Technological Literacy Seminar 16 May 2011 DPU – A review of Definitions

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The term technological literacy has been adopted widely over the previous two decades across areas of concern spanning state and corporate interest groups, academic areas and cultural and social organisations (Kahn & Kellner 2006: 253).

Varying interests have led to equally diverse interpretations as to what technological literacy means or can be. On the face of it this is perhaps not surprising as both literacy and technology are terms open to for example political and educationally debate (Keirl 2006: 82).

One of the more marked origins of the term lies in governmental objectives to ensure the proliferation of adequate computer skills for knowledge workers in the workplace. A prominent example of this is the report *"A Nation at Risk"*, issued by President Ronald Reagan's Department of Education in 1983 (Waks 2006: 277).

A review of the literature confirms that the debate about technological literacy has been centred on the development of curricula and the education of technological literate citizens (Yawson 2010: 7). Including these, a significant portion of the literature considers the philosophical and historical underpinnings of the term (see for example Dyrenfurth 1991; Hayden 1989; Jenkins 1997; Lewis and Gagel 1992; Petrina 2000; Selfe 1999; Todd 1991; Waetjen 1993.-quoted (Yawson 2010: 3).

The term exists alongside neighbouring / related areas of interest such as Scientific or Computer literacy (see for example OECD 1999).

Given the varieties of technology and the complexities of their use and understanding, authors though the literature typically attempts to clarify a particular notion of what technological literacy is after first attempting to understand the bigger picture (Liddament 1994: 198). Consequently there have been countless efforts to define it with the result that: "Technological

literacy is a term of little meaning and many meanings" (Todd 1991 quoted in Kahn & Kellner 2006: 255).

Authors in generally ascribe multiple dimensions to their definitions of technological literacy. For example, the National Academy of Engineering (NAE) expresses it as encompassing: “knowledge, ways of thinking and acting, and capabilities” (Pearson& Young 2002).

A widely quoted version from International Technology Education Association (ITEA) taken as the ability to “use, manage, assess, and understand technology” (ITEA 2000: 242; Rose et al. 2004: 1). They stress the importance of being able to think about technological issues from various perspectives and to be able to appreciate the “interrelationships between technology and individuals, society, and the environment” (TfAAP and ITEA 1996: 11). They have developed their propositions into a series of standards that outline how to acquire technological literacy and what goals must be met at different grades within a school curriculum.

Another definition clarifying multiple dimensions is described through the South Australian Curriculum Standards and Accountability Framework (SACSA), in which it is "the operational, the cultural, and the critical " that are highlighted which are then supported through interrelated activities of "critiquing, designing, and making" (DETE 2001 quoted in Keirl 2006: 97).

Fourez for example takes a multiple social viewpoint in which technical literacy pursues three goals: “individual autonomy; communication with others; and the management of situations” (Fourez 1997: 904).

There is a dominant view that technological literacy involves the ability to understand interrelations between areas of influence. Rose for example refers to relations between “the individual, technology, environment,and society” (Rose 2007: 42) where as Wajcman, describes "a seamless web or network combining artifacts, people, organizations, cultural meanings and knowledge" (Wajcman 2004: 106. quoted in Kahn & Kellner 2006: 255).

Definitions are also seen to follow more specific interests.

Aligned with the distribution and manipulation of information it becomes "the ability to use digital technologies, communication tools, and/or networks to solve information problems in order to function in an information society" (Brasley 2006: 7).

Taken in relation to learning it becomes “the capability as a life-long learner to use, manage and assess the impact of technology and understand the technological nature of our society” (Deal 2002 quoted Baker 2008: 16).

Or related to ability it is perceived as "the acquisition of the skills necessary to make effective use of the various forms of technology encountered in the modern world" (Dow 2006: 246). Here the focus is on the passing on of previously existing knowledge through curricula that are seen as adopting what Dow calls an “expert transmission' skills-based model of teaching” (Dow 2006: 246).

Several authors point towards the inclusion of design as a useful parameter whether through an understanding of its nature and implications (Mitcham & Holbrook 2006: 106) as well as a means through which to approach technological engagements for the purpose of "problem solving, inventing and designing, and troubleshooting" (Munby, Russell & Martin quoted Baker 2008: 16).

Ideas about the rate of technological development transforming our world and a technologically uncertain future are perhaps not surprisingly reoccurring themes amongst claims for the need to become technologically literate.

For some it is about the kinds of "technological knowledge and skills citizens should have and will need in the future" (Cajas 2001: 719) and even include an understanding of the political and educational influences upon technological change (Kahn & Kellner 2006: 258). Within these views there are expressed notions of all encompassing change and alienation affecting "all facets of life and behaviour" in which technological literacy becomes the only means for "individuals to functions effectively" (Yawson 2010: 10). Dakers is a leading proponent of such views and argues that "[w]e need to develop a new language, a new literacy, in order to both understand our brave new world, and learn how to live a meaningful existence in it” (Dakers 2006: 1).

Related to the definitions of technological literacy are descriptions of what it is to be technologically literate. These are equally problematic as there is no single blueprint or prescription for what is varying at very least in terms of the socio-cultural context they apply to (Ingerman & Collier-Reed 2011: 138).

Garmire and Pearson in Tech Tally (2006) provide a three dimensional view that includes (1) knowledge, (2) capability and (3) critical thinking and decision-making.

"First, a technologically literate person must have a certain amount of basic knowledge about technology. Second, a technologically literate person should have some basic technical capabilities, such as being able to work with a computer and to identify and fix simple problems in the technological devices used at home and in the office. More generally, he or she should able to employ an approach to solving problems that relies on aspects of a design process.

.....And third, a technologically literate person should be able to think critically about technological issues and act accordingly." Garmire Pearson (2006): 21)

Being technologically literate is also expressed in terms of relations with the complexities of the world.

Yawson refers to technological literacy as offering people the tools to "engage intelligently and conscientiously in the world around them" (Yawson 2010: 5) and Michael to citizens being "embroiled in a complex process of ensembling" (Michael 2006: 61).

Authors such as these express technological literacy in the wider context of being more than the acquisition of any particular skill but related to how we live our life.

We are seen to exist within a technologically mediated world in which it is particularly the young whose experiences become dependent upon the nature of technology. Technological literacy becomes "an awareness of the impact of technology, both desirable and undesirable, upon humans at the level of both the individual and society" (Dow 2006: 245)

This impact is considered in a political sense through the use of ideas like empowerment and democratisation (Dow 2006: 246) that lead to the need for an alternative form of pedagogy and debate (Dakers 2005).

Kahn & Kellner take this view in which technological literacy allows the means to “understand. critique, and transform the oppressive social and cultural conditions in which they live, as they become ecologically informed , ethical, and transformative subjects as opposed to objects of technological domination and manipulation" (Kahn & Kellner 2006: 268). They go on to say that this can be achieved through "producing multiple oppositional literacies for critical thinking, reflection, and the capacity to engage in the creation of discourse, cultural artifacts, and political action amidst widespread technological revolution" (Kahn & Kellner 2006: 268).

Michael points to the difficulty of assessing or valuing such impact because of it being implicit within other concerns such as "a commitment to discrimination, to improvement of the world, to criticism, creativity, and autonomy" (Michael 2006: 56).

Technological literacy becomes a case of clarifying the impact of technology from different perspectives. Thomas and Knezek attempt a comprehensive definition explaining technological literacy as: "…demystifying technology through conceptual understandings of the underlying science and mathematics principles, operational competence with modern technology systems, the ability to evaluate and use a variety of common technology applications, the ability to innovate and invent ways of applying technology in challenging new situations, an awareness of technology-related careers and of factors critical to success in those careers, and understanding

of and sensitivity to societal issues related to technology" (Thomas & Knezek 1995: 1,2 - quoted Yawson 2010 : 6).

Generally technologically literate person is seen as one who is able to make sense of changes in society.

This aligns with authors who adopt a historic viewpoint to understand how technology has shaped the world and in which being technological literate means accepting that history could have been different (Fourez 1997: 919).

Goodson and co authors place these concerns on the shoulders of people in decision making positions in which they must answer the question: “If I decide to deploy a technology in a certain way, what might be the potential impact on the environment, on the culture of the people using the technology, and on the global society?” (Goodson et al 2007: 11).

Technological literacy becomes so much a part of living in the changing world that claims also stretch as far as "Technological literacy should not be seen as a discipline, but as a ‘language of life’ where every citizen will need to understand in order to be able to communicate" (Yawson 2010: 11).

Even though many authors have considered technological literacy within a broad context it remains a term affiliated up until now to a few key areas notably the use of IT and the development of non vocational curricula. One of its shortcomings (and one I hope we will address during the seminar) is that it has “not been placed within the broader context of all technologies and also devoid of the current debate concerning the epistemology of practical knowledge" (Yawson 2010: 3).

References

Baker J (2008). Submitted Doctoral Thesis. *Exploring Technological Literacy - Middle School Teachers’ Perspectives. WALDEN UNIVERSITY*, 2008, 177 pages; 3342498

Brasley, S. (2006). Building and using a tool to assess info and tech literacy. *Computers in Libraries, 26*(5), 6.

Cajas F 2001. The science/technology interaction: Implications for science literacy. *Journal of Research in Science Teaching* 38(7):715-729.

Dakers, J. R. (2005). Technology education as solo activity or socially constructed learning. *International Journal of Technology and Design Education, 15*, 73–89.

Dakers, J. R. (2006). Introduction: Defining technological literacy. In J. R. Dakers (Ed.), *Defining technological literacy: Towards an epistemological framework* (pp. 1–2). New York, NY: Palgrave Macmillan.

Deal, W. (2002). Making the connection: Technological literacy and technological assessment. *The Technology Teacher, 61*(7), 16.

Dow W (2006). Implicit Theories: Their Impact on Technology, In J. R. Dakers (Ed.), Defining technological literacy: Towards an epistemological framework (pp. 239- 250). New York, NY: Palgrave Macmillan,

Dyrenfurth, M. J. (1991). Technological literacy synthesized. In M. J. Dyrenfurth & M. R.

Kozak (Eds.), *Technological literacy* (pp. 138–186). Peoria, IL: Glencoe, McGraw-Hill.

Dyrenfurth, M. J. (1991). Technological literacy synthesized. In M. J. Dyrenfurth & M. R. Kozak (Eds.), *Technological literacy* (pp. 138–186). Peoria, IL: Glencoe, McGraw-Hill.

Fourez, G (1997). Scientific and technological literacy as a social practice. *Social Studies of Science* 27: 903–936.

Gamire, E., & Pearson, G. (Eds.). (2006). *Tech tally: Approaches to assessing technological literacy. Committee on Assessing Technological Literacy, National Academy of Engineering, National Research Council.* Washington, DC: National Academy Press.

Goodson, C., Miertschin, S., Faulkenberry, L., Stewart, B., Johnson, C.(2007). Integrating technology: Our culture, our students. (2007) *ASEE Annual Conference and Exposition, Conference Proceedings*.

Hayden, M. (1989). What is technological literacy? *Bulletin of Science, Technology and Society*, 119, 220–233.

Ingerman, A., Collier-Reed, B. (2010). Technological literacy reconsidered: a model for enactment. *International Journal of Technology and Design Education*, pp. 1-12.

ITEA. (2000*). Standards for technological literacy: Content for the study of technology*. Reston, VA: International Technology Education Association (ITEA).
Jenkins, E. W. (1997). Technological literacy: Concepts and constructs. *Journal of Technology Studies*, 23(1), 2–5.

Kahn R & Kellner D (2006). Reconstructing Technoliteracy: A Multiple Literacies Approach, In J. R. Dakers (Ed.), *Defining technological literacy: Towards an epistemological framework* (pp. 254- 273). New York, NY: Palgrave Macmillan,

Keirl S (2006). Ethical Technological Literacy as Democratic Curriculum Keystone , In J. R. Dakers (Ed.), *Defining technological literacy: Towards an epistemological framework* (pp. 81 - 102). New York, NY: Palgrave Macmillan,

Lewis, T., & Gagel, C. (1992). Technological literacy: A critical analysis. *Journal of Curriculum Studies*, 24(2), 117–138.

Liddament, T. (1994). Technological literacy: The construction of meaning. *Design Studies*, 15(2), 198–213.

M. R. Kozak (Eds.), *Technological literacy* (pp. 10–27). Peoria, IL: Glencoe, McGraw-Hill.

Michael M (2006). How to Understand Mundane Technology: New Ways of Thinking about Human-Technology Relations, In J. R. Dakers (Ed.*), Defining technological literacy: Towards an epistemological framework* (pp. 49–17). New York, NY: Palgrave Macmillan.

Mitcham C and Holbrook J B (2006). Understanding Technological Design , In J. R. Dakers (Ed.), *Defining technological literacy: Towards an epistemological framework* (pp. 105 - 120). New York, NY: Palgrave Macmillan,

Munby, H., Russell, T., & Martin, A.K. (2001). Teachers' knowledge and how it develops. In V. Richardson (Ed.), *Handbook of research on teaching* (pp. 877- 904). Washington, DC: American Educational Research Association.

OECD. (1999). *Measuring Student knowledge and Skills - A new framework for Assessment*. Paris: OECD.
Pearson, G., & Young, A. T. (Eds.). (2002). *Technically speaking: Why all Americans need to know more about technology. Committee on Assessing Technological Literacy, National Academy of Engineering, National Research Council*. Washington DC: National Academy Press.

Petrina, S. (2000). The politics of technological literacy. *International Journal of Technology and Design Education*, 10(2), 181–206.

Rose, L., Gallup, A., Dugger, W., & Starkweather, K. (2004). The second instalment of the ITEA/Gallup Poll and what it reveals as to how Americans think about technology. A Report of the Second Survey Conducted by the Gallup Organization for the International Technology Education Association (ITEA). http://www.iteaconnect.org/TAA/PDFs/GallupPoll2004.pdf Accessed on: 19 September 2011

Rose, M. A. (2007). Perceptions of technological literacy among science, technology, engineering, and mathematics leaders. *Journal of Technology Education*, 19(1), 35–52.

Selfe, C. L. (1999). *Technology and literacy in the twenty-first century: The importance of paying attention.* Carbondale, IL: Southern Illinois University Press.

Technology for All Americans Project, International Technology Education Association. (1996). *Technology for all Americans: A rationale and structure for the study of technology.* Reston, Va: International Technology Education Association.

Thomas, L. G., & Knezek, D. G. (1995). *Technology literacy for the nation and for its citizens*. Washington, DC: International Society for Technology in Education.

Todd, R. D. (1991). The natures and challenges of technological literacy. In M. J. Dyrenfurth & Waetjen, W. B. (1993). Technological literacy reconsidered. *Journal of Technology Education,* 4(2), 5–11.

Wajcman, J. (2004). *Technofeminism*. Malden, MA: Polity Preu

Waks L J (2006). Rethinking Technological Literacy for the Global Network, In J. R. Dakers (Ed.), *Defining technological literacy: Towards an epistemological framework* (pp. 275- 273). New York, NY: Palgrave Macmillan,

Yawson R 2010 - An epistemological framework for nanoscience and nanotechnology literacy. *International Journal of Technology and Design Education*. DOI: 10.1007/s10798-010-9145-1