Using Cluster Analysis to Investigate the Role of Culture in the Adoption of Web-Based Learning Tools

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Introduction

Web-based learning technologies are now more or less pervasive in higher education institutions, but in many instances they are not used to their full potential. There may be many reasons for this, including inadequate technology skills on the part of lecturers, increased workload as a result of implementing such tools, and difficulties with integrating the technology into traditional teaching approaches (Singh & Blewett, 2004). Many studies have examined the issues of adoption from the perspective of the academic staff, with fewer examining the impact of student perceptions on acceptance (Grandon *et al.*, 2005). In this study, a student-centred perspective is therefore taken, whereby students' perceptions of web-based learning technology are solicited, and how these influence usage is determined. The impact of cultural values on this process is furthermore elucidated.

To assess the factors influencing usage, the well-known technology acceptance model (TAM) is employed (Lee *et al.* 2003), whilst to assess culture the equally well-known Hofstede (1980) dimensions are used. The effect of culture is examined by employing a statistical technique known as cluster analysis (Segars & Grover, 1999). Cluster analysis allows groups (in this case cultural groups) to be formed on

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the basis of multiple criteria (the cultural dimensions), and in the process differences within groups are minimised whilst differences between groups are maximised.

In the next section, web-based learning technologies, technology adoption, and culture are discussed. This leads to the development of hypotheses, before the research procedure is outlined. The data is then analysed, and the results reported. Following this is a discussion on the implications of the findings, before ideas for future research are suggested and the paper concluded.

Conceptual Background

The theoretical foundations of this study are web-based learning technologies, technology adoption (TAM specifically), and culture, respectively. This section will therefore briefly examine past literature and research in these areas, as well as their relevance to the South African context.

Web-Based Learning Technologies

There exists a wide variety of web-based learning tools that make use of Internet technologies to enable and enhance the teaching and learning process (Mioduser *et al.*, 2000). One such tool is WebCT (Web Course Tools). This is a course management web-based tool that was developed for academic purposes at the University of British Columbia, and is now used at educational institutions across the globe (Wernet *et al.*, 2000). The tools enable educators to develop and maintain a structured web site that can be used for an entirely online web-based course or to supplement classroom-based activities (McClelland, 2001). A typical WebCT site in general may have four main modules:

- Course Material module (*e.g.*, course syllabus template, course contents)
- Communication Tools (e.g., bulletin board, chat room, email, and whiteboard)

- Evaluation Tools (e.g. quizz, self-tests, assignments, results)
- Study Tools (e.g. student web pages, presentations)

This tool could be particularly useful in institutions with highly diverse student bodies, such as are found in South Africa. For example, schools in formerly disadvantaged areas are generally crowded, and under-resourced, and may not prepare students sufficiently for tertiary-level studies (Hall, 2001). Students coming from these backgrounds may therefore face enormous challenges when entering universities that have previously catered for students from better-resourced, advantaged schools (Brown, 2002). Educators are faced with the dilemma of having students from both advantaged and disadvantaged backgrounds in the same class, with vastly different prior knowledge and experiences. Web-based learning technologies offer opportunities for managing such diversity, as their flexibility allows for students to work at their own pace, and use the technology in a manner consistent with their learning styles and prior knowledge and experience (Lanham & Zhou, 2003).

Technology Adoption

In assessing technology adoption the popular technology acceptance model (TAM) is often employed (Lee *et al.*, 2003). This predicts that usage of a technology is influenced in the main by two interrelated variables – perceived usefulness, and perceived ease of use respectively. To take into account the nature of the learning environment, an additional variable can be included – that of perceived voluntariness (Brown, 2003). This is defined as the extent to which users perceive the adoption decision to be voluntary (Agarwal & Prasad 1997). The rationale for including this variable is that very often the attitude of the lecturer or instructor determines the extent to which a technology is used. If it is mandated for the course, or if it is

perceived to be, then for certain individuals, they will more likely use it, sometimes even if they perceive it to be not useful.

Cultural Values and Measurement Issues

The subject of national culture and its impact on technology adoption has received fairly widespread research attention in information systems (IS) (McCoy *et al.*, 2005). Much of this interest has been fuelled by the diffusion of information technology (IT) into countries having very different cultures to that from where they were first launched. Thus, conventional models of adoption, such as the TAM (Lee *et al.*, 2003), developed and tested in USA, have been questioned as to their utility in other cultures. Straub *et al.* (1997), for example, found the model to be suitable for explaining adoption of email in the USA and Switzerland, but not in Japan. In the context of learning, Grandon *et al.* (2005) found there to be differences too between American and Korean students with regards to the factors influencing adoption of online classes.

National culture has very often been defined in terms of Hofstede's (1980) dimensions. He defined culture as being "*the collective programming of the mind which distinguishes the members of one group or category of people from another*" (Hofstede, 1991, p. 5), and operationalised it along four dimensions:

- *Power-distance* – Degree of inequality among people, which the population of a culture considers normal.
- *Uncertainty avoidance* - Degree to which people in a culture feel uncomfortable with uncertainty and ambiguity.
- *Individualism* - Degree to which people in a culture prefer to act as individuals, rather than as members of groups.
- *Masculinity*- Degree to which values like assertiveness, performance, success and competition prevail among people of a culture over gentler qualities like the quality of life, maintaining warm personal relationships, service, care for the weak, etc.

Hofstede later added a fifth dimension – long-term orientation (Hofstede, 1991). However, many studies still use the original 4 dimensions when examining national culture. Many of the studies on culture and technology adoption work from this basis – i.e., they take Hofstede's (1980) findings to be reflective of current reality (McCoy *et al.*, 2005). Several problems have been noted with this approach.

Firstly, Hofstede conducted his study of national culture about two decades ago. Thus, no recognition is taken of the dynamic nature of culture. His measures may not accurately reflect the current reality (McCoy *et al.*, 2005). Secondly, his sample for the study were IBM employees, and thus may not be reflective of the demographics of a country. South Africa is a case in point. The cultural profile of South Africa as captured by Hofstede (1980) reflected that of IBM employees and managers at that time – mainly White. Thus generalisation of his profile to the nation at large is problematic. Hofstede (1998) responds to this critique (although not referring to South Africa specifically) by asserting that differences between countries in terms of values remain more or less stable over time, and that in order to compare across nations, the sample group must be similar, in as many ways as possible. Only then is it possible to compare groups across nations, and focus only on the differences between national cultures.

Some researchers have attempted to overcome these problems by including the Hofstede measuring instrument in their studies. However, in several of these cases, it has been found that the measures do not exhibit statistical validity and reliability (Spector *et al.*, 2001). Concerning lack of validity and reliability, Hofstede (2002) responds that his measures were designed to assess the values of a multitude, and not an individual. Thus, standard statistical tests for reliability and validity are not always appropriate.

McCoy *et al.*, (2005) contend that "the assumption of homogeneity is not appropriate, particularly if the national culture construct are to be integrated into IS models that reflect individual beha-

viour..." (p. 214). They therefore argue for assessing the cultural values of individuals rather than a multitude, in recognition of the fact that people from the same nation or ethnic group may have different values (Srite *et al.*, 2003).

In the South African context, whilst apartheid sought to deliberately keep ethnic groups separate, with the new South Africa, freedom of association is guaranteed. Thus cultural values will not be entirely based on ethnicity or race. Indeed in a recent study, Thomas & Bendixen (2000) found there to be little difference between ethnic groups in South Africa in terms of Hofstede's cultural dimensions. Ethnicity as a surrogate for cultural values also has other connotations. For example, socio-economic differences between ethnic groups at a macro level is still very much a reality in South Africa (StatsSA, 2003), and may also explain differences found in technology adoption between ethnic groups (Brown & Licker, 2003).

This article reports on a study which employed Hofstede's measures to assess cultural values of students, and in so doing investigate what impact these have on the adoption process for web-based learning tools. Thus, unlike with other culture studies, which had national profiles or ethnic groups as the unit of analysis, the focus here was on groups of students, regardless of race or ethnicity.

Initial study findings were reported in Brown *et al.* (2003). However, in that analysis each dimension of culture was analysed separately for its effect on technology adoption. The intent of Hofstede was for culture to be described by the profile across all four dimensions (5 if long-term orientation is included). In this article, cluster analysis was therefore employed to re-analyse the data and generate profiles (Segars & Grover, 1999). Groups were thus formed such that within groups, differences across a set of criteria were minimised, whilst between groups differences were maximised. The criteria in this instance were the four original cultural dimensions proposed by Hofstede (1980).

Development of Hypotheses

The WebCT technology investigated in this study consisted of four main modules. Usage behaviour for each module is affected differently by cultural values, therefore only a single module was selected for further analysis. Preliminary data analysis showed that the evaluation module was used to the greatest extent, and so was the focus of further attention. The effects of cultural values (uncertainty avoidance, masculinity, power-distance and individualism) on the strength of relationship between perceived ease of use and usage, perceived usefulness and usage, and perceived voluntariness and usage were investigated, leading to the hypotheses outlined next.

Anandarajan *et al.* (2002) posit that where there is high uncertainty avoidance, usage of a technology will be significantly influenced by its perceived ease of use, as this attribute reduces ambiguity of use. Thus, the hypothesis is:

- H1A: The influence of perceived ease of use on usage of web-based learning evaluation tools is greater for those with high uncertainty avoidance than those with low uncertainty avoidance.

Where there are high levels of uncertainty, a strong motive exists to want to reduce it amongst those with high uncertainty avoidance traits (Straub *et al.*, 1997). Any technology that is perceived as supporting this goal will be perceived as useful, and may subsequently be used quite extensively. The online evaluation module in WebCT provides facilities for learners to reduce uncertainty in performance by providing quick feedback on quizzes, *etc.* The hypothesis therefore is:

- H1B: The influence of perceived usefulness on usage of web-based learning evaluation tools is greater for those with high uncertainty avoidance than those with low uncertainty avoidance.

High uncertainty avoidance cultures have been shown to prefer clear written rules and regulations concerning matters (Milberg *et al.*, 1995) and are more likely to comply with these than low uncertainty avoidance cultures. Thus, it follows that those who score high on uncertainty avoidance will be more likely to use a technology if it is mandated for a course, as they would not want to take the risk of not following the advice and requirements. The hypothesis is:

- H1C: The influence of perceived voluntariness (inverted) on usage of web-based learning evaluation tools is greater for those with high uncertainty avoidance than those with low uncertainty avoidance.

For those who score low on masculinity (high on femininity), usage of the tool will be influenced more by the comfort and ease of use of a technology, than for those who score high on masculinity (Hofstede, 1980). The hypothesis is therefore:

- H2A: The influence of perceived ease of use on usage of web-based learning evaluation tools is greater for those with low masculinity than those with high masculinity.

For high masculinity individuals the online evaluation tools offer an opportunity to assess performance, success, and competitiveness, all of which are of value to them (Hofstede, 1980). Thus, evaluation tools will be seen as useful, which in turn will motivate their usage to a greater extent than those lower in masculinity. The hypothesis is therefore:

- H2B: The influence of perceived usefulness on usage of web-based learning evaluation tools is greater for those with high masculinity than those with low masculinity.

Those with high masculinity traits have a greater focus on task accomplishment (Hofstede, 1980). Thus, they will more likely use a tool, if it is perceived as mandatory and required for completing a task. Those who score low in masculinity will, however, also be

more likely to use a technology if it is perceived as mandatory, but the motive in this case will be due to social pressure, to which they are more susceptible (Hofstede, 1994). Thus the hypothesis:

- H2C: The influence of perceived voluntariness (inverted) on usage of web-based learning evaluation tools does not differ between those with high masculinity, and those with low masculinity.

Those with high individualism scores will more likely perceive evaluation tools as being easy to use, as the tools are compatible with their preference for working independently rather than collectively (Veiga *et al.*, 2001). The hypothesis supported is:

- H3A: The influence of perceived ease of use on usage of web-based learning evaluation tools is greater for those with high individualism than those with low individualism.

Those scoring high on individualism will perceive evaluation tools to be more useful than those who are collectivist, as it is more compatible with their style of working independently (Veiga *et al.*, 2001).

- H3B: The influence of perceived usefulness on usage of web-based learning evaluation tools is greater for those with high individualism than those with low individualism.

Those who score low on individualism (highly collectivist) will be more influenced by social pressures from peers and superiors in usage of tools, as they are more conformity-oriented (Steenkamp *et al.*, 1999), thus the hypotheses is:

- H3C: The influence of perceived voluntariness (inverted) on usage of web-based learning technologies is greater for those with low individualism than those with high individualism.

In high power-distance cultures, "*subordinates defer to superiors and do not question their authority*" (Lim, 2004, p. 32). In the lear-

ning context, students thus accept the lecturer authority almost without question. Usage of a technology for those high in power-distance cultures will be driven to a great extent by whether the supervisor/lecturer encourages or mandates usage. The hypothesis supported is:

- H4: The influence of perceived voluntariness (inverted) on usage of web-based learning evaluation tools is greater for those with high power-distance than those with low power-distance.

Research Procedure

In this study cluster analysis is to be used to generate groups of students having similar cultural profiles, based on the dimensions of masculinity, individualism, uncertainty avoidance and power-distance. Differences in technology adoption between the groups will then be examined by drawing from the above hypotheses. The approach to the research is positivistic, hypothetico-deductive and quantitative.

Questionnaire Design

The questionnaire consisted of three sections. In the first section demographic information regarding the respondents' degree program, year of study, home language, race, family income, gender and age were gathered. In the second section respondents' cultural values were assessed using a 20-item abridged and modified version of Hofstede's (1980) original measures taken from Hepburn *et al.* (2000). The wording of the 20 items were modified so as to be understood by undergraduate students. For each cultural value, participants were asked to rate its importance to them as individuals on a scale of 1 to 5. The third section of the questionnaire related to respondents' perceptions and usage of WebCT. These were all assessed using a 7-point Lickert scale, anchored by Strongly disagree at one end to Strongly agree at the other. Perceived Usefulness was operationalised with 5 items identified from Davis (1989) and Teo *et al.*

(1999), and modified for the particular context. Perceived Ease of Use, too, was measured with 4 items modified from Teo *et al.* (1999). Perceived voluntariness was operationalised with 3 items derived from Agarwal & Prasad (1997). Finally, usage of WebCT was assessed according to respondents' self-assessment of the extent to which they used the standard features available in each of the four modules of a typical WebCT site. For the Course content module, there were 6 items, for the Communications module 4 items, the Evaluation tools, 4 items, and the Study module, 4 items. Each item was assessed on a scale of 1 to 7, anchored by Never used at one end to a Great Extent at the other.

A pilot questionnaire was handed out to ten students who were asked to fill in the questionnaire and make suggestions where necessary. Problem areas were identified and questions reworded to improve understanding. See Appendix 1 for the final item measures used.

Data Collection Procedure

A list of courses that make use of WebCT was obtained from the WebCT systems administrator at the University of Cape Town. Emails were sent to a number of course lecturers requesting permission to distribute questionnaires during their lectures. Arrangements were finalised for four courses, although respondents from any other course that used WebCT were not excluded from participating. The four courses were:

- A first year Statistics course, in which the WebCT Evaluation tools were mainly used.
- A first year Information Systems course, in which WebCT was made available as a learning tool. Usage was encouraged, but not made compulsory.
- A first year Biology course, in which the WebCT evaluation tools were mainly used.

- A third year Economic course, in which Chat room and other communications tools were used extensively.

A total of 250 questionnaires were distributed. 178 questionnaires were returned. 32 questionnaires were returned incomplete and were therefore discarded from any further analysis. This resulted in 146 responses that were usable.

Demographic Profile of Respondents

The majority (77%) of students were in first year and thus under 21 (88%). Most were studying Business (BCom and BBusSci) (71%), with the remainder mainly studying for a BSc (27%). There was an even gender mix, and a majority of Black students (40%), followed by White (37%), Coloured (12%), then Indian and Asian (6%) students. In essence, therefore, the spectrum of South African race-based cultures were represented.

The demographic profile of respondents is shown in Table 1 below.

Table 1: Demographic Profile

Variable	Items	Frequency	Percentage
Year of Study	First	113	77.4%
	Second	17	11.6%
	Third	11	7.5%
	Fourth	5	3.4%
Degree	BCom	60	41.1%
	BBusSci	44	30.1%
	BSocSci	2	1.4%
	BSc	40	27.4%
Gender	Male	73	50%
	Female	73	50%
Age	Under 21	128	88%
	21 to 30	18	12%
Race	Black	59	40.4%
	White	54	37%
	Coloured	17	11.6%
	Indian	7	4.8%
	Asian	2	1.4%
	Did not answer	7	4.8%

Cluster Analysis

Cluster analysis was employed, in order to generate groups (profiles) based on individualism, masculinity, uncertainty avoidance and power distance collectively. This resulted in two groups having the cultural profiles shown in Figure 1 below.

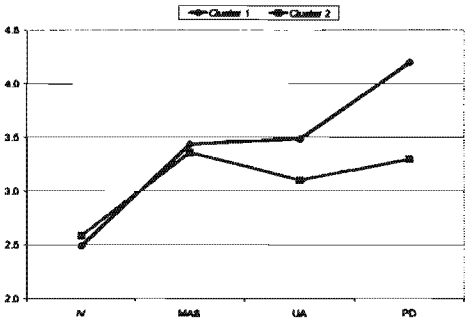

Figure 1: Cultural Profiles arising from Cluster Analysis

Cluster 1 was much higher in power-distance (PD) and uncertainty avoidance (UA) than Cluster 2, with minimal difference on the individualism (IV) and masculinity (MAS) dimensions.

T-tests were used to further examine differences between the clusters, as shown in Table 2. There were significant differences on the uncertainty avoidance, power-distance, and individualism dimensions, but not the masculinity dimension. The difference on the individualism dimension was furthermore minimal. There were no significant differences in terms of perceptions of WebCT and usage of evaluation tools, indicating minimal effect of culture on these variables.

Table 2: t-tests for Clusters

	Cluster 1 Mean	Cluster 2 Mean	t-value	p	Cluster 1 Size	Cluster 2 Size
Cultural Values						
Power-Distance	***4.2***	***3.3***	***-13.7***	***0.0000***	***76***	***70***
Uncertainty Avoidance	***3.5***	***3.1***	***-4.5***	***0.0000***	***76***	***70***
Individualism	***2.5***	***2.6***	***2.0***	***0.0507***	***76***	***70***
Masculinity	3.4	3.4	-1.7	0.1003	76	70
Perceptions of WebCT						
Perceived Ease of Use	5.3	5.4	0.6	0.5217	75	70
Perceived Usefulness	4.7	4.4	-1.0	0.3020	76	70
Perceived Voluntariness	2.8	2.7	-0.3	0.7937	76	70
WebCT Usage						
Evaluation Tools Usage	3.9	4.4	1.8	0.0795	76	70

In order to examine the impact of the cultural profiles on the relationships between variables, two separate regression models can be developed for each cluster, and the regression coefficients compared. This is similar to the technique employed by Venkatesh & Morris (2000) when testing the effect of gender on technology adoption. Before developing regression models, both sets of data must exhibit validity and reliability. The data from the 76 respondents belonging to Cluster 1 were therefore subjected to validity and reliability tests, and then separately the data from the 70 respondents in Cluster 2.

Validity Tests

To test validity, factor analysis with varimax rotation was employed, with eigenvalue set to 1. If items load at greater than 0.5 on their own factor, and less than 0.4 on all other factors validity is demonstrated (*e.g.* see Tan & Teo, 2000).

For the both clusters, one of the perceived usefulness items (PU3 – I find WebCT to be useful), cross-loaded on the ease of use factor, and so was dropped. The factor analysis was repeated without this item, resulting in validity being demonstrated in both cases – *i.e.*,

items for perceived ease of use, perceived usefulness, and perceived voluntariness all loaded as separate factors (see Table 4a and 4b)

Table 4a: Factor Analysis for Cluster 1

	Ease of Use	Usefulness	Voluntariness
EOU1	0.82	0.11	0.00
EOU2	0.87	0.09	0.08
EOU3	0.89	0.07	0.13
EOU4	0.87	0.07	0.04
PU1	0.11	0.85	-0.05
PU2	0.07	0.87	-0.02
PU4	0.12	0.85	0.06
PU5	0.05	0.92	-0.09
Vol1	-0.02	0.01	-0.86
Vol2	-0.12	0.03	-0.89
Vol3	-0.08	0.05	-0.89

Table 4b: Factor Analysis for Cluster 2

	Ease of Use	Usefulness	Voluntariness
EOU1	0.79	0.21	0.02
EOU2	0.87	0.26	-0.14
EOU3	0.74	0.18	-0.02
EOU4	0.83	0.23	0.05
PU1	0.28	0.87	-0.03
PU2	0.25	0.88	-0.05
PU4	0.16	0.92	-0.04
PU5	0.39	0.70	-0.01
Vol1	-0.01	0.27	0.73

Vol2	-0.02	-0.11	0.91
Vol3	-0.02	-0.25	0.84

Reliability Tests

To test for reliability, the two sets of data were assessed for their Cronbach alpha. If for each construct, the alpha is greater than 0.7, then reliability is proven (e.g., see Teo *et al.*, 1999). Table 5 shows the results of reliability analysis for each cluster.

Table 5: Reliability Analysis

	Cluster 1	Cluster 2
Perceived Ease of Use	0.89	0.86
Perceived Usefulness	0.90	0.92
Perceived Voluntariness	0.85	0.77
Evaluation Tool Usage	0.77	0.89

Multiple Linear Regression

Multiple linear regression was now possible for each of the clusters, where the three independent variables, perceived usefulness, perceived ease of use, and perceived voluntariness were regressed on to evaluation tool usage. The results of this test are shown in Table 6. For Cluster 1, only perceived mandatoriness (the inverse of voluntariness) was a significant influence on usage, whereas for Cluster 2 it was perceived usefulness and perceived mandatoriness. The values of coefficients for perceived ease of use, and perceived voluntariness in Cluster 1 were furthermore greater than for Cluster 2.

Table 6: Multiple Linear Regression with Evaluation Tool Usage as Dependent Variable (**p < 0.01; *p < 0.05)

Independent Variable	Cluster 1	Cluster 2	Relevant Hypotheses
Perceived Ease of Use	0.12	-0.01	H1A
Perceived Usefulness	0.21	*0.27	H1B (H2B)
Perceived Voluntariness	**-0.43	*-0.23	H1C, H4

In order to interpret these findings the hypotheses previously generated can be revisited. Of specific interest are the hypotheses concerning uncertainty avoidance (H1A, H1B, H1C) and power distance (H4), since there were major differences between the clusters based on these two dimensions.

For Cluster 1, which is higher in uncertainty avoidance and power distance than Cluster 2, it is expected from H1A that perceived ease of use will be a greater influence; from H1B that perceived usefulness will be a greater influence, and from H1C that perceived voluntariness will be a greater influence. From H4, it is expected again that perceived voluntariness would be a greater influence. The regression coefficients in Table 6 confirm the hypotheses H1A, H1C and H4, but not H1B.

The reasons for hypothesis H1B not being supported may be because Cluster 2 exhibited a small but significantly higher score for individualism, than Cluster 1. The WebCT tool allows students to work more or less independently. Thus perceived usefulness becomes a more salient factor for Cluster 2 (higher individualism) than cluster 1, based on hypothesis H2B. This influence may be stronger than that caused by high uncertainty avoidance (H1B).

Discussion and Implications

The findings point to the need for there to be a balance when introducing web-based learning technologies into a classroom. The

technology in itself is not an end, and its introduction must be considered within the social context of student learning. Thus student cultural values, as well as their perceptions of the technology must be taken into account, as all of these ultimately impact on levels of usage.

In the South African context, where at the tertiary level, there is student diversity in terms of culture, socio-economic background, and levels of preparedness for higher education (Hall, 2001), these are issues that cannot be ignored. Lecturers and instructors must be conscious of the differing expectations and interpretations of students, and how these will impact on issues such as usage of learning technology. So, for example, this study has shown there to be two major groups – one high in power-distance and uncertainty avoidance, and the other lower on these dimensions. Each group is motivated by different factors. In terms of using learning technology, the one is motivated by perceived mandatoriness (the opposite of voluntariness), the other by perceived usefulness, as well as mandatoriness. Thus, to ensure both groups are catered for, a useful strategy would be to ensure that the web-based learning tools are perceived as useful, by making sure the tools are aligned, integrated, and relevant to the course of interest. Instead of merely encouraging use, usage could be made a requirement by, for example, including as part of the course assessment, a test or tests that must be completed through the web-based evaluation tools. Since perceived ease of use is not a factor for everyone, an optional training session could be provided for those who feel they need it before using the tools independently.

From another perspective, lecturers may want to develop in students the ability to work independently and think critically. Those who are using the tool primarily because they see it as a requirement, or because it is easy to use, may have to develop a more critical mindset, whereby they can independently assess and evaluate the tool, in terms of the value it adds. If it is perceived as not contributing to learning, they ought to challenge the lecturer/instructor on

this. In that way it can be ascertained whether they have critically evaluated the tool. It may be that they have not fully explored its features, or that the functionality has been difficult to use, in which case these issues can be addressed first.

Limitations and Future Research

The study has been limited to examining the impacts of three variables on usage of web-based evaluation tools – perceived usefulness, perceived ease of use, and perceived voluntariness of WebCT respectively. The perceptions measured were of WebCT in general. WebCT, however, consists of several different modules, inclusive of evaluation tools. Future research ought to be more specific, and investigate both perceptions and usage with regards to a particular tool or tools within WebCT.

It is perhaps appropriate that qualitative, interpretive studies be now conducted in this area to get a richer understanding of student perceptions, attitudes, and experiences with these technologies. Alternatively, a mixture of both quantitative and qualitative techniques can be employed, whereby a study such as this one can initially be carried out, and then follow up interviews conducted with a set of students who responded to the questionnaire.

The subject of culture is both interesting and controversial, with Hofstede's (1980) study attracting widespread attention and critique (McCoy *et al.*, 2005). It is thus a fertile area for research in the context of education and technology use.

Conclusion

Web-based learning technologies are used in a diverse array of courses in South African tertiary institutions. Much research has focused on the technologies and their capabilities. However, for these to make an impact on learning, it is important that they be firstly accepted and used by students. This research, therefore, took a student-

centred view, and examined their perceptions and usage, as well as the effect of social factors such as cultural values.

Culture was examined by assessing the importance to students of four sets of cultural values – individualism, masculinity, power-distance, and uncertainty avoidance. Cultural groupings independent of ethnicity and language were then generated using the statistical technique of cluster analysis. This analysis generated two clusters (groups). The one cluster was higher in power-distance and uncertainty avoidance than the other, with little difference between the clusters on the masculinity and individualism dimensions.

Factors influencing usage of web-based learning technologies were then compared between the groups. Consistent with expectations, for the group higher in power-distance and uncertainty avoidance, usage was influenced mainly by whether such usage was perceived as being mandatory, and to a lesser extent by its perceived usefulness and ease of use. For the group lower in uncertainty avoidance and power-distance on the other hand, usage was motivated primarily by perceived usefulness, and to a lesser extent by whether its use was perceived as being mandatory, with perceived ease of use playing no part.

The findings point to the need for educators to understand not only the technology and its capabilities, but to also consider what might motivate student usage, and how these motivations may differ depending on cultural values. In other words, there is a need to view web-based learning tools not simply as technical innovations to improve educational practice, but more holistically as a socio-technical innovation that may have positive consequences for student learning.

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Appendix: Questionnaire Measures

Cultural Values Importance (Scale 1 - 5)

Individualism:

IV1. Having sufficient time for personal or family life.

IV2. Having considerable freedom to adopt one's own approach to any task.

IV3/M9. Having challenging things to do, from which to get a personal sense of accomplishment.

IV4 (-). Having good physical working conditions.

IV5(-)/M10. Fully using your skills and abilities on any task.

IV6 (-). Having training opportunities to improve your skills or to learn new skills.

Masculinity:

M1 (-). Living in a desirable district.

M2 (-). Working with people who co-operate well with one another.

M3 (-). Having a good working relationship with those in authority.

M4 (-). Having security of employment.

M5. Having an opportunity to earn large rewards.

M6. Getting the recognition for a task well done.

M7 (-). Being helpful to others.

M8. Having an opportunity to advance to high-level jobs.

M9/IV3. Having challenging things to do, from which to get a personal sense of accomplishment.

M10/IV5(-). Fully using your skills and abilities on any task.

Uncertainty Avoidance:

UA1. Not feeling nervous or tense when working.

UA2. Sticking with an employer for as long as possible and changing jobs only when absolutely necessary.

UA3. Keeping to the rules of a group – even when one thinks breaking them ought to be in the group's best interests.

Power-Distance:

PD1 (-). Having leaders who consult with everyone before making decisions.

PD2 (-). Not feeling afraid to express disagreement with those in authority.

PD3. Accepting that some people are more powerful than others.

Perceptions about WebCT (Scale 1 – 7)

Perceived Ease of Use:

EOU1. WebCT is easy to use.

EOU2. WebCT is easy to learn.

EOU3. WebCT is user friendly.

EOU4. WebCT is easy to master.

Perceived Usefulness:

PU1. Using WebCT would improve my understanding of the subject.

PU2. Using WebCT would increase my productivity.

PU3. I find WebCT to be useful.

PU4. Using WebCT would improve my results.

PU5. Using WebCT would assist with my learning/study.

Perceived Voluntariness:

Vol1. My use of WebCT is voluntary.

Vol2. Although it might be helpful, using WebCT is certainly not compulsory in my course.

Vol3. My lecturers do not require me to use WebCT.

WebCT Extent of Usage (Scale 1 – 7)

Course Content Module:

Calendar

Course Syllabus

Course Content Module

Glossary

Search

Compile

Communications Module:

Discussion

Chat

Email
Whiteboard

Evaluation Module:
Quizz/Survey
My Grades module
Self-tests
Assignments module

Study Tools Module:
My Progress module
Student Home Pages
Student Presentations
Student Tips

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