Looking Back, to Look Forward: Using Traditional Cultural Examples to Explain Contemporary Ideas in Technology Education

Although the term *technology* means different things to different people, most would generally agree that it is about "stuff." For some it may be more complex than this, and for others it may simply involve using or studying high-tech gadgetry, such as computers and iPhones. Whatever your view, technology cannot occur without people, and therefore, values and culture are inherent influences on and features of technology. Understanding this interdependence between design and culture is a critical part of technology education. In order to know what one wants and needs for the future, it is important to have a good historical and cultural understanding of technological change. Although many countries include historical, societal, cultural, and environmental emphases in their technology curriculum, these can be lost in the drive to design, make, and create. The following article will provide justification and examples for these notions to be key parts of a technology program.

Over the last decade, the one thing that has been constant in education is change. Teachers are expected to cover more concepts, whilst addressing the ever-increasing diversity amongst their pupils. Technology education is no exception (de Vries, 2006). However, providing justification and examples for the inclusion of historical, societal, cultural, and environmental emphases may help teachers and teacher educators to see the validity of and ease with which they can include this crucial material. Including these approaches will allow students to utilise the wisdom of other generations and cultures in order to contemplate contemporary technological developments.

Technology Education

The term *technology*, although part of everyday language, means different things to different people. The majority of people identify technology with products such as computers, iPods, and iPhones (Jarvis & Rennie, 1996; Lawson, 2008). Advertisements referring to the "latest technology" reinforce this interpretation of the term. Upon contemplation, most people "can describe technology in general as the means by which human beings have sought and provided for their survival and enjoyment of life on this planet" (Burns, 1997, p. 16). People use technology, create technology, and do technology. It can be a noun, adjective, or verb. Undertaking technology can be seen as an age-old task of innovation and adaptation, which focuses not only on the product, but includes the processes by which technological products are developed and used (Lindgren, 2005).

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However technology education is perceived, it always involves something that people have made or done, and therefore, is inherently situated within a culture and its values. The place of values in technology education has been argued for decades (Layton, 1991; Pavlova, 2006; Prime, 1993). *Culture*, in this paper, is defined as the "relationship between a given group of people and their environment. It includes patterns of production and consumption and the beliefs, values and structures that maintain these patterns" (Kokko & Dillon, 2010). Foucault (2002) writes that understanding of the world is influenced by socio-cultural factors and discourses prevalent in each society, with an individual's actions being a response to their experience-based disposition and their specific surroundings.

Many technology curricula throughout the world acknowledge the importance of the relationship between history, society, and culture and technology. In an international study of six countries' technology curricula, the "history of technological developments" was found the most significant common content across all curricula (Rasinen, 2003).

The Swedish technology curriculum requires students to "be able to describe important factors in technological development, both in the past and present, and give some of the possible driving forces behind this" (Skolverket, 2000, as cited in Hallström & Gyberg, 2009, p. 4). The South African technology curriculum requires a third grade learner to "find out about the historical context when given a problem, need or opportunity related to structures, processing or systems and control" (Department of Education, Republic of South Africa, 2002, p.4 as cited in Hallström & Gyberg, 2009, p. 4). The New Zealand curriculum requires students to "to appreciate the socially embedded nature of technology and become increasingly able to engage with current and historical issues and to explore future scenarios" (Ministry of Education, 2007, p. 32). Despite many countries including cultural and societal aspects in their technology curriculum, for a variety reasons (time, lack of knowledge, and interest) these are frequently not covered (Mawson 1999).

Internationally, the last 20 years have been very turbulent for technology education (de Vries, 2006). There has been a great deal of change, and, for the most part, teachers have been expected to change both what and how they teach. For some this has been a breath of fresh air, but for many it has been an arduous undertaking (Lee, 2003a). Teachers often lack subject knowledge and understanding of the nature of teaching and learning involved in new subjects (Elton, 2006). Teachers have been expected to master a plethora of new terms and jargon, as well as translate their new curriculum into implementable classroom activities, often with limited access to resource materials (Rasinen et al., 2009; Stevens, 2006). This article demonstrates the ease with which contemporary technological notions can be linked to topical, local, and cultural products and issues.

The Need for Culturally Appropriate Resources

Two of the most frequent opening statements made in Australian public speeches are "we live in times of rapid social change" and "we are a multicultural society" (Jamrozik, Boland, & Urquhart, 1995). These phrases are not unique to Australia, as the cultural diversity of cities and nations is rapidly changing (Inglehart, 1997). And yet, we must question whether our teaching reflects these changes.

Providing historical and cultural examples will not only value students' cultural capital, but will also develop a broader understanding of technology (Lee & Waqavanua, 2008). An authentic learning environment allows students to construct knowledge using real world contexts and examples. In doing so, teachers will "close the gap between technology in the real world and technology education in schools" (Stein, McRobbie, & Ginns, 2001, p. 241). Children will be able to link news articles and items they see every day with concepts presented in the technology curriculum. Rather than seeing technology as something that is high-tech and foreign, e.g. the latest iPhone application, they can see that it is an age-old tradition of problem solving, adaptation, and modification to meet needs, whilst considering the consequences of one's actions.

The following section shows how traditional cultural and historical examples can be used to support contemporary technological concepts. A brief justification will be provided to validate use of the material.

Using Traditional Cultural and Historical Examples to Support Contemporary Technological Concepts

Students are usually very keen to construct (make or do) something when learning about technology and can become quickly frustrated when asked to think, discuss, and write (Lee, 2003b). Providing current topical examples, which highlight adverse consequences if this process is ignored, may help students see the value of undertaking more than just the practical nature of technology.

The students of today need to look at yesterday in order to design a better tomorrow (de Vries, 2006; Starkweather, 2006). Given that the majority of technology teachers and teacher educators are not educated as historians (Hallström & Gyberg, 2009), gathering historical cultural examples may need to be a shared responsibility. It is important, however, to "avoid the technological version of the 'Whig theory of history' in which the past is read as a sequence of steps leading inevitably to the accomplishments of today" (Winner, 1993, p. 370).

Being aware and researching the impact of historical events and the values placed on these by certain cultures ensures that contemporary designs are more viable. An example of the importance of this occurred in 2001, when a Chinese actress/fashion model on a New York assignment wore an outfit that looked like the Japanese imperial flag from World War II. This caused an international incident, as people in China, particularly those in Nanjing (who had suffered greatly during World War II), were deeply offended.

The difference between wisdom and out-of-date knowledge is often more a case of perspective; thus, much of the knowledge held by our forebears is lost. Decisions about which skills and information are valued enough to be passed on are always hotly debated, especially by those teachers close to retirement. The well known story of hunting the sabre-tooth tiger, where children were taught the fundamental skills of how to grab fish, club woolly horses, and scare sabre-tooth tigers even when (due to climate changes) these were no longer food sources, is a good example of this. (Peddiwell, 1939). On the other side of the argument, history is full of lost knowledge and skills, that, if "(re-)discovered" at a later time, prove to be very valuable. One such example is that of the skull trepanation, which occurred in Neolithic times about 7,000 years ago. This is the oldest known surgical procedure that involves drilling a circular hole into the skull. In Neolithic times flints or obsidian would have been used as the cutting edge of the tool, specific mushrooms may have provided antibiotic actions, and poppies served as analgesics (painkillers). Surgeons knew enough about the anatomy to know how far into the cranium they could operate, and they developed processes so that the patient remained still and the drilling procedure was so quick and precise that part of the skull could be removed but the brain matter below (dura) not penetrated. Archaeological evidence has shown that patients survived months or years after these operations, with skull fractures showing healing without evidence of inflammation and infection (Weber & Wahl, 2006). Trepanation also occurred 3,000 years ago in Egypt (El-Zawahry et al., 1997) and 2,000 years ago in Peru (Rifkinson-Mann, 1988). It appears, however, that this wisdom was not passed from culture to culture, but rather has been a process of lost knowledge, discovery, and rediscovery over the millennia.

Transferring, valuing, and financially benefiting from cultural knowledge leads to rich discussion points such as bio-piracy and bio-prospecting. Rich philosophical discussions can occur about the ethics of intellectual property (IP) and transference of sacred tribal wisdom. With the rapid increase in "charges of misappropriation or theft of traditional knowledge of the uses of plants" (Mgbeoji, 2001, pp. 163-164), examples are easily found. One is that of the Samoan Nonu plant, which is now being grown in numerous countries for its medicinal and anticancer properties.

Knowledge about power relationships lead to other philosophical and ethical discussions about how human actions and "developments" can have positive and negative influences on the social and natural world. For example, a boat with an outboard motor providing links between two islands may be seen as a much faster alternative to a traditional outrigger canoe. Trade, travel, and communication will be faster, but the tradeoff is noise, small oil slicks, and erosion caused by wakes. A once quiet, secluded island may now have a constant buzz, as boats with outboard motors move around islands. Is and/or should money be the deciding and driving force for adoption of technologies? This leads to discussions and debates about stakeholders' needs, perspectives, and rights.

Culture and design are always interwoven "as design does not take place in isolation but is embedded in its user's culture" (Moalosi, Popovic, & Hickling-Hudson, 2010, p. 1). Designers who focus on the intelligence and values of the users, rather than the intelligence and values placed on the technology, will produce meaningful innovations. "Innovation starts with people, not with enabling technologies, and the designers' main role is to mediate between technology and culture and to get ethics and aesthetics to technology" (Ross 2002, as cited by Moalosi, et al., 2010, p. 3).

Culture gives objects meaning and provides the rituals within which these objects are used and the values that are often reflected in their form and function (Press & Cooper, 2003). It has a large influence on how items are valued and used. It has been said that "technology is not a good traveller unless it is culturally calibrated" (Kaplan 2004, as cited in Moalosi, et al., 2010, p. 177). An example of this is a fofo`e, which is a traditional wooden Samoan tool used to peel bananas. Samoans use this tool to slit and remove the skin in seconds, and it has become an implement used as frequently as a knife and fork; yet, similar tools are rarely seen in countries where bananas, although eaten, are not peeled in vast numbers.

Figure 1
Fofo`e being used to peel bananas

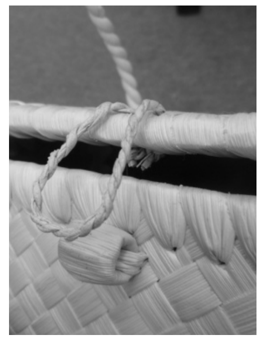
When using a thesaurus to find synonyms for the word *man-made*, the following words can be found: counterfeit, ersatz, factitious, false, manufactured, not genuine, plastic, synthetic, and unnatural. Although these terms are accurate it is surprising how many create a negative emotion. Technology can be likened to Frankenstein's monster, grown beyond control (Ellul, 1965), or as the latest "must have" (gadetphilia) (Lee, 2009). Drengson (2010) identifies these emotions as being part of the four stages of technological development, these being *technological anarchy*, *technophilia*, *technophobia*, and, finally, *appropriate technology*.

Technology is often personified by the media. We read how "machines steal jobs" and "cell phones cause car accidents." Although these phrases appear quite harmless, they give the impression that society is powerless. These media reports create the opportunity for discussions as to whether society has the power "to modify technology to fit people, rather than modifying people to fit technology" (Marshall, 1996, pp. 65, as cited in Oudshoorn, 2003, p.335). This leads to notions of haecceity (Collinson, 1988), hylomorphism, technocracy, phenomenology, existentialism, techno-determinism, post-modernism, post-structuralism, social construction, somnambulism, social constructivism, deconstruction, and actor-network theory which are just a few technology related philosophies able to be "googled" and debated. Writings by Aristole, Hegel, Husserl, Ihde, Heidegger, Ellul, Winner, Wittgenstein, Mumford, Pinch, Biijker, Derrida, Latour, Mitcham, Vincenti, and deVries form a reference basis for technology philosophy.

With over 30 million Google results for the word *sustainability*, it is clear that this is a popular and well used concept. Triple bottom line philosophies (Elkington, 2004) and *Agenda 21*, which developed from the Brundland Report (WCED, 1987), have made sustainability not only the responsibility of individuals, but also of nations. Many new curricula expect teachers to incorporate aspects of sustainability within classroom practices. Traditional craft items are often excellent examples to show how products can be sustainably designed, as they are often made from the primary resources of their local environment (Kokko & Dillon, 2010). When one raw material is no longer available, another can be sourced and processes altered accordingly. In Samoa a very hard seed called a pu'a was traditionally used to form latches on bags. With increased tourism, alternatives were needed. A new technique developed that utilised the more commonly used pandanus leaf (as in Figure 2 on next page), thus saving the treasured pu'a resource.

Figure 2a
Latch using a pu'a

Figure 2b
Latch using the pandanus leaf



In 2007, 50% of the global population lived on less than $2 a day (income level has been adjusted for purchasing power) (Kaplinsky, 2011). Since the recent financial crisis the numbers living in absolute poverty has risen by over 60 million (United Nations, 2009). In trying to address this issue a number of different strategies relating to technology have been developed, these include *hard* and *soft technologies*, *intermediate technology*, *alternative technology*, *green technology*, and *appropriate technology*. Investigating appropriate technology requires a thorough understanding of the culture for which the product is to be manufactured, used, and, if possible, repaired or reused. In this way, the solution is an appropriate piece of technology that is designed to take into consideration social, cultural, ethical, and environmental, as well as, political and economic aspects of the community for which it is intended to be used. An example of this is a pump that can provide water for 100 Indonesian village families and is able to be cheaply made from locally bought components with spare parts able to be sourced from everyday items such as old tire tubes (http://www.youtube.com/watch?v=l_SwFN3z9lg). YouTube videos such as the one provided are excellent visual examples for students to see the impact this type of technology can have on people's lives.

Conclusion

Historical, societal, cultural, and environmental knowledge should enrich contemporary design theory and underpin creativity and innovation in technological practice. Providing relevant, topical, and cultural examples will allow students to link their everyday lives to new areas of learning. This article has provided a variety of international examples to explain contemporary concepts in technology education. These have been justified to highlight the practical relevance of this material for today's multicultural classes. Although there may be large cultural diversity within a class, utilizing the historical, societal, cultural, and environmental knowledge available from the community and media will enable a teacher (at any stage of their technology career) to make technology education come alive.

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References

Burns, J. (1997). Technology-intervening in the world. In J. Burns (Ed.), *Technology in the New Zealand curriculum: Perspectives on practice* (pp. 15-30). Palmerston North: Dunmore Press.

Collinson, D. (1988). *Fifty major philosophers: A reference guide*. London: Routledge.

de Vries, M. (2006). Two decades of technology education in retrospect. In M. de Vries & I. Mottier (Eds.), *International handbook of technology education* (pp. 3-11). Rotterdam: Sense Publishers.

Drengson, A. (2010). Four philosophies of technology. In C. Hanks (Ed.), *Technology and values: Essential readings* (pp. 26-37). Chichester, UK: Wiley-Blackwell Publishers.

El-Zawahry, M., Ramzy, A., El-Sahwi, E., Bahnasy, A., Khafaga, M., Rizk-Allah, M., et al. (1997). Surgery in Egypt. *Archives of surgery, 132*(7), 698-702.

Elkington, J. (2004). Enter the triple bottom line. In A. Henriques & J. Richardson (Eds.), *The Triple bottom line does it all add up? Assessing the sustainability of business and CSR* (pp. 1-16). London: Earthscan. (Reprinted from: 2005).

Ellul, J. (1965). *The technological society* (J. Wilkinson, Trans.). London J Jonathon Cape.

Elton, F. (2006). Technology education in Chile after nine years of implementation: From paper to classroom. In M. de Vries & I. Mottier (Eds.), *International handbook of technology education* (pp. 499-503). Rotterdam: Sense Publishers.

Foucault, M. (2002). *The order of things: An archaeology of the human sciences*: Brunner-Routledge.

Hallström, J., & Gyberg, P. (2009). Technology in the rear-view mirror: how to better incorporate the history of technology into technology education. *International Journal of Technology and Design Education, 21*(1), 3-17. doi: 10.1007/s10798-009-9109-5

Inglehart, R. (1997). *Modernization and postmodernization: Cultural, economic, and political change in 43 societies*. Princeton, New Jersey: Princeton Univ Press.

Jamrozik, A., Boland, C., & Urquhart, R. (1995). *Social change and cultural transformation in Australia*. Cambridge, UK: Cambridge Univ Press.

Jarvis, T., & Rennie, L. (1996). Perceptions about technology held by primary teachers in England. *Research in Science and Technological Education, 14*(1), 43-54.

Kaplinsky, R. (2011). Schumacher meets Schumpeter: Appropriate technology below the radar. *Research Policy, 40*(2), 193-203. doi: DOI: 10.1016/j.respol.2010.10.003

Kokko, S., & Dillon, P. (2010). Crafts and craft education as expressions of cultural heritage: Individual experiences and collective values among an international group of women university students. *International Journal of Technology and Design Education, 20*(4). doi: 10.1007/s10798-010-9128-2

Lawson, C. (2008). An ontology of technology: Artefacts, relations and functions. *Techne, 12*(1), 48-64.

Layton, D. (1991). *Aspects of national curriculum: Design and technology*. York: NCC.

Lee, K. (2003a). *What motivates teachers to teach the technology curriculum?* Paper presented at the TENZ Conference, Waikato University, New Zealand.

Lee, K. (2003b). So what do parents want and expect from a technology education programme? -An exploration. *International Journal of Technology and Design Education, 13*(2), 105-115.

Lee, K. (2009). Who has the ultimate control? In V. Wang (Ed.), *Handbook of research on e-learning applications for career and technical education: Technologies for vocational training* (pp. 747-763). Hershey, PA: IGI Global.

Lee, K., & Waqavanua, U. (2008). It is just two words! An investigation of two cultures' interpretations of two new curricula terms. *The International Journal of the Humanities, 6*(3), 117-121.

Lindgren, M. (2005). Technology and innovation as an attractive and crucial discipline for tomorrow. In L. Lindstrom (Ed.), *Technology education and new perspectives* (Vol. 14, pp. 127-143). Stockholm: Stockholm Institute of Educational Press (HLS Forlag).

Mawson , B. (1999). *In search of the missing strand: Technology and society*. Paper presented at the TENZ Conference, Auckland.
Mgbeoji, I. (2001). Patents and traditional knowledge of the uses of plants: Is a communal patent regime part of the solution to the scourge of bio piracy? *Indiana Journal of Global Legal Studies*, 163-186.
Ministry of Education. (2007). *The New Zealand Curriculum*. Wellington: Learning Media.
Moalosi, R., Popovic, V., & Hickling-Hudson, A. (2010). Culture-orientated product design. *International Journal of Technology and Design Education, 20*(2), 175-190.
Oudshoorn, N. (2003). The decline of the one-size-fits-all paradigm, or, how reproductive scientists try to cope with postmodernity. In D. MacKenzie & J. Wajcman (Eds.), *The social shaping of technology* (2nd ed. Pp. 325-340). Philadelphia: Open University Press.
Pavlova, M. (2006). Comparing perspectives: Comparative research in technology education. In M. de Vries & I. Mottier (Eds.), *International handbook of technology education* (pp. 19-32). Rotterdam, Netherlands: Sense.
Peddiwell, A. J. (1939). *The sabre-tooth curriculum.* New York.: McGraw-Hill.
Press, M., & Cooper, R. (2003). *The design experience: the role of design and designers in the twenty-first century*. Burlington: Ashgate Publishing.
Prime, G. (1993). Values in Technology: approaches to learning. *Design and Technology Teaching, 26*(1), 30-36.
Rasinen, A. (2003). An analysis of the technology education curriculum of six countries. *Journal of Technology Education, 15*(1), 31-47.
Rasinen, A., Virtanen, S., Endepohls-Ulpe, M., Ikonen, P., Ebach, J., & Stahl-von Zabern, J. (2009). Technology education for children in primary schools in Finland and Germany: different school systems, similar problems and how to overcome them. *International Journal of Technology and Design Education, 19*(4), 367-379.
Rifkinson-Mann, S. (1988). Cranial surgery in ancient Peru. *Neurosurgery, 23*(4), 411-416.
Starkweather, K. (2006). A retrospective look at what was essential to technology education during the past 20 years. In M. de Vries & I. Mottier (Eds.), *International handbook of technology education* (pp. 13-17). Rotterdam: Sense Publishers.
Stein, S., McRobbie, C., & Ginns, I. (2001). Authentic programme planning in technology education. *International Journal of Technology and Design Education, 11*(3), 239-261.
Stevens, A. (2006). Technology teacher education and South Africa. In M. de Vries & I. Mottier (Eds.), *International handbook of technology education* (pp. 505-514). Rotterdam: Sense Publishers.

United Nations. (2009). The millennium development goals report (pp. 60). New York: United Nations.

WCED. (1987). Our common future (pp. 1-318). Oxford: United Nations World Commission on Environment and Development.

Weber, J., & Wahl, J. (2006). Neurosurgical aspects of trepanations from Neolithic times. *International Journal of Osteoarchaeology, 16*(6), 536-545.

Winner, L. (1993). Upon opening the black box and finding it empty: Social constructivism and the philosophy of technology. *Science, Technology, and Human Values, 18*, 362-378.