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## 152. Demographic Impacts in IT Education: Research Agendas.

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### Abstract

*Culture impacts upon use, useability and decision-making processes that surround Information Technology (IT). Radical changes in the demographic profile of New Zealand cause us to reflect on the impact of such changes, as the underlying culture of the country must change with the demographic changes. This process gives rise to some interesting questions, including whether we still accept Hofstede's analysis of New Zealand as an individualistic country. Pacifika, Asian and Maori are collectivist cultures. One important question is what impact do demographic changes have on educational requirements, given that Maori experience of IT differs from mainstream New Zealand, and given that Maori and other collective cultures form an increasing proportion of the population, particularly in Auckland.*

**Keywords:** Demographics, Hofstede, Maori, Education.

### Introduction.

We have been interested in the adoption of IT by Maori, in the low numbers of Maori taking IT courses at university, and factors affecting the success of these Maori students. The Ministry of Education (2005) reports that overall, in 2002 only 9% of Maori secondary students went on to undertake degree studies (compared with 23% of all students), and that retention rates and completion rates for Maori at degree and higher level are lower than for other groups. In addition, at degree level Maori women are over-represented in society and culture subjects, and under-represented in management and science. Maori men are also over-represented in society, culture and education, and under-represented in management and commerce, science, information technology and engineering. Furthermore, only about 1% of Maori completing degrees went on to higher studies.

We have been asking whether models of cultural impacts on decision-making in IT and problem solving might help us understand better how to better approach issues affecting Maori access to IT, including these educational issues. We have been looking at two models of culture:- Hofstede's dimensions (Hofstede 1983), and Trompenaars' dimensions (Trompenaars and Hampden Turner 1997).

Hofstede (1983) studied intercultural parameters in the 1970/80's, investigating the impact of the personal values of IBM employees, as they related to their work situation. Individual cognitions arise from patterns of thinking, feeling and acting learned in early childhood. Comparing the mind to a computer with a mental programme, Hofstede's model consists of three elements: the universal programme, the collective programme and the individual

programme. The universal programme includes love, joy, sorrow: common for all people. The collective programme includes the culture learned not inherited whereas the individual programme holds the personality of each person partly inherited and partly learned.

**Table 1: Hofstede's and Trompenaars' cultural dimensions.**

<b>Hofstede</b>	<b>Trompenaars</b>
<b>Power-Distance.</b> (The extent to which a society accepts unequal distribution of power in institutions and organisation).	<b>Universalism-Particularism.</b> (tendency to follow standardized rules vs a tendency to prefer a flexible approach to unique situations).
<b>Individualism-Collectivism.</b> (Whether an individuals concern for themselves and immediate family is expected to take precedence over their responsibility to other groups in society, such as wider family and social groups. Collectivist societies emphasis social harmony as an important value).	<b>Individualism-Communitarianism</b> (focus on individual performance and creativity vs. focus on the larger group leading to cohesion and consensus).
	<b>Specific-Diffuse</b> (low vs. high degree of involvement in personal relationships).
	<b>Neutral-Affective</b> (controlled emotions vs. overtly displayed emotions).
<b>Uncertainty-Avoidance.</b> How societies accommodate high levels of uncertainty and ambiguity in the environment.	<b>Internal-External.</b> (one's inner drive and sense of control vs. one's adaption to external events beyond one's control).
<b>Masculinity-Femininity.</b> (Whether a culture maximised the differences between the sexes, and values material success and assertiveness, or values instead quality of life and relationships and concern for others).	<b>Achievement-Ascription</b> (status and power determined by one's performance vs. status and power determined by school, age, gender, family background).
<b>Long-Term Time Orientation.</b> (The valuing of long-term alliances, persistence and thrift, versus forthright and explicit interpersonal interactions).	<b>Sequential-Synchrotic</b> (organisation in sequential fashion, one task at a time, vs. parallel organisation, multi-tasking).

From this work Hofstede defined five dimensions with which to classify countries or cultures when considering societal impacts in IT. Under Hofstede's model, technical terminology is a cultural construct, and genres and conventions are "norms" that fit a particular culture.

One of the important critiques of Hofstede's work is that cultures do not necessarily line up with national boundaries. New Zealand is a country where there are distinct cultures - it was a bicultural country, that is now rapidly in parts becoming a multicultural polyglot, with an increasing proportion of brown faces. Maori society differs in important ways from European society in New Zealand. Maori are an indigenous culture that has been extensively colonised by English and other European cultures. Maori also form an underclass as a consequence of colonisation and land thefts which have impacted on socio-economic status (Rankin 1995, Bishop 2007). None-the-less, value sets that originally arose from Maori culture still pervade

New Zealand, and are held to a lesser or greater extent by the indigenous peoples of this country.

Trompenaars and Hampden Turner (1997) in contrast define culture as the way in which a people solves its problems. They assert that a culture is layered. There is an outer layer (the explicit layer), in which the culture manifests its artefacts, the things that can be observed, like its language, food dress code greeting rituals, art etc. Beneath the explicit layer is a middle layer, which comprises the norms and values of a culture. The values of a culture determine what is 'good' or 'bad'. Finally there is an inner core or implicit layer that defines the core of a culture - the subconscious and the basic assumptions which arise from the way culture relates to nature. Cultures have developed in different ways because they have endured different natural environments. On the basis of how cultures have chosen to solve the problems of time, nature, and human relationships, Trompenaars identifies seven different, fundamental cultural dimensions (see Table 1) where ideas such as the interpersonal relationships between people, and how status is accorded, are emphasised. What is important about these models is that Hofstede's and Trompenaars' models give us frameworks with which to talk about the impacts of culture on uptake of IT skills, management, and related issues. The predominant culture of a country is strongly impacted by demographics - demographic changes are affecting New Zealand society in some very fundamental ways. An interesting question is whether Trompenaars' dimensions may be more suited than Hofstede's for investigating differences between cultures in New Zealand. What do each set of dimensions really measure?

### Demographic Changes.

New Zealand is changing rapidly. When Hofstede profiled New Zealand in the late 1970's, 86% of the population identified as NZ European. (Statistics NZ, 1976 census). Hofstede's analysis was therefore based upon a situation where the predominant workforce in IT was white, male and European. New Zealand was classified by Hofstede as an individualistic country. By the 2001 census only 76.9% of the population identified as NZ European, but 14.1% identified as Maori, 6.2% as Pacific Islanders, and 6.4% identified as Asian.

In the 2006 census, 67.6% identified as European, [another 11.1% as New Zealander], 14.6 identified as Maori, 6.9% identified as Pacific Peoples, and 9.2% identified as Asian. The Asian ethnic groups grew the fastest, increasing from 238,176 in 2001 to reach 354,552 in 2006 (an increase of almost 50 percent). The number of people identifying with the Asian ethnic groups has doubled since 1996, when it was 173,502

**Table 1. New Zealand Population Demographics by ethnicity.**

Regional Council	European	Māori	Pacific Peoples	Asian	Middle Eastern/ Latin American/ African	Other Ethnicity	
						New Zealander	Total Other Ethnicity
Auckland Region	0.56	0.11	0.14	0.19	0.01	0.08	0.08
Gisborne Region	0.54	0.47	0.03	0.02	0.00	0.09	0.09
Manawatu-Wanganui Region	0.73	0.20	0.03	0.04	0.01	0.12	0.12
Tasman Region	0.83	0.07	0.01	0.01	0.00	0.15	0.15
<b>Total</b>	0.68	0.15	0.07	0.09	0.01	0.11	0.11

(source: Statistics New Zealand 2006)

If we investigate the regional differences, the problem with Hofstede's analysis becomes more apparent. For example, Auckland City can no longer be regarded as ethnically European. Hofstede's suggestion that New Zealand is an individualistic country probably is no longer accurate in Auckland, [whereas the Tasman Region may well still fit that analysis]. Clearly the cultural impacts of demographics changes will have an impact on New Zealand ICT education, and in Auckland, these demographic changes are already impacting on the way we teach. The middle of the North Island is clearly still bicultural.

The prevailing assumption about the underlying culture of New Zealand (Hofstede suggests "individualistic") and its impacts on decision making and learning in the IT sector may well be no longer valid.

### **Maori Society and Consequences.**

The proportion of Maori in the population means there is an economic imperative for Maori to participate effectively in the economy. The Government Digital Strategy (2004) has identified that it is now important to address issues surrounding Maori access to ICT. Whilst nearly 47% of New Zealand households had computers as at the 2000 HES survey, only 27 percent of Maori households and 23 percent of Pacifica households had computers. The Asian population, in contrast, although also being a collectivist society, has a very different social dynamic. Households containing at least one person of Asian ethnicity at the 2001 Census had the highest level of Internet access, with 58 percent of households connected. (Stats NZ (2004)).

Kampf (2005) points out that physical theories are constructions of the human mind – and as such, are artifacts of dynamic, man-made cultures. Kampf asserts that technical disciplines are tied to the cultural systems in which they function. Massey et. al. (2001) point out that culture partially determines a person's communication preferences and behaviour. They choose a communication style based upon how they predict the receiver will respond. In making those predictions, communicators rely on the experience of past events, and future expectations. Choices of technology may enable or hinder a particular communication style relevant to a particular culture.

For example Duncker (2002) in a study at Waikato University pointed out that the use of libraries did not fit some of the (older) Maori students in her study, because they were uncomfortable with the technology – and with the cultural assumptions they made about libraries. In particular, the use of Western classification schemes were said to make Maori material relatively un-accessible to Maori. She suggested that digital libraries in particular emphasised individualism rather than collectivism, and that issue made the use of digital libraries laborious for Maori. Despite that her sample was biased and small, and not representative of the majority of Maori students in CS and IS classes with which we are familiar (who are young, and computer literate), the conclusion that there are clashes for Maori in Western style library classification systems and content, because there is a lack of culturally specific classification systems on the library side, and there is a lack of awareness of Western classification systems, is probably correct. She points out that Maori have traditional tribal knowledge repositories that are emotionally and cognitively different from Western Libraries, and that Western Libraries classification systems misrepresent Maori

content. She suggests that this problem is not limited to Maori, but affects all indigenous peoples, in particular those who have an oral tradition.

Search (1999) suggests that it is valuable to reconsider the aspects of how indigenous cultures view space, time and action, as a basis for reconsidering how we design computer interfaces. She suggests that symbols are a consequence of action, and it is the action that integrates sensory experiences into an understanding of complex relationships. She suggests that the Western concepts of space and time are limited by a Newtonian concept of causality and a linear perspective which indigenous cultures do not have, rather utilising a temporal continuum that transcends those limitations, and where time and space are collapsed into a single frame that encompasses past, present and future. Search suggests that the use of suitable metaphors and icons and the use of webs of association allow us to collapse time and space in a computing environment.

Pinkard (2004) points out that there is a dearth of articles in the educational literature that deal with cultural impacts on development of computer-based learning tools. He says

“One might ascertain from this silence that the cultural diversity represented in classrooms is irrelevant to the design process or that learning tools are being developed to be culturally neutral. However, I argue that the concept of a culturally neutral computer-based learning tool is an oxymoron ....” (page 415)

Teachers of ICT are technical communicators. Kampf (2002) suggests that it is the technical communicators who need to become aware of the differing communication patterns that arise because of cultural differences. Intercultural interactions can result in paradigm shifts, and that such paradigm shifts by technical communicators can result not only in more effective communication, but also affect respective culture groups.

Khaled et. al.(2006) suggest that cultural differences between NZ Europeans and Maori are sufficiently different that games aimed at persuasion (anti-smoking) require a different emphasis for Maori versus European audiences. They point out that much of the variation in cultural differences are due to the individualism versus collectivism dimension that Hofstede defined, and this has marked implications for relationships between people, and the content of their game. They point out that whilst designers of Persuasive Technologies might not consciously embed their cultural assumptions into their products, culture is sufficiently pervasive that it affects a person’s attitudes, beliefs, and assumptions in ways they are not able to consciously identify. It is useful to look at the characteristics of Maori society in contrast to the European population, because these differences may inform us about the changes we might expect to see over time in the way we operate as a society, and in terms of the educational issues we may have to face.

For Maori, one of the major (political) issues in adopting new technologies is contained in the following question – “ When you adopt a technology, do you adopt the cultural assumptions that go along with it?” Is the adoption of Information Technologies yet another form of colonisation? Are there other ways of teaching ICT that don’t adopt the colonising assumptions?

Of particular importance is that for Maori, the use of whakapapa (genealogy) is applied not only to human relationships, but also as a meta-model for codifying knowledge about the environment and relationships between humans and the environment. Relationships are all important. In addition, Maori is an oral tradition, and whilst most Maori are literate, there is

still a preference for face-to-face communication, especially for important issues, and for education.

### **Research Themes.**

Demographic changes involving marked changes in ethnic profiles raises a large number of questions for IT education and management. We have started looking at some of these questions with respect to Maori.

1. Our first research theme is that of appropriate ways to involve Maori in ICT studies. Recently completed is an action research project considering pedagogical models for 8–11 year age Maori (Rumaki Reo) primary school pupils. (Lomax and Lemon 2007). Maori students benefit from alternative teaching pedagogies in IT. Related to this study are the following unanswered questions:
  - a. Will these models transfer from primary to secondary to tertiary teaching?
  - b. does the Maori preference for a face-to-face communication style reflect a similar preference for Asian and Pacifika communities – how might such preferences impact on teaching models for IT education. Does this preference impact on computer-based learning tools?
  - c. how do the cognitive processes of Maori, Pacifika and Asian students differ from each other and from mainstream (European) students. What are we looking for in terms of cognitive skills? How do we measure cognition in students? Are the cognitive differences, assuming they exist, a consequence of culture, or of deprivation? Do these differences impact upon IT education?
  - d. What are appropriate research paradigms? Does a Kaupapa Maori research approach have a particular value for these studies?
  
2. A second research theme is that of changing demographics. What impact do demographic changes have on management practices and decision making? What are Hofstede's dimensions for New Zealand now? Are Trompenaars' dimensions any better for looking at indigenous communities? Research questions that arise here for us are about Maori involvement in IT.
  - a. Do Maori experience a different IT experience from non-Maori? Current Research underway is investigating experiences of Maori women who work in IT, utilising a kaupapa Maori/Mana Wahine Maori approach.
  - b. Do Maori women's experiences differ from Maori men, and from the mainstream population.
  - c. Can we derive educational needs of Maori from such studies?
  - d. Do the three major ethnic minority populations (Maori, Pacifika, and Asian) have the same or differing educational needs. Are there any synergies arising from these cultures being driven by collectivist values.
  - e. What happens to the educational curriculum if these students become the majority (as is happening in Auckland)? As the underlying ethnic profile of Auckland changes, which culture is at risk – Maori, or Pakeha? What impacts should these changes have on how we teach ICT?
  
3. A third possible research theme (suggested by referees) is how does economic status impact on acquisition of computing technologies in the home? Is the lower participation rate in ICT by Maori and Pacific Communities a consequence of cultural

choice, or is it purely socio-economic. Have Maori taken up the use of alternative technologies such as mobile phone, being a more “face-to-face” communication style.

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