The Role of Cognitive Instrumental Processes, Social Influence Processes and Perceived Behavioural Control in the Acceptance of the Internet as a Learning Tool

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1. Introduction

The adoption and use of the Internet and World Wide Web (hereafter referred to as the Internet) for learning purposes has increased rapidly over the past few years, and a plethora of new web-based learning tools and technologies have begun to emerge (Mioduser, Nachmias, Lahav & Oren 2000). The use of such tools has not been restricted to the traditional distance learning environment, and their adoption by institutions for internal courses as well is now commonplace (McClelland 2001).

The Internet by itself, however, contains a vast amount of information and resources that can be harnessed for learning with or without the use of dedicated web-based learning tools. In fact, many of the technological components contained in web-based learning tools are also available on public Internet web sites. Examples include, among others, email, group calendars, and chat rooms. It is therefore feasible to examine the adoption of the Internet for learning, without regards to a specific tool or web site. The overall aim of this study specifically is to determine what factors influence end user acceptance of the Internet as a learning tool. Armed with such an understanding, educators and trainers may be in a better position to encourage students to use this invaluable tool for purposes other

than entertainment or leisure (Venkatesh 1999). Insights gained from such a study are furthermore useful for those involved in designing and implementing web-based learning environments, as many of the factors that apply to general Internet-for-learning acceptance will also apply to specific web-based learning tools.

In the next section, the conceptual background to technology acceptance will be discussed, which will lead into the development of the research framework and hypotheses. In the research method section, the means of testing these hypotheses is outlined. A report on the results follows, with a discussion of the results thereafter. Recommendations for future research are made, and the paper is then concluded.

2. Conceptual Background

In attempting to understand what factors lead to technology adoption by end users, researchers have typically turned to the tried and tested technology acceptance model (TAM) (Davis 1989). The TAM in its most basic form posits that a user's intention to use a technology (and in turn, the subsequent use of that technology) is influenced principally by the perceived usefulness and perceived ease of use of that technology. The former has a greater influence on user's intentions than the latter, with perceived ease of use also having a direct effect on perceived usefulness (Davis 1989).

Whilst the basic TAM is useful in predicting technology usage behaviour, in order to better understand the adoption process, richer descriptions of user beliefs, attitudes, intentions and usage behaviour are required (Taylor & Todd 1995). This holds true especially with relatively new technologies such as the Internet. As a result many studies on Internet technology adoption have been grounded in alternative theoretic frameworks, or have attempted to combine different theories together. Examples include the Triandis social psychological model (in Cheung, Chang & Lai 2000), the diffusion of innovations theory (in Agarwal & Prasad 1997) and the decomposed theory of planned behaviour and diffusion of innovations theory (in Tan & Teo 2000). Other studies have simply sought to extend and modify the TAM to capture the richness of Internet adoption (Lederer, Maupin, Sena & Zhuang 2000; Jiang, Hsu, Klein & Lin 2000; Teo, Lim & Lai 1999). At the same time, the underlying theories

themselves are being extended, a case in point being the extensions suggested for the TAM (Venkatesh & Davis 2000; Venkatesh 2000).

Common to all frameworks, is the premise that user perceptions of a technology are important predictors of the user acceptance of that technology. The dependent variable that measures acceptance has typically been either use of the technology or the intentions to use the technology, or even in some cases both (Venkatesh & Davis 2000). The independent variables (perceptions, beliefs, attitudes, system characteristics) are many and varied, and findings with regards to the value of some in predicting technology acceptance have been mixed (Agarwal & Prasad 1997). Some studies based on the TAM furthermore assume that all factors, other than perceived usefulness and ease of use, influence acceptance indirectly through these two variables (Venkatesh 2000). In order to gain a better understanding of the different variables, they are listed and defined in Table 1.

Table 1: Variables used in Internet Acceptance Studies

Variable	Abbreviation	Definition
Perceived relative advantage	RADV	Extent to which a person views an innovation as offering an advantage over previous ways of performing the same task (Agarwal & Prasad 1997)
Perceived usefulness	PU	The degree to which a person believes that using a particular system would enhance his or her job performance (Davis 1989)
Perceived near-term consequences	NTCONS	The extent to which an individual believes that using a system can enhance job performance (Cheung *et al.* 2000)
Perceived long-term consequences	LTCONS	The increased flexibility to change job or increased opportunities to have a more meaningful job (Cheung *et al.* 2000)
Perceived ease of use	EOU	The degree to which a person believes that using a particular system will be free of effort (Davis 1989)

Perceived complexity	CMPLEX	The degree to which an innovation is perceived as relatively difficult to understand and use (in Cheung *et al.* 2000)
Result demonstrability	RDEM	The tangibility of the results of using an innovation (in Agarwal & Prasad 1997)
Affect	AFF	Feelings of joy, elation, pleasure, or displeasure, hate or disgust associated by an individual with a particular act (in Cheung *et al.* 2000)
Perceived enjoyment	PENJ	The perceived degree of enjoyment with using a system (Teo *et al.* 1999)
Perceived playfulness	PPLAY	The perceived degree of concentration, curiosity and enjoyment when using a system (Moon & Kim 2001)
Compatibility	COMPAT	The degree to which an innovation is viewed as being consistent with the existing values, needs, and past experiences of users (in Agarwal & Prasad 1997)
Banking needs	BNEED	The extent and breadth of banking services used by an individual (Tan & Teo 2000)
Visibility	VIS	The extent to which users see the innovation as being visible in the adoption context (in Agarwal & Prasad 1997)
Trialability	TRIAL	The extent to which users perceive that they have an opportunity to experiment with the innovation prior to committing to its usage (Agarwal & Prasad 1997)
Perceived risk	RISK	A person's perceived sense of risk when using the Internet for financial transactions (Tan & Teo 2000)
Experience	EXP	Prior experience of using an innovation (Jiang *et al.* 2000)
Social Factors	SFACT	An individual's internalisation of the reference group's subjective culture in social situations (in Cheung *et al.* 2000)

Subjective Norm	SNORM	A person's perception that most people who are important think that he/she should perform the behaviour in question (in Tan & Teo 2000)
Image	IMG	The perception that using an innovation will contribute to enhancing the social status of an individual (Agarwal & Prasad 1997)
Perceived Voluntariness	VOL	The extent to which users perceive the adoption decision to be voluntary (Agarwal & Prasad 1997)
Facilitating conditions	FCOND	The availability of resources needed to engage in the behaviour (in Tan & Teo 2000)
Self efficacy	SEFF	An individuals' self-confidence in his or her ability to perform a behaviour (in Tan & Teo 2000)
Usage	USE	Usage of an innovation
Intentions to use	IUSE	Future intentions to use an innovation
Enquiry task	IENQ	Intentions to use Internet for enquiry tasks (Gefen & Straub 2000)
Purchasing task	IPUR	Intentions to use the Internet for purchasing tasks (Gefen & Straub 2000)

From this table it can be seen that some variables are very similar in definition. For example, near-term consequences, relative advantage and perceived usefulness are all defined and measured in very much the same way. Similarly, affect, perceived enjoyment and perceived playfulness share commonality in definition. The same can be said of social factors and subjective norm. Complexity and ease of use are not generally examined together in any study, and although they may be distinct constructs, the one is more or less the opposite of the other.

Findings from key studies that have examined the impact of these variables on Internet acceptance are displayed in Table 2. The findings reported in this table relate to those where either use or intentions to use have been the dependent variable, and a direct relationship between independent variables and the dependent variable has been found. The

studies may have found other relationships but these are not of relevance to this study, where direct influences on adoption are the focus.

*** Table 2: Summary of Studies on Internet Acceptance**

Study	Independent Variables	Depen-dent variable (s)	Findings	Technology
Agarwal & Prasad (1997)	RADV, EOU, COMPAT, TRIAL, VIS, RDEM, IMG, VOL	USE IUSE	VOL – USE VIS – USE COMPAT – USE TRIAL – USE RADV – IUSE RDEM – IUSE	Internet/WWW for work/study
Lederer *et al.* (2000)	PU, EOU	USE	PU – USE EOU – USE	Web site for work
Teo *et al.* (1999)	PU, EOU, PENJ	USE	PU – USE EOU – USE PENJ – USE	Internet
Venkatesh (1999)	PU, EOU	IUSE	PU – IUSE EOU – IUSE	(Internet) computer-based training
Cheung *et al.* (2000)	CMPLEX, NTCONS, LTCONS, AFF, SFACT, FCOND	USE	CMPLEX – USE (-) NTCONS – USE SFACT – USE FCOND – USE	WWW at work
Jiang *et al.* (2000)	EXP, NTCONS, LTCONS, FCOND	USE	NTCONS – USE LTCONS – USE FCOND – USE EXP – USE	Internet/WWW for study

Gefen & Straub (2000)	PU, EOU	IENQ IPUR	PU – IENQ PU – IPUR EOU – IENQ	Ecommerce
Tan & Teo (2000)	RADV, COMPAT, EXP, BNEED, CMPLEX, TRIAL, RISK, SNORM, SEFF, FCOND	IUSE	RADV – IUSE COMPAT – IUSE EXP – IUSE BNEED – IUSE TRIAL – IUSE RISK – IUSE SEFF – IUSE (FCOND – IUSE)	Internet banking
Chang & Cheung (2001)	CMPLEX, NTCONS, LTCONS, AFF, SFACT, FCOND	IUSE	NTCONS – IUSE AFFECT – IUSE SFACT – IUSE FCOND – IUSE	WWW at work
Moon & Kim (2001)	PU, PPLAY, ATT	IUSE	PU – IUSE PPLAY – IUSE ATT – IUSE	WWW

*** See Table 1 for meaning of abbreviations.**

These variables and relationships form the basis for developing the research framework for this study, and will be discussed further in the next section.

3. Research Framework and Hypotheses

One of the major reasons for examining factors that influence the acceptance of the Internet as a learning tool is to identify how to promote and encourage the sustained long-term use of this tool by students. In such cases, assessing intentions to use is the more appropriate dependent variable, rather than the more immediate current usage (Chang & Cheung 2001). This choice in turn determines which factors are to be used as independent variables, from the possibilities listed in Table 1. Variables that will not be considered further, together with the reasons for dropping them are given in Table 3.

***Table 3: Variables to be Dropped**

Variable to be dropped	Reason
RADV	PU, a similar variable, will be used
NTCONS	PU, an identical variable, will be used
CMPLEX	EOU, the opposite of complexity will be used
AFF	PENJ, a similar variable, will be used
PPLAY	PENJ, a similar variable, will be used
SFACT	SNORM will be used.
BNEED	Relevant to Internet banking only (Tan & Teo 2000)
TRIAL	Trialability was shown to be relevant only for initial adoption (use) of the WWW (Agarwal & Prasad 1997). It is also of greater relevance when examining a specific Internet application, such as Internet banking (Tan & Teo 2000).
RISK	Risk is deemed not relevant to the acceptance of the Internet as a learning tool, given that this variable refers to risk with regards to financial transactions (Tan & Teo 2000).
IMG	This factor had no significant influence on either intentions to use, or initial usage where reported in a study of Internet adoption (Agarwal & Prasad 1997).
VIS	Visibility was shown to have influence on immediate initial use, rather than long-term future usage intentions (Agarwal & Prasad 1997)

*** Refer to Table 1 for the meaning of abbreviations.**

The remaining variables will thus form part of the research model. Given the large number of variables, a means of categorising them into higher order dimensions would be useful. A novel way of categorising such factors is provided by Venkatesh and Davis (2000) and Taylor and Todd (1995) respectively. Venkatesh and Davis (2000) categorise variables as either cognitive instrumental processes, or social influence processes. Taylor and Todd (1995) provide a further category that is relevant to this study—that of perceived behavioural control.

Cognitive Instrumental Processes

Cognitive instrumental processes can be defined as the mental representations that people use in order to make a decision as to whether to adopt a technology or not (Venkatesh & Davis 2000). Variables that can be included in this category include perceived usefulness, perceived ease of use, result demonstrability, compatibility with values/learning style, long-term consequences of use and perceived enjoyment. Hypotheses relating to these variables are therefore as follows:

Hypothesis 1. Perceived usefulness will have a positive effect on intentions to use.
Hypothesis 2. The perceived long-term consequences of use will have a positive effect on intentions to use.
Hypotheses 3. Perceived ease of use will have a positive effect on intentions to use.
Hypothesis 4. Result demonstrability will have a positive effect on intentions to use.
Hypothesis 5. Perceived compatibility with values/learning style will have a positive effect on intentions to use.
Hypothesis 6. Perceived enjoyment will have a positive effect on intentions to use.

Social Influence Processes

Social influence processes are defined as those social factors that may influence a person's decision to adopt an innovation (Venkatesh & Davis 2000). This dimension will be represented by subjective norm, and perceived voluntariness. Findings with regards to the influence of voluntariness on Internet adoption have been mixed. Agarwal and Prasad (1997) found perceived voluntariness to have an influence only on initial use and not long-term intentions to use. However, in the learning context, it was deemed appropriate to include it, as whether the use of a tool is mandatory or voluntary for a specific course will have a bearing on student's adoption decisions. This, then leads to the following hypotheses:

Hypothesis 7. Subjective norm will have a positive effect on intentions to use.

Hypothesis 8. Perceived voluntariness will have a negative effect on intentions to use

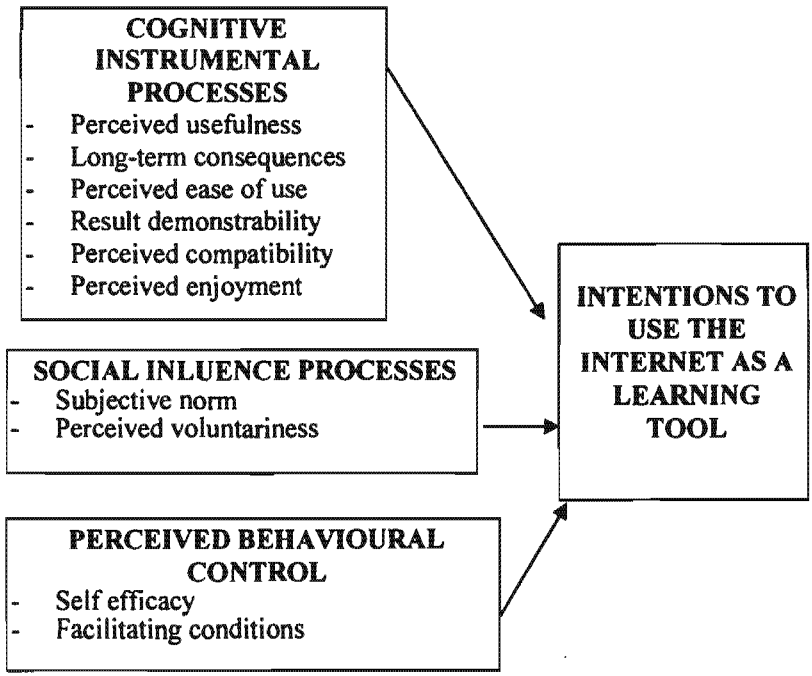
Perceived Behavioural Control

Perceived behavioural control is made up of internal control (self-efficacy), and external control (facilitating conditions) (Venkatesh 2000). Hypotheses concerning these variables are:

Hypothesis 9. Self-efficacy will have a positive effect on intentions to use.
Hypothesis 10. Facilitating conditions will have a positive effect on intentions to use.

The research framework is illustrated in Figure 1 below.

Figure 1: Research Framework



4. Research Method

4.1 Research Procedure

In order to test these hypotheses, a questionnaire was developed and distributed to University students who were studying an introductory course in Information Systems. This group was chosen, for its relative diversity, and accessibility. Demographic information was gathered about the respondents, such as their age, gender, degree program, year of study, and home language. Their experience with the Internet was also assessed through a three-item measure that examined the number of years using the Internet, the frequency of usage, and intensity of usage (number of hours on average per day). Diversity of Internet usage was assessed through an 8-item 7-point Lickert scale, ranging from 'Never' used at one end, to 'A great extent' of use at the other. Each of the 8 items related to a common use that is made of the Internet. The other measures on the questionnaire related to the constructs to be used in testing the hypotheses, and are discussed in the next section.

4.2 Construct Measures

In order to operationalise the constructs, measures for each were identified from the literature, and in some case modified to suit the context of the Internet for learning. A summary of the measures, the type of scale used, the number of items in each scale, and the references for the measures is displayed in Table 4. In most cases a seven-point Lickert scale anchored by Strongly Disagree (1) at one end, to Strongly Agree (7) at the other was employed. A copy of the questionnaire items is included in Appendix 1.

Table 4: Construct Measures

Construct	Number of Items	Type of Scale	Reference
Cognitive Instrumental Processes			
Perceived Usefulness	4	7-point Lickert Scale	Davis (1989)

Long-term Consequences	5	as above	Cheung *et al.* (2000)
Perceived Ease of Use	4	as above	Teo *et al.* (1999)
Result Demonstrability	4	as above	Agarwal & Prasad (1997)
Perceived Compatibility	3	as above	Tan & Teo (2000)
Perceived Enjoyment	5	7-point Semantic Differential Scale	Teo *et al.* (1999)
Social Influence Processes			
Subjective Norm	3	7-point Lickert Scale	Tan & Teo (2000)
Perceived Voluntariness	2	as above	Venkatesh & Davis (2000)
Perceived Behavioural Control			
Self-efficacy	3	7-point Lickert Scale	Taylor & Todd (1995)
Facilitating Conditions	4	as above	Cheung *et al.* (2000)

4.3 Subjects

4.3.1 Demographic Profile

A total of 322 completed questionnaires were received, of which 294 formed the sample. The remainder were rejected, as they were deemed to be insufficiently complete to be of any use. Of the 294 respondents in the sample, 41% were male, and 59% female. Their ages varied from 17 to 26, with the majority being in the 18 to 21 year -old bracket (94% of sample). Approximately one third were Social Science students, the remainder being from the Commerce faculty. Of the Commerce students, only 8% were majoring in Information Systems. Thus, on the whole, they were not students who had a career interest in information technology. 83% of the subjects were in their first year, with progressively fewer in second, third, and fourth

year/postgraduate level, respectively. English was indicated as the home language for 61.3% of the sample, with 30.5% indicating another official South African language, and the remainder indicating a foreign language. A summary of this demographic data is provided in Table 5 below.

Table 5: Demographic Profile of Sample

		Number	%
Gender	Male	116	41
	Female	169	59
Age	17	7	2.4
	18	134	45.9
	19	88	30.1
	20	41	14.0
	21	11	3.8
	22 to 26	11	3.8
Degree Program	Social Science	92	32.1
	Commerce	180	62.7
	Commerce (IS)	15	5.2
Year of study	First	240	83.3
	Second	27	9.4
	Third	14	4.9
	Fourth/PostGrad	7	2.4
Home Language	English	179	61.3
	Other South African (Official)	89	30.5
	Other	24	8.2

Numbers may not add up consistently due to missing values

4.3.2 Internet Use

In terms of years of Internet use, there is considerable diversity, with 28.3% claiming to have been using the Internet for a year or less, 18.7 % for 1 to 2 years, 18.7 % for 2 to 3 years, 15.6% for 3 to 4 years, and 18.7% for more than 4 years. 70.9% of the sample furthermore claims to use the Internet a

few times a week or more, and 90.4% use it for 2 to 3 hours or less on an average working day.

For the items on diversity of use, the highest mean score was for using the Internet for email (5.9, on a scale of 1 to 7), indicating that email is used to quite a great extent by the sample. The only other mean score greater than 4 is for using the Internet to get information for pleasure or entertainment (5.1). Using the Internet for getting information for study purposes has a mean of only 3.9, which on a scale of 1 to 7 is quite low. The lowest mean scores are for electronic commerce tasks, such as financial transactions (1.4) and purchasing/shopping (1.5), indicating that for this sample, electronic commerce is almost never carried out. A summary of the Internet usage statistics is shown in Table 6 below.

Table 6: Internet Usage Statistics

		Number	%
Internet Years	<=1	82	28.3
	1 to 2	54	18.7
	2 to 3	54	18.7
	3 to 4	45	15.6
	> 4	54	18.7
Frequency of Use	Almost Never	10	3.5
	Less than 1/ month	13	4.5
	Few times / month	30	10.4
	Once / week	31	10.7
	Few times / week	108	37.4
	Once / day	51	17.6
	Few times / day	46	15.9
Hours per average working day	Almost never	26	9.2
	Less than ½ hour	46	16.2
	½ hour to 1 hour	76	26.8
	1 to 2 hours	87	30.6
	2 to 3 hours	33	11.6

	3 to 4 hours	7	2.5
	> 4 hours	9	3.2
		Mean	**Standard Deviation**
Diversity of Use (on a scale of 1 to 7)	To get information for degree program	3.9	1.8
	To get information for leisure/entertainment	5.1	1.7
	For email	5.9	1.6
	To get product support	2.6	1.6
	To down load free resources	3.0	2.0
	For chat rooms	2.5	1.8
	For Purchasing/Shopping	1.4	0.9
	For financial transactions	1.5	1.2

5. Data Analysis and Results

5.1 Reliability

The constructs were assessed for reliability using the Cronbach alpha. A minimum alpha of 0.7 is required for a construct measure to be deemed reliable (as in Agarwal & Prasad 1997). As can be seen from Table 7, all items had scores greater than 0.7, with perceived voluntariness being the exception . This was because, for the Cronbach alpha to be assessed using the Statistica software package employed in this analysis, a construct should contain at least 3 items. In the case of voluntariness, there were only 2 items present.

Table 7: Reliability Analysis

Dimension	Construct	Number of Items	Cronbach Alpha
Cognitive Instrumental Processes	Perceived usefulness	4	0.92
	Long-term consequences	5	0.87
	Perceived ease of use	4	0.91
	Result demonstrability	4	0.88
	Compatibility	3	0.89
	Perceived enjoyment	5	0.97
Social Influence Processes	Subjective norm	3	0.85
	Voluntariness	2	-
Perceived Behavioural Control	Self-efficacy	3	0.87
	Facilitating conditions	4	0.76

5.2 Descriptive Statistics

The means, standard deviations, and correlations for the various constructs are displayed in Table 8. The correlations between dependent variables are all less than 0.52, indicating that they are distinct constructs, with those significant at $p < 0.01$ highlighted.

Table 8: Descriptive Statistics

	Mean	Std. Dev.	*Correlations										
			PU	LT	EOU	RD	COMP	PE	SN	VOL	SE	FC	IU
Perceived Usefulness	5.33	1.20	1.00										

Long-term Consequence	5.32	1.02	***0.51***	1.00							
Ease of Use	5.50	1.08	***0.19***	***0.18***	1.00						
Result Demonstrab.	5.30	1.12	***0.28***	***0.24***	***0.37***	1.00					
Compatibility	4.60	1.22	***0.45***	***0.29***	***0.35***	***0.48***	1.00				
Perceived Enjoyment	5.19	1.53	***0.34***	***0.24***	***0.30***	***0.20***	***0.32***	1.00			
Subjective Norm	5.10	1.30	***0.33***	***0.30***	0.15	***0.26***	***0.30***	***0.22***	1.00		
Voluntariness	5.57	1.28	- 0.04	0.03	***0.29***	***0.18***	0.09	0.07	0.05	1.00	
Self Efficacy	5.26	1.25	0.08	0.07	***0.52***	***0.39***	***0.34***	***0.22***	***0.21***	***0.27***	1.00
Facilitating Conditions	4.87	1.11	***0.20***	***0.25***	***0.35***	***0.28***	***0.32***	***0.17***	***0.17***	0.14	***0.30***	1.00
Intentions to Use	4.99	1.31	***0.51***	***0.37***	***0.20***	***0.35***	***0.60***	***0.37***	***0.26***	-0.09	***0.24***	***0.18***	1.00

*** Coefficients highlighted are significant at $p < 0.01$**

5.3 *Construct Validity*

Construct validity was demonstrated through the use of factor analysis with varimax rotation, as displayed in Table 9. If items have factor loadings greater than 0.5 on their expected factors, and less than 0.4 on the others, then construct validity is demonstrated (as in Tan & Teo 2000). For the items in the study, it was expected that 10 constructs should be evident, and so a 10-factor structure was suggested with a minimum eigenvalue of 1. All items loaded on their expected factors with factor loadings greater than 0.5, and less than 0.4 on other factors, thus construct validity was proved. The extracted factors accounted for 77% of the variance.

****Table 9: Factor Analysis**

	LTCONS	EOU	PENJ	RDEM	SN	FCOND	PU	COMPAT	SEFF	VOLUNT
PU1	0.22	0.01	0.14	0.11	0.12	0.08	***0.79***	0.08	-0.02	-0.06
PU2	0.16	0.05	0.19	0.07	0.08	0.02	***0.83***	0.19	0.00	0.02
PU3	0.22	0.04	0.13	0.07	0.07	0.07	***0.86***	0.15	-0.03	-0.04
PU4	0.26	0.09	0.10	0.11	0.14	0.03	***0.83***	0.11	0.06	-0.01
LT1	***0.72***	0.06	0.10	0.12	0.10	0.09	0.33	-0.08	0.02	-0.11
LT2	***0.77***	0.13	0.13	0.10	0.03	0.08	0.25	0.03	0.02	-0.03
LT3	***0.81***	0.08	0.10	0.09	0.05	0.00	0.24	0.10	0.06	0.06
LT4	***0.84***	0.06	0.03	0.06	0.07	0.05	0.10	0.05	0.04	0.07
LT5	***0.73***	-0.06	0.04	-0.01	0.12	0.14	0.03	0.18	-0.11	-0.03
EOU1	0.02	***0.83***	0.12	0.12	0.02	0.09	0.11	0.06	0.19	0.09
EOU2	0.01	***0.86***	0.13	0.13	0.03	0.10	0.04	0.12	0.19	0.07
EOU3	0.06	***0.79***	0.14	0.11	0.00	0.20	0.05	0.17	0.15	0.02
EOU4	0.15	***0.81***	0.09	0.18	0.04	0.10	0.00	-0.01	0.19	0.07
SE1	0.03	0.31	0.14	0.18	0.04	0.04	0.04	0.04	***0.81***	0.06
SE2	0.01	0.20	0.08	0.12	0.14	0.17	0.00	0.17	***0.79***	0.04
SE3	-0.05	0.23	0.03	0.19	0.03	0.11	-0.04	0.07	***0.84***	0.05
FC1	0.07	0.20	0.10	0.10	-0.05	***0.57***	-0.04	0.01	0.08	0.28
FC2	0.07	0.09	0.04	0.00	0.05	***0.85***	0.00	-0.03	0.03	0.04
FC3	0.09	0.03	0.00	0.13	0.02	***0.82***	0.09	0.16	0.09	-0.08
FC4	0.13	0.20	0.09	0.13	0.13	***0.64***	0.19	0.18	0.14	-0.07
SN1	0.05	0.06	0.06	0.07	***0.90***	0.05	0.08	0.17	0.01	0.04
SN2	0.11	0.04	0.07	0.10	***0.93***	0.01	0.11	0.12	0.04	-0.03
SN3	0.22	-0.03	0.14	0.14	***0.67***	0.09	0.22	-0.07	0.20	0.00
RD1	0.15	0.16	0.09	***0.78***	0.11	0.06	0.06	0.10	0.11	0.04
RD2	0.10	0.07	0.04	***0.86***	0.04	0.04	0.07	0.15	0.08	0.01
RD3	0.05	0.14	0.05	***0.78***	0.09	0.12	0.08	0.09	0.21	0.09
RD4	0.03	0.15	0.04	***0.82***	0.08	0.12	0.14	0.17	0.09	0.00
C1	0.10	0.16	0.24	0.32	0.06	0.10	0.30	***0.65***	0.21	0.00
C2	0.08	0.10	0.07	0.18	0.10	0.04	0.19	***0.89***	0.08	0.05
C3	0.15	0.13	0.13	0.21	0.13	0.18	0.17	***0.80***	0.09	-0.03

V1	0.19	0.29	0.08	0.11	0.08	0.07	0.01	0.06	0.31	***0.60***
V2	-0.12	0.03	-0.03	0.03	-0.02	0.03	-0.08	-0.02	-0.02	***0.87***
PE1	0.10	0.12	***0.90***	0.11	0.09	0.02	0.12	0.08	0.09	-0.01
PE2	0.07	0.10	***0.93***	0.03	0.08	0.02	0.11	0.08	0.05	0.00
PE3	0.07	0.10	***0.95***	0.02	0.04	0.07	0.10	0.05	0.04	0.01
PE4	0.07	0.05	***0.93***	0.06	0.04	0.05	0.12	0.04	0.07	0.01
PE5	0.07	0.12	***0.92***	0.03	0.03	0.07	0.12	0.07	0.01	0.02
Eigen-val	**3.49**	**3.31**	**4.63**	**3.14**	**2.33**	**2.40**	**3.37**	**2.26**	**2.46**	**1.27**
Cum-ul Var.	**9%**	**18%**	**31%**	**39%**	**46%**	**52%**	**61%**	**67%**	**74%**	**77%**

**** See Table 1 for definitions of constructs**

5.4 Hypotheses Testing

The 10 hypotheses that have been formulated were tested using multiple linear regression analysis. Before carrying this out, however, it was necessary to establish whether multi-collinearity would pose a problem. If the variance inflation factors (VIFs) for the independent variables are greater than 10, then multi-collinearity could unduly influence the results of regression analysis (as suggested by Tan and Teo 2000). The VIFs were less than 1.67 for all independent variables in this study, thus indicating that multi-collinearity would not be a problem. The independent variables were regressed on the dependent variable (Intentions to use), with the results shown in Table 10.

Cognitive Instrumental Processes

Of the cognitive instrumental processes, there is support for hypothesis 1 (Perceived usefulness influences intention to use the Internet for learning), hypothesis 2 (Long-term consequences influence intentions), hypothesis 5 (Compatibility influences intentions), and hypothesis 6 (Perceived enjoyment influences intentions). Of these, hypothesis 5 is the most significant, with compatibility being a very strong influence on the intentions to use the Internet for learning (beta = 0.40, $p < 0.000001$). The influence of perceived usefulness (beta = 0.21, $p = 0.0002$) is next in line, followed by

perceived enjoyment (beta = 0.15, p = 0.002), and long-term consequences (beta = 0.12, p = 0.02). Ease of use, and result demonstrability showed a weak influence on intentions, and as such there was no support for hypotheses 3 and 4.

Social Influence Processes

Of the social influence processes, perceived voluntariness had a significant negative influence on intentions to use the Internet for learning (hypothesis 8 supported, beta = -0.14, p = 0.002), but there was no support for subjective norm as an influence (hypothesis 7 not supported).

Perceived Behavioural Control

In the perceived behavioural control dimension, neither self-efficacy nor facilitating conditions had any significant influence on intentions to use the Internet for learning, thus hypotheses 9 and 10 were not supported.

Table 10: Results of Regression Analysis

Dimension	Independent Variables	Beta	p-level
Cognitive Instrumental Processes	***Perceived Usefulness***	0.21	***0.0002***
	Long-term Consequences	0.12	***0.0217***
	Perceived Ease of Use	-0.06	0.2526
	Result Demonstrability	0.07	0.2052
	Compatibility	0.40	***0.0000***
	Perceived Enjoyment	0.15	***0.0014***
Social Influence Processes	Subjective Norm	-0.01	0.8110
	Voluntariness	-0.14	***0.0022***
Perceived Behavioural Control	Self-Efficacy	0.10	0.0724
	Facilitating Conditions	-0.05	0.3415

Adjusted R squared = 45.83%

6. Discussion and Implications

6.1 Cognitive instrumental processes

Compatibility: The strong and significant influence of compatibility on intentions to use the Internet for learning is in line with the findings of Tan and Teo (2000), who found compatibility with values to be a significant influence on user intentions to adopt Internet banking. In the context of learning, this result clearly illustrates the importance that must be attached to learning styles, when web-based learning environments are introduced. Those who find use of the Internet to be compatible with their learning and working styles will quickly adapt to this environment, whilst those who do not may avoid its use. It may be necessary, therefore, to develop facilitation mechanisms to assist such students, as all indications are that web-based learning environments are becoming pervasive in many learning institutions.

Perceived Usefulness: The significant influence of perceived usefulness is not surprising, as it has consistently been shown to influence technology acceptance in general, especially as part of the TAM (Davis 1989). Providing students with links to sites that are useful for the courses they are studying will thus promote Internet acceptance for learning.

Long-term Consequences: Findings with regards to the influence of long-term consequences have been mixed, with one study showing it to have a significant influence on Internet use (Jiang *et al.* 2000), while another showing it as having a weak influence (Chang & Cheung 2001). In the context of the sample group in this study, this factor was significant, as for university students concerned about their future careers, if the Internet is perceived as enhancing career opportunities, there is a greater possibility of its acceptance for learning purposes. Thus, the use of the Internet in specific careers should be made known to students.

Perceived enjoyment has been shown in previous studies to have an influence on Internet acceptance (Teo *et al.* 1999; Moon & Kim 2001; Chang & Cheung 2001). This study confirms this to still hold true when the intention is to use the Internet for learning purposes. Teo *et al.* (1999) refer to perceived enjoyment as intrinsic motivation, whereby intentions to use the

Internet are motivated by an internal sense of pleasure with its use. This is in contrast to extrinsic motivation (perceived usefulness), whereby the Internet is adopted because it is perceived to be of benefit to learning. Thus, by allowing students to use the Internet for leisure and entertainment (within limits), institutions can foster this sense of enjoyment.

Ease of Use had no significant influence on intentions to use the Internet for learning. This lends weight to the argument of Jiang *et al.* (2000), who state that a rapidly diffusing innovation such as the Internet that is highly user friendly, makes ease of use of no great significance in adoption. Agarwal and Prasad (1997) support this view. Furthermore, the subjects in this study were on average fairly experienced Internet users, and so ease of use was not of concern in their adoption decisions.

Result Demonstrability: The same can be said of result demonstrability. Since the subjects were already using the Internet (albeit not always for learning purposes), the results of using it were clear to them, and result demonstrability was not a significant factor in the decision as to whether to use it for learning purposes.

6.2 Social Influence Processes

Subjective Norm: Findings with regards to the influence of peers, colleagues and superiors on Internet acceptance have been mixed. Chang and Cheung (2001) found this factor to have an influence on intentions to use the Internet at work, whilst Tan and Teo (2000) found it to have no influence on intentions to use Internet banking. Venkatesh and Davis (2000) furthermore demonstrate that the strength of its influence is moderated by the perceptions of voluntariness. Where usage is mandatory, subjective norm has a greater influence on intentions to use than when use is voluntary. In this study, subjective norm had no influence on intentions to use the Internet, and given that on average, subjects perceived its use to be voluntary (mean of 5.6, on a scale of 1 to 7), this is perhaps not surprising.

Voluntariness: Voluntariness had a significant negative influence on intentions to use the Internet for learning, in line with expectations. The explanation for this is that in the learning context, where a particular tool

such as the Internet is prescribed for a course (i.e., mandated), students would be more likely to use it than if it were not.

6.3 *Perceived Behavioural Control*

The behavioural control factors, ***self-efficacy***, and ***facilitating conditions*** had no significant influence on the intentions to use the Internet for learning. This is in contrast to many previous studies on Internet acceptance (Jiang *et al.* 2000; Chang & Cheung 2001; Tan & Teo 2000). Once again, the sample group were relatively experienced Internet users, and thus confident in their ability to use the Internet. As a result, self-efficacy did not feature as an influence on their adoption decisions. In the same way, external support (facilitating conditions) was not important as an influence on their intentions to use the Internet for learning. These factors have furthermore been shown to be important predictors of ease of use, rather than intention to use a technology (Venkatesh 2000). Their impact, therefore, may be indirect.

7. Limitations and Future Research

The subjects that made up the sample were mostly first year students, studying either social science or commerce. Thus, any findings must take into account this profile. Future research may then also examine subjects from a more diverse sample, and may include students from other faculties, such as health and engineering as well as postgraduate and MBA students. Including students that study through distance learning mode as well as through on-site courses may further diversify the sample. This will aid in generalisation of the findings.

Rather than examining the Internet in general, a specific learning web site or web-based learning tool may be assessed, so that responses can be more directed (Lederer *et al.* 2000).

The perceptions of lecturers and trainers on the adoption of web-based learning environments may also provide an additional perspective on this new and exciting development in education.

The data that has been collected allows for further analysis to be done. For example, the differences in adoption decisions between gender, language and degree groups can also be examined. If language is used as a proxy for culture, the role of culture in adoption decisions can be examined.

Using techniques, such as structural equation modelling, other relationships between the independent variables may be examined. For example, self-efficacy and facilitating conditions have been shown to influence ease of use (Venkatesh 2000). Although in this study ease of use was found to have a weak influence on adoption, it has been shown in other studies, to have an influence on perceived usefulness (Davis 1989). Perceived usefulness in turn has been shown to influence long-term consequences, as well as adoption (Jiang *et al.* 2000).

A large number of factors have been considered in this study, but by the same token, there are a large number of additional factors that could have also been included. Examples include, among others, computer anxiety, and computer playfulness (Venkatesh 2000). More specifically, Internet anxiety and Internet playfulness can be considered. If a specific web site or tool is to be examined, web site characteristics such as information quality may also influence adoption decisions (Lederer *et al.* 2000).

Finally, the strong influence of compatibility on the adoption of the Internet as a learning tool warrants further investigation into this factor specifically, with antecedents of compatibility possibly being examined.

8. Conclusion

This study has sought to examine the role of cognitive instrumental processes, social influence processes, and perceived behavioural control in the acceptance of the Internet as a learning tool. Based on a survey of 294 university students, it was found that the cognitive instrumental processes perceived compatibility with values/learning style, perceived usefulness, perceived enjoyment, and perceived long-term consequences of use significantly influenced the acceptance of the Internet as a learning tool. Likewise, the social influence process perceived voluntariness was shown to have a significant negative influence, whilst none of the perceived behavioural control factors (self-efficacy and facilitating conditions) had any effect on acceptance. In all, the 5 influential factors accounted for 45.8% in the variance of intentions to use the Internet for learning.

In order to promote the use of the Internet as a learning tool, therefore, educators and trainers should make it a requirement for students to use the Internet in their courses. This can be done through setting tasks that

require the student to use the Internet, and/or through the establishment of a web-based learning environment using any one of many web-based tools available on the market.

Sites that are useful for a specific course can be made available from the course web site through hyperlinks, and/or be included in course readers. The uses of the Internet in specific careers should also be amply illustrated.

Students who enjoy using the Internet are more likely to use it for learning purposes, so institutions should not be too restrictive on students using the Internet for leisure or entertainment outside of class times. This helps to make the use of the Internet more compatible with students' experiences and learning styles, thus preparing them for a learning environment in which the Internet and related applications are becoming increasingly pervasive.

Whilst encouraging students to use the Internet for learning, educators should nevertheless at the same time warn them against using this tool for plagiarism and cheating. The potential of the Internet for good is countered by the potential for its abuse.

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Appendix 1: Questionnaire Items

Internet Usage

Please answer the following with regards to your Internet usage.

1. For how many years have you been using the Internet?	Less than 1	1	1-2	2-3	3-4	4-5	More than 5
2. On the average, how frequently do you use the Internet?	Almost never	Less than 1/month	Few times/ month	Once/ week	Few times/ week	Once/ day	Few times/ day
3. On the average working day, how much time is spent on the Internet?	Almost never	Less than 1/2 hour	1/2 hour to 1 hour	1 -2 hours	2 -3 hours	3 -4 hours	More than 4 hours

Diversity of Internet Usage

Please indicate the extent to which you use the Internet for the following:

	Never						A great Extent
1. To get information for my degree program.	1	2	3	4	5	6	7
2. To get information for pleasure or entertainment.	1	2	3	4	5	6	7
3. Email	1	2	3	4	5	6	7
4. To get product support	1	2	3	4	5	6	7
5. To download free resources.	1	2	3	4	5	6	7
6. To use chat rooms							
7. For purchasing/shopping.	1	2	3	4	5	6	7
8. For financial transactions.	1	2	3	4	5	6	7

Perceived Usefulness

	Strongly disagree	Dis-agree	Some-what disagree	Neutral	Some-what agree	Agree	Strong-ly agree
1. Using the Internet would improve my performance in my degree program.	1	2	3	4	5	6	7
2. Using the Internet in my degree program would assist my learning/study.	1	2	3	4	5	6	7
3. Using the Internet would increase my effectiveness in my degree program.	1	2	3	4	5	6	7
4. The Internet would be useful in my degree program.	1	2	3	4	5	6	7

Perceived Ease of Use

	Strongly disagree	Disagree	Somewhat disagree	Neutral	Some-what agree	Agree	Strongl y agree
1. The Internet is easy to use.	1	2	3	4	5	6	7
2. The Internet is easy to learn.	1	2	3	4	5	6	7
3. The Internet is user friendly.	1	2	3	4	5	6	7
4. The Internet is easy to master.	1	2	3	4	5	6	7

Long-term Consequences	Strongly disagree	Disagree	Some-what disagree	Neutral	Some-what agree	Agree	Strong-ly agree
1. Using the Internet will increase the opportunity for preferred future job assignments.	1	2	3	4	5	6	7
2. Use of the Internet will increase the amount of variety in my work.	1	2	3	4	5	6	7
3. Use of the Internet will increase the opportunity for more meaningful work.	1	2	3	4	5	6	7
4. Use of the Internet will increase the flexibility of changing jobs..	1	2	3	4	5	6	7
5. Use of the Internet will increase the opportunity to gain job security.	1	2	3	4	5	6	7

Self-efficacy

	Strongly disagree	Disagree	Some-what disagree	Neutral	Some-what agree	Agree	Strong . -ly agree
1. I would feel comfortable using the Internet on my own.	1	2	3	4	5	6	7
2. If I wanted I could easily use any of the Internet tools and functions.	1	2	3	4	5	6	7
3. I would be able to use the Internet even if there is no one around to show me how to use it.	1	2	3	4	5	6	7

Facilitating conditions

	Strongly disagree	Disagree	Some-what disagree	Neutral	Some-what agree	Agree	Strong-ly agree
1. The Internet is available to me when I need it.	1	2	3	4	5	6	7
2. A person (or group) is available for assistance with Internet difficulties.	1	2	3	4	5	6	7
3. Specialised instruction concerning the Internet is available to me.	1	2	3	4	5	6	7

4. Overall the use of the Internet is very supportive.	1	2	3	4	5	6	7

Subjective norm

	Strongly disagree	Disagree	Some-what disagree	Neutral	Some-what agree	Agree	Strong-ly agree
1. My friends think that I should use the Internet.	1	2	3	4	5	6	7
2. My classmates think that I should use the Internet.	1	2	3	4	5	6	7
3. My lecturers think that I should use the Internet.	1	2	3	4	5	6	7

Result Demonstrability

	Strongly disagree	Disagree	Some-what disagree	Neutral	Some-what agree	Agree	Strong-ly agree
1. I would have no difficulty telling others about the results of using the Internet.	1	2	3	4	5	6	7
2. I believe I could communicate to others the consequences of using the Internet	1	2	3	4	5	6	7

3. The results of using the Internet are apparent to me.	1	2	3	4	5	6	7
4. I would have no difficulty explaining why using the Internet may be beneficial.	1	2	3	4	5	6	7

Compatibility

	Strongly disagree	Disagree	Some-what disagree	Neutral	Some-what agree	Agree	Strong-ly agree
1. Using the Internet is compatible with my learning style.	1	2	3	4	5	6	7
2. Using the Internet fits well with the way I like to study.	1	2	3	4	5	6	7
3. Using the Internet fits into my working style.	1	2	3	4	5	6	7

Voluntariness

	Strongly disagree	Disagree	Some-what disagree	Neutral	Some-what agree	Agree	Strong -ly agree
1. My use of the Internet is voluntary.	1	2	3	4	5	6	7
2. Although it might be helpful, using the Internet is certainly not	1	2	3	4	5	6	7

compulsory in my degree program.

Perceived enjoyment

Using the Internet for my degree program would be:

Unenjoyable	1	2	3	4	5	6	7	Enjoyable
Dull	1	2	3	4	5	6	7	Exciting
Unpleasant	1	2	3	4	5	6	7	Pleasant
Boring	1	2	3	4	5	6	7	Interesting
Frustrating	1	2	3	4	5	6	7	Fun

Intentions to use

	Strongly disagree	Disagree	Some-what disagree	Neutral	Some-what agree	Agree	Strong-ly agree
1. I intend to use the Internet frequently in my degree program.	1	2	3	4	5	6	7
2. I intend to be a heavy user of the Internet in my degree program.	1	2	3	4	5	6	7