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Can Our Schools Deliver An Education In Technology?

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Abstract

The casual observer can be forgiven for concluding that today, more than ever before, most Australian High Schools have a significant commitment, driven essentially by interpretations of State policies, to teach and learn more task specific job skills at school particularly in technical areas. Not only do we witness media releases of the imperative of computers in schooling but most recently, the high profile campaign to shift a significant proportion of school students into technically grouped Trade/Vocational streams (specific job category skills training). Indeed, policies and programs such as 'ready for work' target middle school students themselves. These strategies, essentially similar to Educational Sloyd, (Anon, 1910) and those practiced in the mid 1900s (Gibson & Barlow, 2000), are occasionally highlighted as innovative.

However, at least two specific issues may be explored in response to the above scenario. Firstly, the issue of what constitutes an education in technology? Secondly, if as we are to believe, job security is a thing of the past, manufacturing labour markets are shifting out of Australia and ideas/academic economies are poised to replace traditional vocations (mostly yet to be invented), what ought constitute an education that readies adolescents for employment? If our schools interpret technology in the curriculum as essentially and superficially the two extremes of VET skills application or 'hightech' information technology user skills, and little more, could our State School systems be selling a lolly to our youth: popular and tastes good in the short term, but is it good for their wellbeing in the longer term? Have our schools beguiled our youth to a future that at best serves a very narrow labour market to the many and a level of technology understanding that lacks sufficient depth to confidently make informed decisions in life that has carriage through a range of career changes and lifestyle and employment circumstances? If in addition we consider the policy push to reduce technology teacher degrees to the same VET specific level of technology skills instruction (a model the profession fought hard to be rid of 30 years ago), what depth of understanding and capacity for global awareness can students in schools expect from their new technology teacher graduates?

Preamble

*"The industrial revolution laid the foundation of the transformation of the economy from agriculture to industry, with it, not only did living standards rise, but also the location of life changed, from rural communities to metropolitan megalopolises. The scientific revolution of the past century has resulted in the systemisation of change itself; the very process of processing new innovations has altered from isolated and independent inventors like Thomas Edison to huge research laboratories. Knowledge and information is being reproduced today like cars and steel were produced a hundred years ago. Those like Bill Gates who know how to produce knowledge and information better than others, reap the rewards, just as those who knew how to produce cars and steel a hundred years ago became magnates of that era."*¹

¹ Public Policy for a Knowledge Economy, remarks at the UK Department for Trade and Industry and Centre for Economic Policy Research, Joseph Stiglitz, Senior Vice President and Chief Economist, The World Bank Group, 27 January 1999.

In a recent paper presented by Dr Walker to NSW Technology Teachers in a State forum several futures issues were addressed. This paper draws on some of those futures and includes trend data from the United States, traditionally a glimpse into the near future (5-8 year outlook) for the Australian labour market. If its happening in America now, chances are it will soon happen in Australia too! Walker noted that, the world is entering a new phase, beyond the industrial revolution and the information revolution. Knowledge (particularly expressed by large employing corporations as innovative ideas economies) has become a valuable commodity and demand for knowledge has seen the growth of knowledge-intensive industries providing increasing levels of employment (Walker, 2000). He notes that the choices we make and how we choose to respond to the opportunities and challenges presented by a new world economic order will determine in the large part, the sort of society we shape for future generations of Australians.

What is Shaping or Driving this new International Order?

- Globalisation - you can't close off from the outside world; equally you can not ignore the fact that 50% of the world population can not compete in the global economy.
- Multinational corporations and world brands.
- Currency and financial markets
- Technology

Acting together these drivers have resulted in massive increases in human knowledge and opportunity to access knowledge, for some, and a relative increase in knowledge poverty for others. In this new economy the old paradigm of land, labour and capital as the factors of success have been replaced by ideas, speed and action as the critical success factors. We have moved from a period of periodic change to one of continuous change. (Walker, 2000)

VET in schools and TAFE in emerging technology teacher degrees are in policy, rhetoric and theory at least, if not evident in practice, based essentially on domestic perceptions and standards mostly at the regional and state level. National modules, modules developed from start nationally, appear to be rare in NSW. Nevertheless the majority of VET modules are domestically centred with the added inertia of funding and standards policies that are designed to slow down the capacities for TAFE providers to adapt their own module content and delivery hours to meet client needs. In relation to Walker's first driver of globalisation, VET in schools and Teacher training appears to have placed students of technology immediately at a disadvantage.

VET in Schools and Teacher training also appears to fail the test of having the structures and teaching framework that would enable them to easily move on from selling the 'lolly' to school students and parents of land, labour and capital employment areas. The sector would require a significant deconstruction to empower local VET providers to deliver a vocational education that develops among our youth and technology teachers ideas, speed and adaptation and actuation in various settings of change.

This is not an assault on vocational education nor on TAFE in schools and teacher training. It is a critical concern for the *type* of vocational education and training our education systems have chosen. It would appear that the choice in place today is quite

possibly, for a good part of it, what VET in schools and technology teacher training ought NOT be.

Recent studies published by the United States indicate a progressive decline in secondary students electing to study trade, agriculture and industrial vocational courses. At the same time they have increased significantly 'academic' course selections at senior school. The academic categories include health and child care, communication and information technologies and service sector vocations. The report notes,

From the 1980s to the mid-1990s, high school vocational coursetaking declined, as academic coursetaking increased Increases in high school graduation requirements ... and long-term trends for higher skill levels in the labor market are two potential factors related to the rise in academic coursetaking (National Centre for Education Statistics, 2000).

With the policy push for students to elect lower academic studies, in the context of the emerging labour market in Australia, the evidence suggests yet another 'lolly' has been dispensed into the educational diet of our future knowledge capital. It would seem we are gearing to dumb down just when we ought be smarting up! A problem not only for school students, but equally for technology teacher education.

Raising children who are well prepared to cope with life in a future world is not an easy task. In a 1996 study *Matching Science and Technology to Future Needs 2010*, the Australian Science Technology and Engineering Council (ASTEC) emphasised the need to increase scientific and technological literacy within the Australian Community.

ASTEC considers it essential to integrate the role of Science and Technology [S&T] in economic, social and environmental decision-making into the 21st. Century. This will require a greater community understanding of the role of S&T in society, which in turn will require improved S&T skills learned from childhood.

'Technacy', the technological equivalent of literacy and numeracy, is defined as competence in Science and Technology problem solving that develops the ability to integrate the human, social, environmental and technical aspects of technological issues or initiatives.

ASTEC recommends that as a priority the Minister for Science and Technology and the Minister for Employment, Education, Training and Youth Affairs, work with State and Territory governments to:

incorporate 'technacy' in primary and secondary school curricula and teaching practice across Australia.

Ref:<http://www.isr.gov.au/science/astec/astec/future/final/futureb.html>

Australia's economic growth, employment opportunities for tomorrow's workers and the ability of citizens to make informed decisions about everyday matters such as foods they consume, the medical procedures they undergo, the machines, facilities and services they use and their impact on the environment will all increasingly require sound knowledge of both science and technology and the global environment it occupies (Walker, 2000).

Clearly literacy and numeracy are both key success factors in life and they have never been more important than they are today. However, given the ever increasing impact of science and technology in our lives, and in the future lives of our children, being literate and numerate will not be sufficient for life in the 21st century. It is inescapable that to live as informed citizens in a western society in the 21st C, individuals will need to be both literate and numerate in the purest sense of the terms and, as well as, to be scientifically and technologically literate. More of this later.

And if raising children is likely to be hard in these circumstances preparing technology teachers is even more of a gamble.

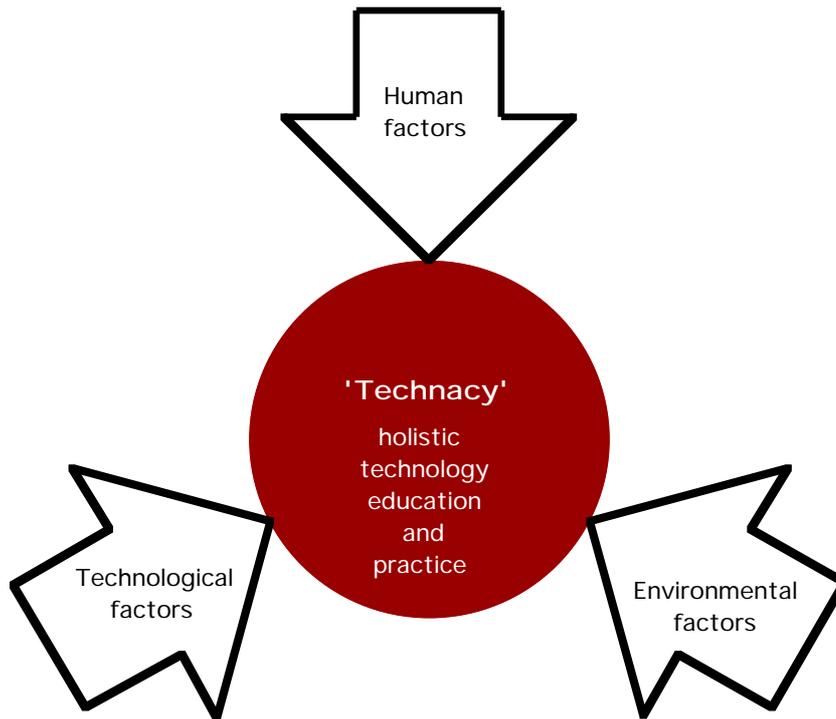
Outside the rhetoric of some State departments and school policies, there is building interest in the need for (particularly First World) societies to raise their level of holistic understanding of the emerging material, digital and molecular world and its interactions and economic opportunities with other cultures and the eco-system. Broadly expressed as a move towards 'innovation education' there has emerged a bigger interest among corporations and international agencies to educate societies with the capability to capture opportunities from the emerging ideas and rapid response economy now driving much of the global and domestic labour markets (Innovation Summit Implementation Group, 2000). Research (science), Technology (tools, materials and understanding) and innovation (design) fuel this drive. The ethical issues of genetic modification technologies, the socio-cultural and socio-economic impact of technology choice in pluralist societies, the significant decrease in job stability and so family relocation tendencies associated with technology choices, and the significant increase in the rate of job and career changes in employed life post schooling all seem to be missing or are increasingly marginalised as key concerns in the interpretation of technology education in school curricula.

Given the above emerging futures, society is entitled to ask why State Education systems still appear to interpret technology schooling and teacher education curricula as either the extreme of teaching highly specific skills, tools and equipment associated with the rapidly declining manufacturing age on the one hand and the extreme of exclusive computer use skills on the other? These syllabus and sector policy drivers appear to be out of sync with the need to have an education in technology that promotes capacities for rapid adaptation (in weeks not years), foresight, innovation and entrepreneurship education.

Preparing for the Future

In the Chairman's introduction to the ASTEC final report he states." If I had to identify a single, critical priority to emerge from this approach, it is the need to develop Australia's technological literacy as part of the inculcation in the young of a spirit of enterprise. This must start at the primary education level and continue through all levels and forms of education and training.² ASTEC then recommended that all States and Territory worked with the Commonwealth to incorporate technacy in primary and secondary curricula and teaching practices across Australia.(Walker, 2000)

² ASTEC, *Developing Long Term Strategies for Science and Technology in Australia: Outcomes of the Study: Matching science and technology to future needs 2010*, AGPS, June 1996.pxiv



The technacy model requires consideration of access and equity and provides the community with a valid role in decision making processes. It rejects the view of 'Value free' technology, and ensures that social and environmental inputs are considered equally valid parts of science and technology decision making processes.³

Technacy is the ability to make holistic technical decisions, it is the capacity to put them into a three dimensional expression or form. A technate person is able to solve problems in a real world of environmental, human, cultural, social and economic pressure to achieve outcomes for people. A technate individual possesses a suite of skills more in common with innovators and entrepreneurs than industrial functionaries.(Seemann, 1997; Walker, 2000; Walker & Seemann, 1990)

I don't think ASTEC realised the significance of technacy. It was equated with technological literacy and unfortunately the subsequent review of science and technology in primary schools glossed over it. It was seen to be including another item in a packed curriculum rather than an opportunity to look at the relevance of the curriculum overall.

It was significant that this key initiative of ASTEC derived from a research project for Indigenous people.

Conclusion

It is not the technologies here at issue it is the question of what now ought constitute an education in technology during the formative years of adolescent development for a future where one's possible vocation is unclear and often on shifting sands. What do

³ ASTEC, *Developing Long Term Strategies for Science and Technology in Australia*, AGPS, October 1996.p211

we really mean when we say vocational education and training when some State agencies estimate that over 80% of the vocations for year 7 students are yet to be invented by the time they graduate from high school? Outside the shelter of state policy and rhetoric, can universities and so schooling systems truly recover from the functionalist/industrialist march and actually deliver a constructivist education in technology innovation?

Within this complex back drop there remains the need to find what is universal about the experience we associate with technology and with this to rationalise the generic characteristics of technological activities into a robust yet simple unifying paradigm. This paper concludes the summation of the ASTEC report to develop the concepts of Technacy education is worthwhile. Within this development some areas to peruse may be listed.

- *Technacy Pedagogy*
(in addition to the vocational case, what is the educational case for technology studies in k-12 schooling? How and what ought we be teaching today for the future?)
- *Technacy Epistemology*
(what do we understand of the phenomenology of technological activity, designing and technical experience in the development of knowledge, values, and in various settings such as in cross-cultural technology transfer settings and future studies settings?)
- *Developmental Technacy*
(what may be the development psychology and sociology aspects of technacy education? Can we develop a technacy age index as we have for diagnosing development in reading and number? Can we develop a taxonomy for aspects of technacy education?)

Until the many varied aspects of technacy education in technology are researched and developed, there appears to be little hope for convincing policy makers the need to shift to a model different from the current interpretation of what some states constitute an education in technology.

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