Planned behaviour: Student attitudes towards the use of ICT interactions in higher education

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A pilot study was undertaken to collect data from a small group of undergraduate students in a higher education setting to determine their attitudes towards their use and engagement of ICT interactions. The study employed a mixed methods approach with the intention of combining the strengths of both quantitative and qualitative paradigms. The students were asked to complete a questionnaire, individually work though a brief ICT interaction activity and then participate in an informal interview. The questionnaire gathered data on each on the components of the Theory of Planned Behaviour, which is commonly used psychological research, in order to determine the students planned use of ICT. While the collected quantitative data revealed that students believed that interacting with ICT was pleasant, helpful and easy, the qualitative findings showed that some experienced feelings of anxiety and intimidation when working through the ICT interaction. Planned follow up studies will continue to investigate the causalities and relationships between variables to determine likely influences on ICT interaction behaviour.

Keywords: information communication technologies, attitudes, planned behaviour

Background

This paper focuses upon describing and understanding the responses of a small case of undergraduate students (n =30) towards a planned information communication technology (ICT) interaction. The research was undertaken throughout semester one 2008 and the sample comprised students who were completing a component of their undergraduate education degree in the second year of study at a Western Australian university. The students were invited to participate in the pilot study by way of initially completing a questionnaire. This first phase of the research was completed during the first half of the semester. The questionnaire was aimed at eliciting the sample's intentions to use ICT, their attitudes towards such an interaction, their perceived social pressure to interact with ICT, their perceived control over their capacity to interact with ICT, their beliefs about the likely consequences of interacting with ICT, their beliefs about the expectations of others regarding the interaction and their beliefs about the various factors that potentially would either help or hinder their interaction with ICT. Following the completion of the questionnaire the students were invited to progress through a fifteen minute ICT interaction activity on an individual basis. During the activity each student was observed and at the conclusion of the interaction the students participated in a brief informal interview designed to explore their reactions to the activity and their overall attitudes towards the ICT interaction. The items in the questionnaire were designed to gather data on each of the components of the Theory of Planned Behaviour (TPB) as it pertained to ICT interaction. The TPB as initially designed by Fishbein and Ajzen (1980) has been used to investigate the influence of beliefs and attitudes towards a range of social and personal behaviours. As far as can be determined from current research the theory has not yet been applied to the planned use of ICT. The research was designed as a pilot investigation to explore students' planned use of ICT. As a result of the quantitative analysis, the instrument will be refined in the second phase of the study in order to enable a complete causal examination of the factors that impact most strongly upon students' behaviour as it relates to ICT interaction. The second phase of the research will occur in 2009.

Attitude formation

Historically there has been much psychological research undertaken in the area of attitude and attitude formation. Common findings in the research show that attitudes and beliefs are linked, attitudes and behaviour are linked and attitudes are essentially likes and dislikes. Bem (1970) maintains that our affinities for and aversions to situations, objects, persons, groups or any other identifiable aspects of our environment, have roots in our emotions, behaviour and social influences upon us.

The word attitude connotes a subjective or mental state of preparation for action. Attitudes find their roots in our beliefs and they influence our behaviour. They represent the way in which we view the world and organise our relationships. Attitudes are literally mental postures and guides for conduct to which each new experience is referred before a response is made. Droba (1933) described an attitude as a mental disposition of the human individual to act for or against a definite object.

Krueger and Reckless (1931) defined attitude as a residuum of experience which conditions and controls further activity. In this way they can be viewed as acquired tendencies to act in specific ways, towards or against an environmental factor which is imbued with either negative or positive value. More recent research indicates that attitude represents a summary evaluation of a psychological object and is described both internally and externally in dimensions such as good-bad, likeable-dislikeable, harmful-beneficial, pleasant-unpleasant (Ajzen & Fishbein, 2000; Eagly & Chaiken 1993).

All of the above definitions imply a preparation, or readiness for response based on experiences and attitude formation that has occurred prior to the stimulus. If this is the case, students who are approaching an interaction with elements of an online learning program such as an animation may have already based their attitudes towards the experience on past interactions such as formal learning situations which incorporate information communication technology (ICT) as well as the abundance of such technologies available on a daily basis through media in general. Their attitudes may also be influenced by their perceptions of the relationships between the sometimes conflicting dimensions of the visual representation before them. If Krueger and Reckless (1931) are correct, the expectations of the sample towards their interaction with the technology should match the eventual development of the attitudes they hold regarding its components.

Krech, Critchfield and Livson (1958), describe attitudes as being comprised of three main components: the cognitive, the affective and the behavioural. The cognitive component categorises the individual's ideas and beliefs regarding an event or object. This cognitive category must also become associated with either a basically pleasant or unpleasant event. This results in the category becoming charged with meaning and a behavioural pattern develops. Behavioural patterns may have already developed in the sample towards interaction with technology. One of the aims of this study is to investigate the attitudes that coincide with those behavioural patterns.

Human beings constantly search for meaning and categorising events and environments is one way of doing exactly that. Fine discrimination of the environment is beyond the capacity of human attention so individuals treat many discriminated stimuli as instances of the same phenomenon (Krech et al., 1958, p. 101). Language plays a key role in labelling categories and their attributes. Similarly, each label may be denoted differently and the meaning changed accordingly. The affective component is the result of the changing of a category. Once a category has been formed, it becomes associated with meaning and therefore represents either a favourable or unfavourable state. The behavioural component is comprised of beliefs regarding the correct behaviour towards members of a particular category. Over a period of time and following a series of experiences students develop either favourable or unfavourable feelings associated with certain interactions. These feelings or 'states' may well form the basis of their attitudes towards their own self conceptualisation of the use of (ICT) as a means of enhancing learning.

According to Markman and Brendl (2000), people evaluate objects in relation to currently active goals. The life cycles of particular goals are dependent upon beliefs and values and the influence of significant others. Human beings therefore, experience a positive reaction or attitude towards objects or events that assist in the attainment of their personal goals, and negative reactions and attitudes towards objects or events that in some way hinder the attainment of desirable outcomes. Attitudes are often designated as being the result of several major influences. The social group to which the individual belongs is perhaps the most influential. In this way, both the group to which the individual belongs and the groups to which he/she aspire to belong, exert an enormous pressure and influence on attitude development.

Student attitudes towards ICT which emerge through the interaction with the animation utilised in the current research may have been determined through collaborating with peers, the administration of the project, and the influence of academic staff towards its conceptualisation. The idea that attitudes function to evaluate psychological objects would appear to imply that individuals hold only one attitude towards a given object at any one time. Recent research indicates however that this is simplistic and that when attitudes change, the new attitude may override but not completely replace the old attitude. Wilson et al. (2000) suggests that a model of dual attitudes is a more realistic conceptualisation in that people can hold two different attitudes towards an object at any given time. Wilson et al. (2000) posits that while an

individual is capable of interacting with two attitudes at once, one can be viewed as implicit while the other operates more manifestly as explicit in expression. The implicit attitude is understood to be automatically activated when the individual is presented with an attitude object while the explicit is more likely to require cognitive effort. A number of studies of prejudicial attitudes (Bargh et al., 1989) revealed that while implicit attitudes could emerge towards a particular race of people for example, explicit attitudes could override these reactions under the influence of group norms and with access to cognitive resources. In such a way more favourable attitudes could be retrieved. Wilson et al. (2000) found that implicit attitudes exerted more influence than explicit attitudes over involuntary non-verbal behaviour signalling discomfort such as excessive blinking, avoidance of eye contact and spatial distance. During life, experiences lead to the formation of many different beliefs about objects, actions and events. These beliefs may be the result of direct observation or inference. Some attitudes may be stable over time, others may exhibit frequent shifts.

According to Fishbein and Ajzen (1975), a person's attitude towards an object is primarily determined by no more than five to seven beliefs that are salient at any given time. It appears impossible to obtain a precise measure of the beliefs that determine an individual's attitudes, since the number of salient beliefs may vary from person to person. However an approximation can be obtained by considering the first few beliefs. Fishbein and Ajzen (1975) postulated that attitudes are inextricably linked to and based upon beliefs and the evaluative responses associated with those beliefs. Ajzen and Fishbein (2000) went further to infer that evaluative meaning arises spontaneously and inevitably as we form beliefs about an object. Each belief associates the object with a certain attribute which is embedded in context, culture and memory. According to Haugtvedt (1997) and Miniard and Barone (1997) beliefs are only one possible influence on attitudes. Zajonc (1980) had already indicated in earlier research that attitudes may also be controlled by affective processes. This is a position which is supported by the work of Verplanken et al. (1998) who suggests that evaluative response times were less for those participants being asked how they *felt* as opposed to how they *thought* about attitude objects. Verplanken's study indicated that the affective aspects underlying attitudes are more easily accessible in memory and it may be that these aspects play a larger role in the formation of attitudes than previously thought. It then becomes a lengthy task to alter a person's belief system and this clearly must occur over time.

Fishbein and Ajzen (1975, 1980) and Ajzen (1991) worked further towards the development of the theories of *reasoned action* and *planned behaviour* as a means of explaining, predicting and changing particular behaviours. These theories have resulted in a useful conceptual framework which has at its centre the roles of beliefs, attitudes, norms, perceived behavioural control and intentions as crucial indicators of particular behaviours. Reasoned action is best described as a process by which an individual arrives at an intention. According to Ajzen and Fishbein (2005) behavioural intentions are thought to result from beliefs about performing the behaviour. Behavioural, normative and control beliefs that people hold about performing a certain behaviour are influenced by a range of background factors such as personality, mood, values, education, ethnicity and gender amongst others. The central premise of the model concerns the group of effects that start with the development of behavioural, normative and control beliefs. These in turn directly influence the formation of an attitude towards the behaviour, the subjective norm and perceived behavioural control which then produces intention (to behave) and the behaviour itself. Individuals who utilise this process are said to have engaged in *reasoned action* (Ajzen and Fishbein, 2005). While it is understood that shortcuts can be made in this process, it is also accepted that over certain periods of time, attitudes, norms, perceptions of control and intentions are rehearsed and therefore become readily accessible to each individual. In this way a previously formed attitude towards interacting with technology for example, can be readily accessed without the need to debate all the perceived advantages and disadvantages of doing so.

Conceptual framework

There have been a number of studies conducted over the past years which have utilised the theory of planned behaviour in an attempt to understand peoples' intentions to engage in a number of activities. These have been quite diverse and have included activities such as hunting, weight loss, engagement with leisure activities, likelihood of committing traffic violations, willingness to vote and voting choice and gift giving (Abelson et al., 1982; Ajzen & Timko, 1986; Ajzen & Driver, 1991; Hrubes et al., 2001). These studies indicate that the application of the theory of planned behaviour deals with the antecedents of attitudes, subjective norms, and perceived behavioural control. These antecedents determine intentions and actions. The research suggests that human action is influenced by a favourable or unfavourable evaluation of the behaviour (attitude towards the behaviour), perceived social pressure to perform the behaviour (subjective norm) and perceived capability to perform the behaviour (perceived behavioural control). In combination, attitude, subjective norm and perceived behavioural control lead to the

formation of a behavioural intention. In general, the more positive the attitude towards performing the behaviour, along with substantial levels of social pressure to do so and perceived control over one's actions, the more likely the individual is to carry out the behaviour. Often behaviours pose difficulties with regard to execution. In this way it is useful to consider perceived behavioural control in addition to intention. Depending on how realistic people are in their judgements of the level of difficulty associated with a behaviour, a measure of perceived behavioural control can serve as a proxy for actual control and as such can contribute to the prediction of the behaviour in question. When applied to the engagement with ICT, the theory of planned behaviour suggests that intentions to engage and interact with a particular program or software element is influenced by attitudes towards using ICT, perceived social pressure to do so and by perceptions of control over the interaction. The major components of the Theory of Planned Behaviour as designed by Fishbein and Ajzen (1980) are presented in Figure 1.

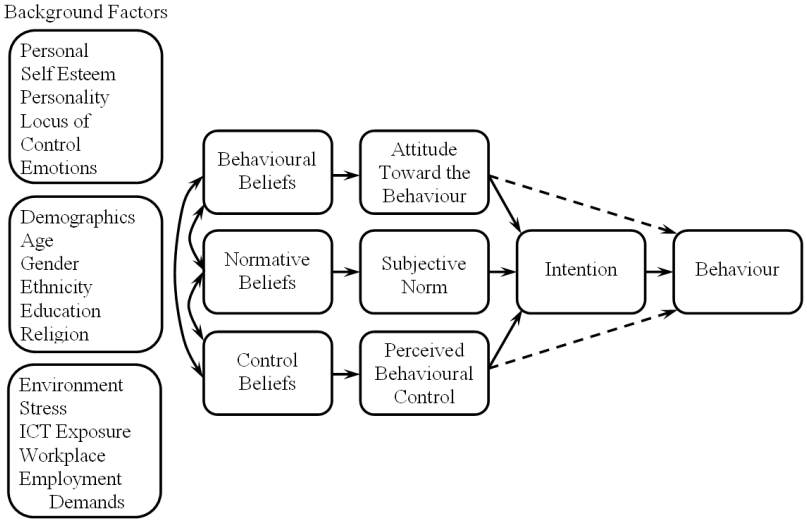

Figure 1: Theory of planned behaviour

Methodology

All research approaches have underlying philosophical assumptions that guide the researcher. In this case the use of a mixed method approach intentionally combines the strengths of both quantitative and qualitative paradigms in order to investigate the phenomenon (Creswell, 2005). Mixed method research focuses upon 'collecting, analysing and mixing both qualitative and quantitative data in a single study or series of studies' in order to understand the problem better (Creswell & Plano Clark, 2007, p. 5). As this is a pilot study the focus of this research is to examine a small convenient sample of students currently studying in the Bachelor of Education Program (n = 30). Stage one of the pilot study involved the development and administration of a 44 item questionnaire. The questionnaire was designed to assess variables associated with the use of ICT and contained sections which were derived from components of the Theory of Planned Behaviour (see Figure 1). The items within these sections were aimed at investigating the participants' behavioural beliefs, normative beliefs, control beliefs, attitudes, subjective norm, perceived behavioural control and intentions. An initial background section was also included in order to collect information related to the students' perceived levels of ICT competence as well as their perception of the importance of ICT use to their future careers as teachers. The sample was also asked to respond to four items that sought to determine the value associated with ICT use in terms of its impact upon learning. The trial questionnaire served to gather baseline data on the attitudes and beliefs of the sample towards the use of ICT.

Following completion of the questionnaire the sample was invited to complete a fifteen minute ICT interaction. The interaction was designed to teach a single physics principle of *average speed*. This activity was chosen for the study due to its suitability for complete student-centred learning and included reading text, viewing animations and understanding the information presented in order to complete the final task without the need for instructor intervention. The students agreed to be filmed as they worked through this activity. Although half of the participants indicated that they had studied physics in high school, they all needed to work through the examples in order to complete the final task. After completing the activity, the participants were asked a series of informal questions regarding how they felt about engaging with the interaction, what they were thinking as they viewed the animations and whether the animations were a help or a hindrance to their learning.

ICT interaction design

The design of this interaction was based upon Moreno and Meyer's (2000) design principles for a learner-centred approach to understanding scientific systems incorporating cognitive theory. The respondents were required to read the text before viewing the animation in order to avoid cognitive overloading. When they had read the text, they clicked on a button to reveal the animation. A brief version of the text was included with the animation to serve as a reminder (see Figure 2). While this approach was deemed satisfactory as the focus of this pilot study was on the theory of planned behaviour, follow up studies will include longer animations with audio narration and less text as students tend to learn better when verbal information is presented as audio speech rather than visually as on-screen text (Moreno & Mayer, 2000; Mayer & Moreno, 2003).

Quantitative data analysis

A total of 30 students completed and returned the questionnaires and also completed the ICT interaction activity. The respondents consisted of 47% males and 53% females; 67% Australian/Caucasian; 33% non-Australian/Caucasian; and 53% who had studied physics in high school. Table 1 provides a summary of the respondents' perceived ICT competency levels (Q6) and their perceived importance of ICT-based learning to their future careers (Q7).

Table 1: ICT competency levels and importance of ICT-based learning to future careers

Item	Statement	1	2	3	4	5	6	7	other	mean	s.d.	cor.
Q6	Please indicate your level of ICT competence		3%	17%	7%	40%	23%	7%	3%	4.83	1.24	1.00
Q7	How important is ICT-based learning skills to your future career?		3%	7%	13%	33%	37%	3%	3%	5.03	1.11	1.00

(N=30. 1 = Extremely low; 7 = Extremely high; other = null response)

A scale analysis of the dimensions used in the student questionnaire is presented in Table 2. With each of the dimensions, seven-point bipolar adjective scales (1 = extremely high, 4 = uncertain or indifferent, 7 = extremely low) were used to assess the participants' perceptions of the item statements presented in the questionnaire. Table 2 also reports the mean (the calculated average of the mean scores for each item within each scale), mode and median scores for each of the scales. The following Tables 3 through to 7 display the item statements and response rates for each item. For the purposes of this study, the analysis is based upon item-by-item rather than whole scale analysis.

Table 2: Scale mean, mode, median and standard deviation from initial student questionnaire analysis

Scale	No. of scale items	Range of items means		Scale					
		Lowest item mean	Highest item mean	Mean	Mode	Median	S.D.	Kurtosis	Skewness
Theory of planned behaviour									
Behavioural Beliefs									
Behavioural Outcomes	9	2.22	6.78	4.81	5.78	4.83	1.00	1.02	-0.54
Behavioural Desirability	9	2.22	6.89	5.14	5.89	5.39	1.10	0.70	-0.91
Normative Beliefs	2	1.00	6.00	3.88	4.00	4.00	1.58	-0.89	-0.48
Control Beliefs	5	3.00	6.60	4.94	5.60	5.20	0.97	-0.42	-0.68
Attitude Towards Behaviour	2	2.50	7.00	5.03	4.50	5.00	1.07	-0.19	-0.39
Subjective Norm	2	2.50	6.50	4.47	4.00	4.25	1.03	-0.76	0.17
Perceived Behavioural Control	2	2.50	6.50	4.82	6.00	4.50	1.11	-1.07	-0.17
Intention	2	2.00	6.50	5.15	5.00	5.00	0.95	3.08	-1.50
Background Factors – Values	4	3.50	7.00	5.46	5.50	5.50	0.75	0.41	-0.29
Student n=30									

The following presents the response percentages for the questionnaire items. Some of the items, such as questions 17, 18, 19 and 23 in the Behavioural Beliefs scale, have been negatively polarised. That is to say, the negatively polarised scores have been reversed so that they are scored and displayed as positive

statements. Reverse scoring has been done for all 7-point bipolar adjective questions in the questionnaire which are interpreted as being negative statements about their perception of ICT interactions. For example, item 17 is worded as a negative statement "Engaging with ICT makes me feel tired and exhausted". However, as it is reversed-scored, the mean score of 4.80 indicates that more participants disagreed with this statement from those which agreed.

Intentions, attitudes, subjective norms and perceived behavioural control

Table 3 shows the response rates to the Intentions, Attitudes, Subjective Norms and Perceived Behavioural Control scales. While the majority of the respondents indicated that they intend and plan to engage in ICT interactions (80%), more than half indicated that interacting with ICT is pleasant (59%) and that interacting with ICT is helpful (77%). Approximately one third (36%) of the sample perceived that people who are important to them think they should engage with ICT, while 60% thought that people important to them would approve of their engagement with ICT. Two thirds (66%) of the participants indicated that engaging with ICT is easy, while just over half (56%) indicated that they can interact successfully with ICT at all levels.

Table 3: Statements and response rates for intentions, attitudes, subjective norms and perceived behavioural control

Item	Statement	1	2	3	4	5	6	7	pol.	mean	s.d.	cor.
	Intentions											
Q8	I intend to engage in ICT interaction		3%	3%	13%	33%	47%		+	5.17	1.00	0.76
Q9	I plan to engage in ICT interaction		3%	3%	13%	40%	37%	3%	+	5.13	1.02	0.76
	Attitudes											
Q10	Interacting with ICT is pleasant			23%	17%	27%	20%	13%	+	4.83	1.34	0.39
Q11	Interacting with ICT is helpful		3%	7%	13%	30%	33%	13%	+	5.23	1.23	0.39
	Subjective Norms											
Q12	People who are important to me think that I should engage with ICT	7%	17%	7%	33%	13%	23%		+	4.00	1.55	-0.10
Q13	Most people who are important to me would disapprove/approve of my engagement with ICT	7%		3%	30%	17%	30%	13%	+	4.93	1.53	-0.10
	Percieved Behavioural Control											
Q14	I rate the difficulty of engaging with ICT extremely difficult/ extremely easy		3%	20%	10%	33%	30%	3%	+	4.77	1.26	0.22
Q15	If I want to I can interact successfully with ICT at all levels	3%	3%	13%	23%	10%	33%	13%	+	4.87	1.56	0.22

(N=30. 1 = Extremely unlikely; 7 = Extremely likely)

Behavioural beliefs: Outcomes and desirability

The participants' responses to the Behavioural Beliefs' statements regarding their engagement with ICT producing outcomes and their desirability of each statement are presented in Tables 4 and 5 respectively. Overall, the participants responded rather positively about the outcomes produced by their engagement with ICT and their perceived desirability for ICT engagement. For example, engaging with ICT produced a positive outcome for the majority of students (73%) regarding a sense of competence and 84% indicated a desire to feel a sense of competence when engaging with ICT.

Table 4: Behavioural beliefs: Outcomes

Item	Statement	1	2	3	4	5	6	7	pol.	mean	s.d.	cor.
	Behavioural Beliefs - Engagement with ICT produces the following outcomes											
Q16	Engaging with ICT makes me feel a sense of competence		7%	10%	10%	13%	57%	3%	+	5.13	1.33	0.69
Q17	Engaging with ICT makes me feel tired and exhausted	23%	10%	27%	17%	13%	7%	3%	-	4.80	1.68	0.71
Q18	Engaging with ICT makes me feel angry	30%	17%	17%	13%	13%	3%	7%	-	5.00	1.84	0.52
Q19	Engaging with ICT makes me feel frustrated	20%	13%	20%	17%	17%	7%	7%	-	4.57	1.80	0.60
Q20	Engaging with ICT makes me feel a sense of achievement		3%	7%	37%	10%	37%	7%	+	4.90	1.25	0.54
Q21	Engaging with ICT makes me feel as though I am in control	3%	10%	17%	23%	23%	17%	7%	+	4.30	1.51	0.50
Q22	Engaging with ICT makes me feel as though I can work more effectively		3%	13%	27%	17%	27%	13%	+	4.90	1.37	0.58
Q23	Engaging with ICT makes me feel apprehensive	7%	23%	30%	20%	10%	7%	3%	-	4.63	1.45	0.32
Q24	Engaging with ICT makes me feel intelligent		3%	7%	23%	27%	30%	10%	+	5.03	1.22	0.54

(N=30. 1 = Extremely unlikely; 7 = Extremely likely)

Table 5: Behavioural beliefs: Desirability

Item	Statement	1	2	3	4	5	6	7	pol.	mean	s.d.	cor.
	Behavioural Beliefs - Rate the desirability of each statement											
Q25	Engaging with ICT makes me feel a sense of competence	7%	7%		3%	40%	37%	7%	+	5.00	1.53	0.61
Q26	Engaging with ICT makes me feel tired and exhausted	27%	30%	17%	3%	3%	17%	3%	-	5.10	1.89	0.62
Q27	Engaging with ICT makes me feel angry	23%	40%	7%	10%	10%	7%	3%	-	5.23	1.71	0.73
Q28	Engaging with ICT makes me feel frustrated	27%	37%	7%	7%	10%	10%	3%	-	5.20	1.81	0.75
Q29	Engaging with ICT makes me feel a sense of achievement		7%	3%	17%	10%	47%	17%	+	5.37	1.38	0.66
Q30	Engaging with ICT makes me feel as though I am in control		7%	13%	10%	27%	30%	13%	+	5.00	1.44	0.52
Q31	Engaging with ICT makes me feel as though I can work more effectively			7%	17%	23%	27%	27%	+	5.50	1.23	0.55
Q32	Engaging with ICT makes me feel apprehensive	13%	33%	7%	13%	23%	7%	3%	-	4.67	1.72	0.54
Q33	Engaging with ICT makes me feel intelligent	3%	7%		13%	30%	30%	17%	+	5.17	1.49	0.36

(N=30. 1 = Extremely undesirable; 7 = Extremely desirable)

Normative beliefs and control beliefs

The sample's response rates to the Normative Beliefs and Control Beliefs scales are shown in Table 6. The participants were nearly evenly divided in their perception of normative beliefs regarding whether their friends (low = 37%, high = 40%, indifferent = 23%) and family (low = 30%, high = 37%, indifferent = 33%) encouraged them to engage in ICT use. They were rather positive with their perception of control beliefs regarding not being too busy (81%), having skills (76%) and having the knowledge (73%) to engage in the use of ICT. Approximately half of the participants indicated that they could afford the cost (53%) and that it takes a great deal of effort (50%) to engage in ICT use.

Table 6: Normative beliefs and control beliefs

Item	Statement	1	2	3	4	5	6	7	pol.	mean	s.d.	cor.
	Normative Beliefs											
Q34	My friends encourage me to engage in ICT use	17%	10%	10%	23%	27%	13%		+	3.73	1.65	0.75
Q35	My family encourage me to engage in ICT use	13%	7%	10%	33%	13%	17%	7%	+	4.03	1.72	0.75
	Control Beliefs											
Q36	How likely is it that you are too busy to engage in ICT use?	17%	30%	33%	10%	7%	3%		-	5.30	1.24	0.44
Q37	How likely is it that you have the skills to engage in ICT use?	3%	3%	13%	3%	13%	50%	13%	+	5.23	1.54	0.60
Q38	How likely is it that you have the knowledge to engage in ICT use?			17%	10%	13%	53%	7%	+	5.23	1.23	0.62
Q39	How likely is it that you can afford the cost of engaging in ICT use?	7%	7%	7%	27%	17%	33%	3%	+	4.53	1.56	0.53
Q40	How likely is it that it takes a great deal of effort for you to engage in ICT use?	7%	30%	13%	17%	13%	20%		-	4.40	1.65	0.15

(N=30. 1 = Extremely unlikely; 7 = Extremely likely)

Background FACTORS: Values

Table 7 shows the response rates to the participants' perception of values. The sample's responses to these items were rather positive with regards to engagement with ICT enhancing learning (94%) and being essential for good education (63%), high ICT skill levels making learning easier (83%) and effective use of ICT being essential in the workplace (90%).

Table 7: Background factors: Values

Item	Statement	1	2	3	4	5	6	7	pol.	mean	s.d.	cor.
	Background Factors - Values											
Q41	Engagement with ICT enhances learning				7%	30%	47%	17%	+	5.73	0.81	0.47
Q42	Engagement with ICT is essential for a good education		3%	7%	27%	23%	33%	7%	+	4.97	1.20	0.66
Q43	High level ICT skills make learning easier		3%	3%	10%	23%	53%	7%	+	5.40	1.08	0.61
Q44	Effective use of ICT is essential in the workplace				10%	30%	37%	23%	+	5.73	0.93	0.35

(N=30. 1 = Definitely no; 7 = Definitely yes)

Summary of the quantitative analysis

The quantitative analysis examined the responses to the seven-point bipolar adjective scales items in the questionnaire within the scales of Intentions, Attitudes, Subjective Norms, Perceived Behavioural Control, Behavioural Beliefs, Normative Beliefs, Control Beliefs and Background Factors. The responses to the Intentions items were very positive, while the responses to the Normative Beliefs were the least positive. Responses to the Attitudes items were also somewhat positive. There was a distinct difference between responses for most of the Behavioural Beliefs items; the sample's perceived Outcomes were slightly less positive than their Desirability.

Qualitative data analysis

The 30 students who participated in the questionnaire relating to the elements concerning their planned behaviour towards engagement in ICT use also contributed to a brief semi-formal interview regarding their interaction with the animation program immediately following their completion of the activity. The interviewees were observed throughout their interaction on an individual basis. Each participant worked through the self-paced activities contained within the animation and each interaction lasted for approximately fifteen minutes. Figure 2 presents a screen capture of one of the screens within the ICT interaction activity. Nineteen male students participated in the interaction as opposed to sixteen females. Following a brief introduction and explanation of the process each member of the sample was invited to begin working their way through the program. Following the interviews each transcript was examined through a content analysis which focussed upon the major issues associated with interacting with the animation. The major themes to emerge from the interview data are presented below.

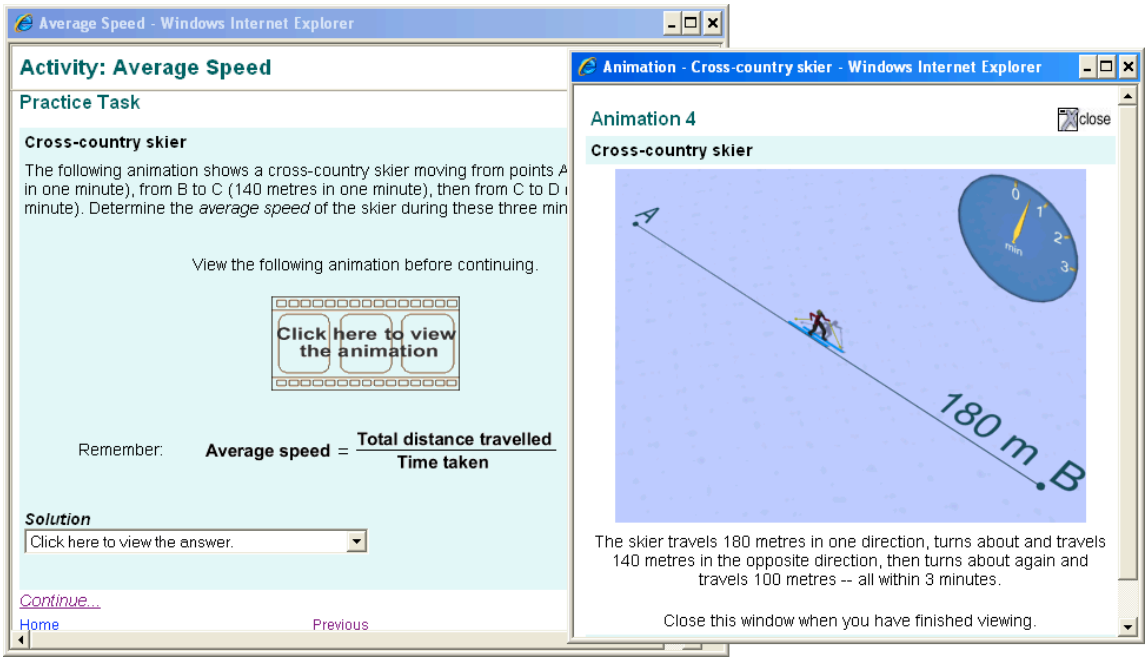

Figure 2: Screen capture of components of the ICT interaction activity

Overall attitudes towards the activity

When asked how the students felt about working through this activity, 19 respondents (63%) indicated that they believed the task represented a standard problem and that as a result they experienced a sense of control over their interactions with the program. These students perceived themselves to have a reasonably strong background in mathematics through their experiences at secondary school in particular and the problems associated with the animation did not present as overwhelming. Their comments indicated that they were comfortable with the interaction and the overall process of being observed whilst working through the program. Students commented that the problems were clearly set out and the requirements were sequential and logical. They enjoyed working on the solutions as they were easy to visualise as a result of the use of the animations to support the text and the mathematical equations. These students also believed they were comfortable with the process as they were highly familiar with computers and that being asked to problem-solve using equipment other than their own did not pose a dilemma for them. Comments also indicated that these students felt 'normal' while engaging in the

program and that they merely needed to be 'told what to do' in order to complete the task. They did not experience feelings of anxiety or apprehension and as a consequence maintained high levels of a sense of control throughout the procedure.

> I felt comfortable. I'm used to computers so I found this really easy to navigate. I'm not good at maths though so I felt as though I would be disadvantaged due to lack of prior knowledge.

Six respondents (20%) indicated that they experienced feelings of anxiety and stress associated with engaging in the task. These students made clear the fact that they did not have a strong background in mathematics and appeared to be concerned with their belief that they would 'fail the test'. These students also demonstrated more agitated behaviour when first settling into a comfortable and work-ready position at the beginning of the program and were more inclined to touch their face and hair with their hands while working through the animation. Even though they were assured that the program did not in any way represent a 'test' these students continued to mention this concept in their responses. One student mentioned that they had experienced feelings of intimidation as a result of taking part in the program.

> I felt intimidated by having to do this… I felt nervous and worried that I would get it all wrong… when I first sat down and started to look at the screen I thought 'oh no this is going to be awful. I don't have any maths background so I felt worried.

Four respondents (13%) expressed feelings of confusion. These students felt that this may have been as a result of the amount of writing in the initial stages of the program. Once they accessed the supporting information offered by the animations they were able to see more clearly the parameters of the required tasks and this enabled them to complete these satisfactorily. A number of comments indicated that they needed to move backwards and forwards throughout the text in order to understand what they were required to do.

> I found some of it confusing. I wasn't quite sure what I was meant to be doing. I had to go back and re-read some of the instructions. It seemed to be clearer at the beginning as the calculations were easier. It might be a good idea to just have the answers revealed at the end of the whole thing and not as you work through each problem… I'm not sure why but it would just make it easier somehow.

> I skipped to the end first and then went back to the beginning. I'm not sure why I did this. I'm not very good at maths so maybe that's why I did it… I might have got a bit confused. At first I was wondering what type of tool it was going to be. I got confused at one point and lost my place which is maybe why I jumped ahead and then went back.

Two respondents (6%) revealed that they really didn't have any expectations of the program or their contribution to it. They were relaxed regarding their engagement in the process and indicated that once they had read through the initial information in the text they were reasonably clear as to how they were to proceed. These students suggested that the animations were useful in order to visualise the problems and that although they were not altogether necessary they added interest and contextual information to the problem solving process. One respondent believed that the animations were not necessary at all in terms of his ability to engage with the program. One respondent suggested that he believed the program was going to represent problem solving at a more advanced level and a further two students indicated that they felt rushed and uncomfortable during the activity. These students experienced feelings of pressure as they believed that they needed to increase the speed at which they completed the tasks.

> I felt rushed… so I felt under pressure to get the problem solved in a much faster way than I normally would. This meant that I had to read faster. Normally I like to go back and re-read sentences and paragraphs but I felt under pressure not to do this. I like to break every sentence and go over it so I felt I didn't do as well as I normally would have done with this.

Usefulness of animations as opposed to text

Sixty six percent of the sample (20 respondents) felt that the animations were not essential in order for them to effectively complete the interaction. They indicated that while the use of animations may be useful for some students, in terms of problem solving they were more inclined to concentrate upon the static text that was provided. There appeared to be a number of reasons for this. The sample suggested that as they had been used to relying heavily on text in order to solve mathematical equations during their

experiences at school that these habits had remained with them into their higher education. It is acknowledged, however, that their perception of the usefulness of the animations may have differed with exposure to activities involving more complex dynamic processes, such as a combustion engine cycle, which might be difficult to describe with text alone. Other comments suggested that if the students had been able to stop the animations during their progression this would have been more helpful. Although the animations did continually repeat playback until the student closed the window, there appeared to be an element of frustration experienced by a number of students regarding their inability to stop the animations once started. Some indicated that they had already worked through the problem and were not in need of the ongoing graphics.

> If the animations could have been stopped they would have been more helpful. I actually don't like learning with moving images. When I was growing up I didn't watch much TV. I think these days there are too many images coming at us all at once. We are getting used to just getting a quick 'grab' at information. I feel as though I am being bombarded with information and I can't take it all in. I would prefer to be able to concentrate on one thing at a time.

Eight respondents (26%) described themselves as visual learners and as such they had enjoyed problem solving with the assistance of moving images. These students indicated that the animations helped them to visualise the problem. They also suggested that as they did not have a strong background in mathematics the animations did help to make the problem clearer. They tended to move backwards and forwards between the animation, the static text and the mathematical equations which were provided. They also mentioned the fact that over time a useful problem solving pattern emerged and this had been enhanced by the moving images. The repetition of what they were watching assisted in the problem solving process.

Three members of the sample (10%) focussed upon the positioning of the animations within the parameters of the screen. These students explained that as the animations had been set above the text that they were distracting as their attention tended to move upwards and then back down to the text. Through their peripheral vision they could still see the movement and as they were unable to turn the animation off once it had begun they found this impacting upon their concentration.

Two respondents (6%) mentioned that they had begun to skip forwards and backwards throughout the interaction and this had impacted on their ability to concentrate and problem solve. These students explained however that this was probably due to their perceived inability to succeed at mathematics and that the constant non-sequential movement could be explained by their lack of confidence.

> I skipped to the end first and then went back to the beginning. I'm not sure why I did this. I'm not very good at maths so maybe that's why I did it… I might have got a bit confused. At first I was wondering what type of tool it was going to be. I got confused at one point and lost my place which is maybe why I jumped ahead and then went back. It was progressive though and I scrolled down to start with. I went to the equations first… I missed the text at the top and the animation box at the top so I went back up.

Summary of the qualitative analysis

While sixty three percent of the sample responded positively towards the ICT interaction, thirty three percent indicated that they felt anxious, stressed or confused regarding their involvement with the program. The students who reacted positively indicated that they perceived the interaction to present a standard problem and given the fact that they had a reasonably strong background in mathematics they were confident that the activities would not present them with a problem. Thirty three percent suggested that they had felt anxious and stressed prior to their engagement. They indicated levels of intimidation with having to proceed through the program and had pre-empted a sense of unpleasant reaction to engagement. Six percent of the sample indicated that they had no pre-conceived expectations of the program and that following their initial reading of the text which was provided they believed they were clear as to the direction in which their problem solving needed to proceed. As far as the animations were concerned, the majority of the sample suggested that as they preferred to concentrate upon the static text in order to problem solve they felt that the moving images were not completely necessary. These students appeared to have a reasonably strong background in mathematics which may explain their focus on the text. They indicated that as mathematical problem solving during their school experience had concentrated upon reading and analysing text they were more inclined to continue this approach post

school. For the students who described themselves as visual learners and/or who had a weaker background in mathematics the graphical information seemed to be of greater use.

Conclusion

The research thus far while not investigating causality, has nevertheless provided some interesting insights into the attitudes of students enrolled in a Bachelor of Education Program towards their use of and engagement in ICT. The Theory of Planned Behaviour has not been applied to ICT use prior to this research and it is the intention of this study to proceed with a second phase of investigation as far as student attitudes and behaviours towards ICT are concerned. It appears from the quantitative data that overall the students believed that interacting with ICT was pleasant, helpful and easy. The majority indicated that interacting with ICT would result in positive outcomes and that most of the sample described a desire to feel a sense of competence when engaging with technology. This is interesting when compared to the qualitative findings which seem to indicate that at least thirty three percent of the responses suggested that the sample had experienced feelings of anxiety and intimidation when actually working through the ICT interaction. There may be a number of reasons for this. The students may have wanted to predict confident use of ICT during their completion of the questionnaire. As the questionnaire was administered during a learning technologies unit of study which designates the successful use of ICT as one of the learning outcomes the students may have experienced a certain level of pressure to indicate confidence. The ICT interaction was administered approximately five weeks following completion of the questionnaire and levels of confidence appeared to decrease in the individual setting provided for the completion of the interaction. Possibly a number of the students also felt intimidated by the fact that they were filmed during their interaction although this did not appear to be an overt issue for them at the time of the data collection. The quantitative data indicated that normative beliefs regarding ICT use were not of any significant importance to the sample. The results to items related to the expectations of others in the main recorded either ‘low’ or ‘indifferent’ scores. This would suggest that the expectations of others as to whether or not the sample engage in ICT use are irrelevant and if this is the case, items regarding the significance of the attitudes and beliefs of others towards ICT use may well be withdrawn from the ongoing refinement of the instrument for phase two of the research. Further investigation into the relationships between the planned ICT use of students and their actual engagement will reveal valuable insights into the design and implementation of ICT interaction for learning.

As a pilot study the research has provided the authors with baseline data regarding the responses of the sample towards the various components of the planned behaviour framework in relation to their attitudes towards the use of ICT. Phase two of the research will involve the refinement of the questionnaire and the withdrawal and re-writing of items in order to increase the reliability of the instrument. This will occur during 2009. Once the internal consistency of the items has been determined the instrument will then be administered to a second sample of education students. Phase two of the research will allow for ongoing statistical analysis of the questionnaire results including correlation and regression procedures. The research will then lead to a full discussion of the relationships between the variables in the framework to determine which are more likely to influence ICT behaviour.

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