relation to the skills required to assess a website's relevance for a school project. Indeed, existing research suggests otherwise. When observing students interacting with text obtained from an Internet search, Sutherland-Smith (2002) reported that many were easily frustrated when not instantly gratified in their search for immediate answers and appeared to adopt a 'snatch and grab philosophy' (p. 664). Similarly, Eagleton, Guinee and Langlais (2003) observed middle-school students often making 'hasty, random choices with little thought and evaluation' (p. 30).

Such research observes shallow, random and often passive interactions with text, which raise significant questions about what digital natives can actually do as they engage with and make meaning from such technology. As noted by Lorenzo and Dziuban (2006), concerns over students' lack of critical thinking when using Internet-based information sources imply that 'students aren't as net savvy as we might have assumed' (p. 2). This suggests that students' everyday technology practices may not be directly applicable to academic tasks, and so education has a vitally important role in fostering information literacies that will support learning.

In summary, calls for a dramatic shift from text-based to multimedia educational resources, the increased use of computer games and simulations, and a move to constructivist approaches that emphasise student knowledge creation, problem solving and authentic learning (Brown, 2000; Oblinger, 2004; Tapscott, 1999) based solely on the supposed demands and needs of a new generation of digital natives must be treated with caution. This is not to discount other arguments made for changes to education that are based on theory and supported by clear research evidence, but we suggest that the same standards must be met before radical change is made on the basis of the digital native idea.

Discussion

Our analysis of the digital native literature demonstrates a clear mismatch between the confidence with which claims are made and the evidence for such claims. So, why have these claims gained such currency? Put another way, why have these arguments repeatedly been reproduced as if they were supported by empirical evidence? An examination of the nature of the 'debate' itself offers some clues.

Cohen's (1972) notion of a 'moral panic' is helpful in understanding the form taken by the digital natives debate. In general, moral panics occur when a particular group in society, such as a youth subculture, is portrayed by the news media as embodying a threat to societal values and norms. The attitudes and practices of the group are subjected to intense media focus, which, couched in sensationalist language, amplifies the apparent threat. So, the term 'moral panic' refers to the form the public discourse takes rather than to an actual panic among the populous. The concept of moral panic is widely used in the social sciences to explain how an issue of public concern can achieve a prominence that exceeds the evidence in support of the phenomenon (see Thompson, 1998).

In many ways, much of the current debate about digital natives represents an academic form of moral panic. Arguments are often couched in dramatic language, proclaim a profound change in the world, and pronounce stark generational differences. These characteristics are exemplified in the followed quote from Prensky (2001a), but are also evident throughout much of the digital natives literature:

Today's students have not just changed incrementally from those of the past ... A really big discontinuity has taken place. One might even call it a 'singularity'—an event which changes things so fundamentally that there is absolutely no going back. (p. 1)

Such claims coupled with appeals to common sense and recognisable anecdotes are used to declare an emergency situation, and call for urgent and fundamental change.

Another feature of this 'academic moral panic' is its structure as a series of strongly bounded divides: between a new generation and all previous generations; between the technically adept and those who are not; and between learners and teachers. A further divide is then created between those who believe in the digital native phenomenon and

those who question it. Teachers who do not change their practices are labelled as 'lazy' and 'ineffective' (Prensky, 2001a). Those who refuse to recognise what is described as an inevitable change are said to be in denial, resistant and out of touch, and are portrayed as being without legitimate concerns (Downes, 2007; Tapscott, 1998).

Thus, the language of moral panic and the divides established by commentators serve to close down debate, and in doing so allow unevidenced claims to proliferate. Not only does this limit the possibility for understanding the phenomenon, it may also alienate the very people being urged to change. Teachers, administrators and policymakers have every right to demand evidence and to expect that calls for change be based on well-founded and supported arguments. As is evident from the review in this paper, many of the arguments made to date about digital natives currently lack that support.

Without critical rational discussion, little progress can be made towards a genuine debate about digital natives. Sceptics can highlight the lack of empirical evidence to dismiss the notion of digital natives as hyperbole. Advocates making claims with little evidence are in danger of repeating a pattern seen throughout the history of educational technology in which new technologies promoted as vehicles for educational reform then fail to meet unrealistic expectations (Cuban, 2001).

Neither dismissive scepticism nor uncritical advocacy enable understanding of whether the phenomenon of digital natives is significant and in what ways education might need to change to accommodate it. As we have discussed in this paper, research is beginning to expose arguments about digital natives to critical enquiry, but much more needs to be done. Close scrutiny of the assumptions underlying the digital natives notion reveals avenues of inquiry that will inform the debate. Such understanding and evidence are necessary precursors to change.

Conclusion

The claim that there is a distinctive new generation of students in possession of sophisticated technology skills and with learning preferences for which education is not equipped to support has excited much recent attention. Proponents arguing that education must change dramatically to cater for the needs of these digital natives have sparked an academic form of a 'moral panic' using extreme arguments that have lacked empirical evidence.

The picture beginning to emerge from research on young people's relationships with technology is much more complex than the digital native characterisation suggests. While technology is embedded in their lives, young people's use and skills are not uniform. There is no evidence of widespread and universal disaffection, or of a distinctly different learning style the like of which has never been seen before. We may live in a highly technologised world, but it is conceivable that it has become so through evolution, rather than revolution. Young people may do things differently, but there are no grounds to consider them alien to us. Education may be under challenge to change, but it is not clear that it is being rejected.

The time has come for a considered and disinterested examination of the assumptions underpinning claims about digital natives such that researchable issues can be identified and dispassionately investigated. This is not to say that young people are not engaged and interested in technology and that technology might not support effective learning. It is to call for considered and rigorous investigation that includes the perspectives of young people and their teachers, and genuinely seeks to understand the situation before proclaiming the need for widespread change.

References

- Berk, L. E. (2006). *Child development*. Boston, MA: Pearson.
- Biggs, J. (2003). *Teaching for quality learning at university*. Buckingham, UK: OUP.
- Brown, J. S. (2000). Growing up digital: how the Web changes work, education, and the ways people learn. *Change, March/April*, 10–20.
- Carlson, R. A. & Sohn, M-Y. (2000). Cognitive control of multistep routines: information processing and conscious intentions. In S. Mondell and J. Driver (Eds), *Control of cognitive processes: attention and performance XV111* (pp. 443–464). Cambridge, MA: The MIT Press.
- Cohen, S. (1972). *Folk devils and moral panics*. London: MacGibbon & Kee.
- Cowan, N., Nugent, L. D., Elliott, E. M., Ponomarev, I. & Saults, J. S. (1999). The role of attention in the development of short-term memory: age differences in the verbal span of apprehension. *Child Development, 70*, 1082–1097.
- Cuban, L. (2001). *Oversold and underused: computers in the classroom*. Cambridge, MA: Harvard University.
- Dede, C. (2005). Planning for neomillennial learning styles: implications for investments in faculty and technology. In D. Oblinger & J. Oblinger (Eds), *Educating the Net generation* (pp. 15.1–15.22). Boulder, CO: EDUCAUSE. Retrieved March 31, 2006, from <http://www.educause.edu/educatingthenetgen>
- Downes, S. (2007). Places to go: Google's search results for the 'Net generation'. *Innovate, 3, 4*. Retrieved June 27, 2007, from <http://www.innovateonline.info/index.php?view=article&id=455>
- Downes, T. (2002). Blending play, practice and performance: children's use of computer at home. *Journal of Educational Enquiry, 3, 2*, 21–34.
- Eagleton, M. B., Guinee, K. & Langlais, K. (2003). Teaching Internet literacy strategies: the hero inquiry project. *Voices from the Middle, 10, 3*, 28–35.
- Frاند, J. (2000). The information-age mindset: changes in students and implications for higher education. *EDUCAUSE Review, 35*, September–October, 14–24.
- Gaston, J. (2006). Reaching and teaching the digital natives. *Library Hi Tech News, 23, 3*, 12–13.
- Gros, B. (2003). The impact of digital games in education. *First Monday, 8, 7*. Retrieved February 21, 2007, from http://www.firstmonday.org/issues/issue8_7/xyzgros/index.html
- Howe, N. & Strauss, W. (2000). *Millennials rising: the next great generation*. New York: Vintage.
- Howe, N., & Strauss, W. (2003). *Millennials go to college*. Washington, DC: American Association of Collegiate Registrars and Admissions Officers.
- Jonassen, D. & Grabowski, B. L. (1993). *Handbook of individual differences, learning and instruction*. Hillsdale, NJ: Lawrence Erlbaum.
- Kennedy, G., Krause, K., Judd, T., Churchward, A. & Gray, K. (2006). *First year students' experiences with technology: are they really digital natives?* Melbourne, Australia: University of Melbourne. Retrieved April 10, 2007, from http://www.bmu.unimelb.edu.au/research/munatives/natives_report2006.rtf
- Kolb, D. A. (1984). *Experiential learning: experience as the source of learning and development*. Englewood Cliffs, NJ: Prentice-Hall.
- Kvavik, R. B., Caruso, J. B. & Morgan, G. (2004). *ECAR study of students and information technology 2004: convenience, connection, and control*. Boulder, CO: EDUCAUSE Center for Applied Research.

- Retrieved February 21, 2007, from <http://www.educause.edu/ir/library/pdf/ers0405/rs/ers0405w.pdf>
- Kvavik, R. B. (2005). Convenience, communication, and control: How students use technology. In D. G. Oblinger & J. L. Oblinger (Eds.), *Educating the net generation* (pp. 7.1–7.20). Boulder, CO: EDUCAUSE. Retrieved May 27, 2007, from <http://www.educause.edu/educatingthenetgen>
- Lee, L. (2005). Young people and the Internet: from theory to practice. *Nordic Journal of Youth Research*, 13, 4, 315–326.
- Lenhart, A., Madden, M. & Hitlin, P. (2005). Teens and technology: Youth are leading the transition to a fully wired and mobile nation. Washington DC: Pew Internet & American Life Project.
- Levin, D. & Arafeh, S. (2002). *The digital disconnect: the widening gap between Internet-savvy students and their schools*. Washington DC: Pew Internet & American Life Project. Retrieved April 10, 2007, from http://www.pewinternet.org/report_display.asp?r=67
- Levin, D., Richardson, J., & Arafeh, S. (2002). Digital disconnect: students' perceptions and experiences with the Internet and education. In P. Baker & S. Rebelsky (Eds), *Proceedings of ED-MEDIA, World Conference On Educational Multimedia, Hypermedia and Telecommunications* (pp. 51–52). Norfolk, VA: Association for the Advancement of Computing in Education.
- Livingstone, S. & Bober, M. (2004). Taking up online opportunities? Children's use of the Internet for education, communication and participation. *E-Learning*, 1, 3, 395–419.
- Lohnes, S. & Kinzer, C. (2007). Questioning assumptions about students' expectations for technology in college classrooms. *Innovate*, 3, 5. Retrieved June 27, 2007, from <http://www.innovateonline.info/index.php?view=article&id=431>
- Long, S. A. (2005). What's new in libraries? Digital natives: if you aren't one, get to know one. *New Library World*, 106, 3/4, 187.
- Lorenzo, G. & Dziuban, C. (2006). Ensuring the Net generation is Net savvy. EDUCAUSE Learning Initiative Paper 2. Boulder, CO: EDUCAUSE. Retrieved May 27, 2007, from <http://www.educause.edu/ir/library/pdf/ELI3006.pdf>
- McHale, T. (2005). Portrait of a digital native. *Technology and Learning*, 26, 2, 33–34.
- McNeely, B. (2005). Using technology as a learning tool, not just a cool new thing. In D. Oblinger & J. Oblinger (Eds), *Educating the Net generation* (pp. 4.1–4.10). Boulder, CO: EDUCAUSE. Retrieved March 31 2006, from <http://www.educause.edu/educatingthenetgen>
- Mityata, Y. & Norman, D. A. (1986). Psychological issues in support of multiple activities. In D. A. Norman & S. W. Draper (Eds), *User centred design* (pp. 265–284). New York: Lawrence Erlbaum.
- Moreno, R. & Mayer, R. E. (2005). Role of guidance, reflection and interactivity in an agent-based multimedia game. *Journal of Educational Psychology*, 97, 1, 177–128.
- Oblinger, D. (2003). Boomers, Gen-Xers and Millennials: understanding the new students. *EDUCAUSE Review*, 38, 4, July/August, 37–47.
- Oblinger, D. (2004). The next generation of educational engagement. *Journal of Interactive Media in Education*, 8. Retrieved June 27, 2007, from <http://www-jime.open.ac.uk/2004/8/oblinger-2004-8-disc-t.html>
- Oblinger, D. & Oblinger, J. (2005). Is it age or IT: first steps towards understanding the net generation. In D. Oblinger & J. Oblinger (Eds), *Educating the Net generation* (pp. 2.1–2.20). Boulder, CO: EDUCAUSE. Retrieved March 31, 2006, from <http://www.educause.edu/educatingthenetgen>
- Oliver, B. and Goerke, V. (2007). Australian undergraduates' use and ownership of emerging technologies: implications and opportunities for creating engaging learning experiences for the Net generation. *Australasian Journal of Educational Technology*, 23, 2, 171–186. Retrieved June 27, 2007 from <http://www.ascilite.org.au/ajet/ajet23/oliver.html>
- Prentsky, M. (2001a). Digital natives, digital immigrants. *On the Horizon*, 9, 5, 1–6.
- Prentsky, M. (2001b). Digital natives, digital immigrants, part II. Do they really think differently? *On the Horizon*, 9, 6, 1–6.
- Prentsky, M. (2005a). Engage me or enrage me. *EDUCASE Review*, 40, 5, September/October, 61–64.

- Prensky, M. (2005b). Listen to the natives. *Educational Leadership*, 63, 4, 8–13.
- Ramsden, P. (1992). *Learning to teach in higher education*. London: Routledge.
- Rubinstein, J., Meyer, D. E. & Evans, J. E. (2001). Executive control of cognitive processes in task switching. *Journal of Experimental Psychology: Human Perception and Performance*, 27, 4, 763–797.
- Selwyn, N. (2006). Exploring the 'digital disconnect' between net-savvy students and their schools. *Learning, Media and Technology*, 31, 1, 5–17.
- Skiba, D. J. (2005). The millennials: have they arrived at your school of nursing? *Nursing Education Perspectives*, 27, 3, 370.
- Sutherland-Smith, W. (2002). Weaving the literacy Web: changes in reading from page to screen. *The Reading Teacher*, 55, 7, 662–669.
- Sweller, J. (1988). Cognitive load during problem solving: effects on learning. *Cognitive Science*, 12, 2, 257–285.
- Tapscott, D. (1998). *Growing up digital: the rise of the Net generation*. New York: McGraw-Hill.
- Tapscott, D. (1999). Educating the Net generation. *Educational Leadership*, 56, 5, 6–11.
- Thompson, K. (1998). *Moral panics*. London: Routledge.
- Windham, C. (2005). Father google & mother IM: confessions of a net gen learner. *EDUCAUSE Review*, 40, 5, 42–59.