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Cognitive Absorption: Its antecedents and effect on user intentions to use technology

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ABSTRACT

Information Technology represents a substantial investment for many corporations and constitutes a significant aspect of organizational work. However, its value is realized only when information systems are utilized by their intended users in a manner that contributes to the strategic and operational goals of the firm.

Although there has been a plethora of studies done on the centrality of beliefs in outcomes such as attitudes and usage, few studies examined how these beliefs are formed. Towards this effort, this paper examines the effect of cognitive absorption on information technology usage. A theoretical model is developed which extends the cognitive absorption model by including normative influence as an additional antecedent of cognitive absorption. This model was then empirically tested on students using Microsoft Access application.

Keywords

Cognitive Absorption, Technology Acceptance, Normative Influence

INTRODUCTION

Information technology (IT) has become critical to most corporations. To be deemed valuable, the need for user acceptance is essential. Many studies have been conducted to examine how individual's beliefs about or perceptions of IT influence usage behavior. Recently, cognitive absorption strongly grounded in cognitive and social psychology provided an additional determinant in understanding users of information technologies. Cognitive absorption is a state of deep involvement with software that is exhibited through five dimensions of temporal dissociation, focused immersion, heightened enjoyment, control, and curiosity (Agarwal and Karahanna, 2000).

Most of the studies in the literature on IT usage focus on the centrality of beliefs but few of these studies have studied the actual formation of these beliefs (Agarwal and Karahanna, 2000). There is therefore a need to do additional work to examine the determinants of beliefs. One such variable which looks at the centrality of beliefs is cognitive absorption. Towards this effort, this study will examine the effect of cognitive absorption on information technology usage. The literature suggests that there are some gaps in the literature on cognitive absorption. Agarwal and Karahanna (2000) discussed two antecedents of cognitive absorption namely personal and cognitive playfulness. These authors recognize their model should be refined to include other antecedents which may also be relevant. We therefore seek to examine whether normative influence, the beliefs about what others will think about the behavior, is an additional antecedent of cognitive absorption. Normative influence suggests that the more others influence your decision, the more likely you are to get engaged in the technology, seek the enjoyment others are getting from using the technology, and utilize the technology to achieve a given task. These reasons support the dimensions of the cognitive absorption theory and as such we think normative influence is worth studying as an antecedent of cognitive absorption.

I therefore proceed to organize my paper as follows. The next section discusses the theoretical background of this study. Next, the research model and the ensuing hypotheses are presented, followed by the research method. The data analysis methods used to validate the scales and test the research model are then presented, and the results of the study are described and discussed. The paper concludes with discussions of the research findings and the practical and theoretical implications of these findings.

LITERATURE REVIEW

Cognitive Absorption

Technology acceptance has been widely studied in the IS literature. However, most of the studies have focused on centrality of beliefs. Using cognitive and social psychology, Agarwal and Karahanna (2000) posit that cognitive absorption which is related to the state of involvement in a technology would provide further explanation of technology acceptance theories. Five dimensions of cognitive absorption has been identified which include temporal dissociation, focused immersion, heightened enjoyment, control, and curiosity.

Temporal dissociation refers to the inability to register the passage of time while engaged in interaction. This dissociation allows an individual to perceive him or herself as having enough time to complete a task. This is important for information technology since it suggests that the more an individual considers himself having the ability to use the technology, the more likely he is to use that technology.

Focused immersion is the experience of total engagement. When individuals become immersed in utilizing the technology, the level of cognitive burden associated with completing the task is reduced. This therefore leads to increased use of the technology.

Heightened enjoyment captures the pleasurable aspects of the interaction. When people experience pleasure in conducting an activity, they generally are willing to participate in that occasion repeatedly. This is important for information technology because the more one enjoys a particular technology, the more likely they are to use it in the future.

Control refers to the individual's perception of being in charge of the interaction. Lepper & Malone (1987) suggest control is the reason why players find computer games so fascinating. We therefore assert that the more control a person gains from a technology, the more likely they are to use that technology.

Curiosity is the extent with which the experience arouses an individual's sensory and cognitive curiosity (Malone 1981). Webster et al. (1993) suggest that the more curious individuals become as they interact with the technology, their imagination and excitement increase. Such excitement decreases the perceived cognitive burden associated with the use of the technology (Agarwal and Karahanna, 2000).

Although cognitive absorption is an important construct, few studies have empirically tested it. Saade and Bahli (2004) empirically tested the model in an online learning environment and found support for three dimensions of cognitive absorption which include temporal dissociation, heightened enjoyment, and focused immersion. Agarwal and Karahanna (2000) however had identified five dimensions of cognitive absorption: curiosity, control, temporal dissociation, focused immersion and heightened enjoyment using the World Wide Web as the chosen technology. They also proposed that playfulness and personal innovation were two antecedents of cognitive absorption.

Playfulness and Innovation

Playfulness refers to the degree of cognitive spontaneity in microcomputer interactions (Webster et. al, 1995). In human computer interaction (HCI) literature, cognitive or computer playfulness has been receiving a great deal of attention. Computer playfulness has been considered both a state and a trait in IS literature (Hackbarth et al., 2003, Yager, et al., 2003). Playfulness as a state refers to how a user would interact in a specific situation. It is therefore a short-lived experience. Playfulness as a trait however, refers to how an individual would generally react. It is a stable or long term condition. One of the major drawbacks of playfulness as a trait is the difficulty in determining which personal traits affect the behavior. In this study, playfulness is conceptualized as a state – how a person would react in a given situation. One study which empirically tested playfulness was Martocchio & Webster (1992) who found that performance was higher in employees with higher cognitive playfulness. We therefore hypothesize:

H1a: Playfulness would have a positive effect on temporal dissociation

H1b: Playfulness would have a positive effect on focused immersion

H1c: Playfulness would have a positive effect on heightened enjoyment

H1d: Playfulness would have a positive effect on control

H1e: Playfulness would have a positive effect on curiosity

Personal innovation refers to an individual's willingness to try out any new technology (Agarwal and Karahanna, 2000). The innovative process is a temporal sequence of steps through which an individual passes from initial knowledge of an innovation, to forming a favorable or unfavorable attitude toward it, to a decision to adopt or reject it, to putting the innovation to use and to finally seek reinforcement of the adoption decision made (Karahanna et. al, 1998, Rogers, 1995). Individuals who adopt the technology at an early stage are considered innovative. Many studies were conducted which examined the innovative process (Cale and Eriksen, 1994; Kwon and Zmud, 1987; Cooper and Zmud, 1990). The more innovative an individual is with using a new technology, the more likely he/she would be inclined to experience cognitive absorption (Woszczynski et al., 2003). Drawing on the literature, we therefore propose that:

H2a: Personal Innovation would have a positive effect on temporal dissociation

H2b: Personal Innovation would have a positive effect on focused immersion

H2c: Personal Innovation would have a positive effect on heightened enjoyment

H2d: Personal Innovation would have a positive effect on control

H2e: Personal Innovation would have a positive effect on curiosity

Normative Influence

Normative influence, or normative beliefs as it is sometimes called, refers to how an individual view the importance of others with respect to adopting the IT (Karahanna and Straub, 1999). Numerous studies have been conducted to examine the impact of social groups on individual behaviors. These studies show that choices in various information-processing situations are susceptible to the influence of reference groups, used as standards of comparison for self appraisal or as a source of personal norms and attitudes (Batra et al., 2001). Normative influence consists of three dimensions which include internalization, identification and compliance (Kelman 1961). Internalization refers to the acceptance of social influence because it is congruent with the individual's value system and perception of reality. Identification refers to the adoption of an individual behavior because satisfies the relationship with another person. Compliance refers to the acceptance of an influence explicitly to receive rewards and avoid certain punishment under the control of another person. Identification and internalization are the two major dimensions that would affect cognition (Lewis, 2003).

In IS research, referents of normative influence include supervisors, friends, local computer technology experts, MIS departments (Cale and Eriksen, 1994; Brancheau and Wetherbe, 1990). In this study, students are the participants hence the referents would include friends, classmates, professors, and lab monitors. Normative influence suggests that since the influence of others would lead to increased engagement, the social component of enjoying the same technology with friends, enabling one to use the technology to complete task, then it can explain some of the variance of cognitive absorption. I therefore propose that:

H3: Normative influence would have a positive impact on the dimensions of cognitive absorption

H3a: Friends would have a positive effect on temporal dissociation

H3b: Friends would have a positive effect on focused immersion

H3c: Friends would have a positive effect on heightened enjoyment

H3d: Friends would have a positive effect on control

H3e: Friends would have a positive effect on curiosity

H3f: Classmates would have a positive effect on temporal dissociation

H3g: Classmates would have a positive effect on focused immersion

H3h: Classmates would have a positive effect on heightened enjoyment

H3i: Classmates would have a positive effect on control

H3j: Classmates would have a positive effect on curiosity

H3k: Professors would have a positive effect on temporal dissociation

H3l: Professors would have a positive effect on focused immersion

H3m: Professors would have a positive effect on heightened enjoyment

H3n: Professors would have a positive effect on control

H3o: Professors would have a positive effect on curiosity

H3p: Lab monitors would have a positive effect on temporal dissociation

H3q: Lab monitors would have a positive effect on focused immersion

H3r: Lab monitors would have a positive effect on heightened enjoyment

H3s: Lab monitors would have a positive effect on control

H3t: Lab monitors would have a positive effect on curiosity

We therefore propose a research model as shown in Figure 1.

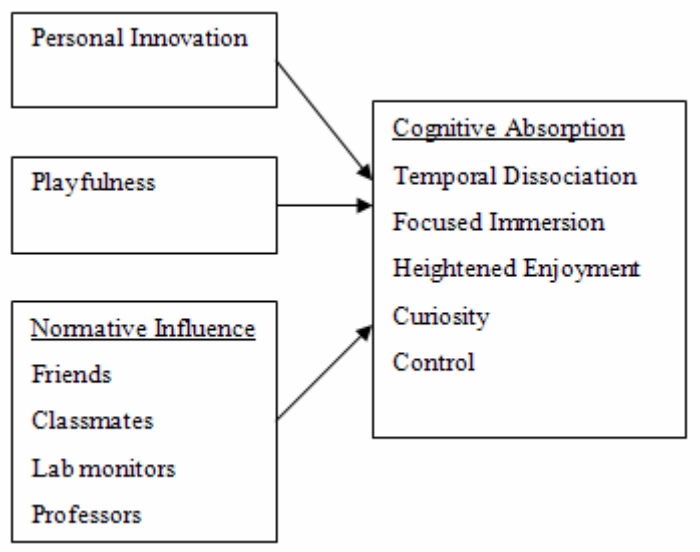

Figure 1. Research Model

METHODOLOGY

A survey was administered to business majors in four introduction to database classes at a large southwestern university. These students were told to give their opinion of Microsoft Access which was the software used in that class. A total of 329 completed surveys were collected.

All the research variables were measured using multi-item scales (see the appendix). These research variables, with the exception of normative influence, were modified from Agarwal and Karahanna's (2000) scale which had utilized the scales of Agarwal and Prasad (1998) to measure innovativeness and cognitive absorption; and Webster and Martocchio's (1992) seven-item scale to measure playfulness. Because of the nature of normative influence, a multi-item scale was developed for each of the referents following the guidelines of Mascarenhas et al. (1993) in conducting marketing research.

Demographic information was collected which is shown in the Table 1. Overall, the statistics include individuals with a reasonable level of PC and web experience which would enable them to make good decisions about information technology in general. A little over half of the students are females and slightly over half of the students were juniors.

The factors proposed in the model were evaluated for convergent validity, discriminant validity, face validity, and reliability. Two professors reviewed the questionnaire and their suggestions were then incorporated into the study. In addition, the first 50 questionnaires returned were analyzed to ensure that the survey was measuring what it was suppose to measure and ensure that there is content and face validity.

	Mean	Standard Deviation
Age	20.8	3.11
PC Experience	3.69	1.24
Web Experience	3.55	1.21
Gender - Male	162	
Female	167	
Classification – Freshman	0	
Sophmore	11	
Junior	202	
Senior	115	
Graduate	1	

Table 1. Demographics

Convergent validity indicates that items measuring the same factor should correlate highly with one another. To assess this validity, the correlation among the items was examined with a one-tailed t-statistic test conducted at the 0.05 significance level. Discriminant validity is achieved if an item correlates more highly with items intended to measure the same factor than items used to measure a different factor. This validity is determined by counting the number of times an item has a higher correlation with an item from another factor than with items in its own factor. Campbell and Fiske (1959) suggested that a count of less than one-half is acceptable as valid. All indicators loaded more highly on their specific construct. was assessed by computing the Cronbach Alpha. The reliability dimensions of all the constructs were good as shown in Table 2.

Construct	Cronbach's Alpha
Peers	0.9252
Playfulness	0.9324
Professor	0.8412
PIIT	0.8352
Lab Monitors	0.805
Heightened curiosity	0.928
Focused Immersion	0.8582
Temporal dissonance1	0.8749
Temporal dissonance2	0.931
Control	0.7348

Table 2. Cronbach's Alpha

Exploratory factor analysis using principal component analysis with Varimax rotation was carried out to determine the dimensions of the various constructs. Because the total number of items was quite large, they were divided into two heterogeneous groups based on the research model. Eigen values (over 1), scree plots, and percent of variance explained were used to assess this dimensionality and to determine which items should be retained. Only items with factor loadings of at least .40 would be retained (Hair et al., 1992).

After purification of the models, clear factor structures were obtained as shown in Tables 3-4. The items for normative influence loaded well on the various dimensions, except for classmates and friends loaded on the same construct. These two dimensions were relabeled peers. This makes sense since students tend to have the same friends and classmates. For cognitive absorption, temporal dissociation was subdivided into two parts. The first relates to how quickly time flies which I was relabeled temporal dissociation – passage; and the second relates to the intended time planned which was relabeled temporal dissociation - intention. Heightened enjoyment and curiosity loaded on the same construct. Malone (1981) posits that curiosity deals with imaginative and excitement. This is similar to enjoyment. Hence this explains why these two factors loaded on the same construct which I refer to as heightened curiosity. The other dimensions of cognitive absorption, however, loaded on their intended construct. The model was therefore refined as shown in figure 2 below.

	Friends/ Classmates	Playfulness	Professors	PIIT	Lab Monitors
Class5	**.869**				
Friend5	**.859**				
Friend4	**.849**				
Class4	**.834**				
Friend3	**.815**				
Class3	**.738**				
Class2	**.633**		.326		
Class1	**.587**		.350		
Friend2	**.559**	.305			
PLAY3		**.862**			
PLAY2		**.838**			
PLAY7		**.805**			
PLAY6		**.796**			
PLAY5		**.786**			
PLAY4		**.758**			
PLAY1	.317	**.734**			
Prof3			**.847**		
Prof2			**.792**		
Prof4			**.767**		
Prof1			**.734**		
PIIT4		.350		**.823**	
PIIT2				**.757**	
PIIT3		.333		**.744**	
PIIT1		.393		**.724**	
LAB2					**.905**
LAB1					**.883**
LAB3	.349		.415		**.542**

Table 3. Exploratory factor analysis for normative influence, playfulness and PIIT

	Heightened Curiosity	Focused Immersion	Temporal dissociation - Passage	Temporal dissociation- Intention	Control
HE2	**.860**				
CUR2	**.839**				
CUR1	**.834**				
HE3	**.833**				
HE1	**.829**				
CUR3	**.818**				
HE4	**.612**				
FI1		**.831**			
FI5		**.770**			
FI2		**.766**			
FI3		**.741**			
FI4		**.700**			
TD3			**.875**		
TD1			**.851**		
TD2			**.793**		
TD4				**.940**	
TD5				**.926**	
CON2					**.830**
CON1					**.734**
CON3					**.688**

Table 4. Exploratory Factor Analysis for Cognitive Absorption.

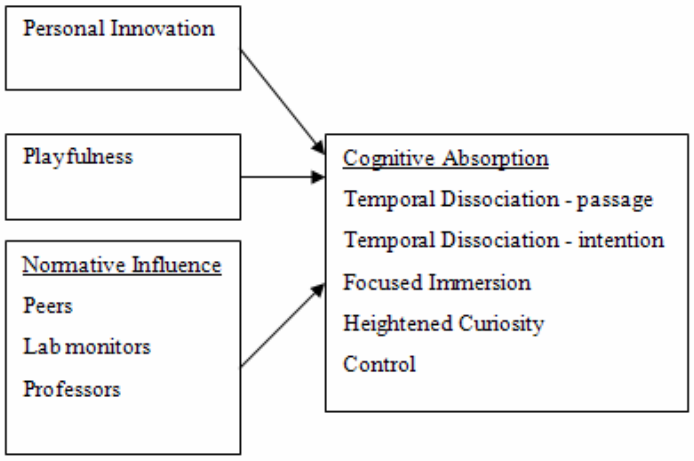

Figure 2. Updated Model

Data Analysis and Results

Multiple regression analysis was used to test the hypotheses. The results are presented in Table 5 below. Playfulness, personal innovation and normative influence explained 9% of the variance in temporal dissociation - passage, 10.4% of the variance in temporal dissociation – intention, 11.1% of focused immersion, 50.2% of heightened curiosity, and 28.1% of control. Results indicate that the dimensions of the normative construct did not always produce significant on the various

dimensions of cognitive absorption. In addition, those significant results were not always positive. For example, peers had a negative relationship with control and temporal dissociation- intention; professors had a positive significant relationship with most dimensions of cognitive absorption except for heightened curiosity; and lab monitors however, had a positive effect on temporal dissociation - intention and a negative effect on control.

Dependent Variable	Independent Variable	T-value	Beta	P-value
Behavioral Intention to Use	• Perceived Usefulness (H1)	**.268**	**5.972**	**.000**
	• Perceived Ease of Use (H2)	**.480**	**10.380**	**.000**
Perceived Usefulness	• Perceived Ease of Use (H3)	**.379**	**7.426**	**.000**
	• Temporal Dissociation1 (H5a)	**.139**	**2.498**	**.013**
	• Temporal Dissociation2 (H5a)	-.033	-.662	.509
	• Focused Immersion(H5b)	**.152**	2.733	**.007**
	• Heightened Enjoyment (H5c&d)	.055	.961	.337
	• Control (H5e)	**.320**	**5.536**	**.000**
	• Professors (9c)	**.215**	**3.691**	**.000**
	• Peers (9a&b)	**.266**	**4.714**	**.000**
	• Lab Monitors (9d)	-.075	-1.268	.206
Perceived Ease of Use	• Temporal Dissociation (H4a)	**.092**	**1.945**	**.053**
	• Temporal Dissociation 2 (H4a)	**-.076**	**-1.783**	.076
	• Focused Immersion(H4b)	**.534**	**11.269**	**.000**
	• Heightened Enjoyment (H4c&d)	.020	.418	.676
	• Control (H4e)	**.167**	**3.385**	**.001**
Temporal Dissociation - Passage	• Playfulness (6a)	**.254**	**3.6122**	**.000**
	• PIIT (7a)	.002	.031	.975
	• Professors (8k)	**.110**	**1.845**	.066
	• Peers (8a&f)	.035	.538	.591
	• Lab Monitors (8p)	-.064	-1.055	.292
Temporal Dissociation - Intention	• Playfulness (6a)	-.037	-.535	.593
	• PIIT (7a)	-.015	-.235	.815
	• Professors (8k)	**.246**	**4.136**	**.000**
	• Peers (8b&f)	**-.206**	**-3.221**	**.001**
	• Lab Monitors (8p)	**.140**	**2.328**	**.021**
Focused Immersion	• Playfulness (6b)	**.223**	**3.208**	**.001**
	• PIIT (7b)	.086	1.375	.170
	• Professors (8l)	**.164**	**2.766**	**.006**
	• Peers (8b&g)	-.034	-.533	.594
	• Lab Monitors (8q)	.000	.006	.995
Heightened Curiosity	• Playfulness (6c &d)	**.664**	**12.752**	**.000**
	• PIIT (7c&d)	.017	.358	.721
	• Professors (8m&n)	.069	1.563	.119
	• Peers (8c,d,h&i)	.045	.932	.352
	• Lab Monitors (8r&s)	-.029	-.639	.524
Control	• Playfulness (6e)	**.391**	**6.252**	**.000**
	• PIIT (7e)	**.200**	**3.573**	**.000**
	• Professors (8o)	**.169**	**3.170**	**.002**
	• Peers (8e&j)	**-.100**	-1.735	.084
	• Lab Monitors (8t)	**-.155**	**-2.862**	**.004**

Note: Significance of the regression is indicated in bold and is done up to the .05 level

Table 5. Multiple Regression Analysis

LIMITATIONS

This study is not without limitations. There may be a problem of generalizability. Firstly, this study was conducted with students in a university, as a result in terms of generalizing the respondent's actions to the general workforce, this would be somewhat limited. Typically here it is felt that students differ from the intended population. However, since this study is done at an individual level of analysis to test how people usually react to a new technology, then it would be possible to generalize this study with other individuals using a new technology. In addition, this research attempts to model the original work done by Argawal and Karahanna (2000) who conducted their study using students in a university setting.

Another limitation is that we were unable to test the five dimensions of CA I initially set out to. The dimensions of heightened enjoyment and curiosity loaded on one factor. Thus, a new factor, heightened curiosity was used. In addition, temporal dissociation split into two factors: one looking at how quickly time flies when using the technology (temporal dissociation - passage), and the second part looked at the actual time one intended to spend actually utilizing the technology (temporal dissociation - intention). In addition, friends and classmates loaded on the same factor. However, the cronbach alphas for those new dimensions were extremely high which indicated that it was adequate to modify the model and test those new dimensions.

Yet another limitation is the fact that all the measures were collected at one point in time. This may lead to common method variance. This cross sectional study makes inferring causality impossible.

IMPLICATIONS AND CONCLUSION

This study would be valuable to both theory and practice. Theoretically, this study provides support for the importance of cognitive absorption in technology acceptance research and shows the importance of normative influence as an antecedent of cognitive absorption. This study is also valuable to practitioners. Firstly, it would help managers in their decision making process. When new technology is implemented, it is cognizant that managers know which members within the organization can have an impact on the actual use of the technology, i.e., how various members at different levels within the organization would affect the use of the technology. Thus, cognitive absorption would help managers need to know those in an organization that would encourage use of the technology.

Secondly, cognitive absorption would help in the design. Here, features such as help menus and hot keys should be the main focus would help in "the diffusion of new technologies via direct effect of CA on behavioral intention" (Agarwal and Karahanna, 2000). Cognitive absorption would also help with training programs. Thus, cognitive absorption would be instrumental in helping individuals understand the technology.

Overall, the research was conducted to gain a better understanding of how individuals react towards the introduction of new technologies. In this regard, the study extends Agarwal and Karahanna's (2000) theoretical model and posits that normative influence is an additional antecedent of cognitive absorption. This construct was chosen because by its definition, normative influence has characteristics which would make it more or less susceptible to be absorptive. Future research would be conducted to test this model using different technologies.

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APPENDIX – SURVEY INSTRUMENT

Temporal Dissociation
1. Time appears to go by very quickly when I am using the Access.
2. Sometimes I lose track of time when I am using the Access.
3. Time flies when I am using the Access.
4. Most times when I get on to the Access, I end up spending more time that I had planned.
5. I often spend more time on the Access than I had intended.

Focused Immersion
1. While using Access I am able to block out most other distractions
2. While using Access, I am absorbed in what I am doing.
3. While on Access, I am immersed in the task I am performing.
4. When on Access, I get distracted by other attentions very easily.
5. While on Access, my attention does not get diverted very easily.

Heightened Enjoyment
1. I have fun interacting with the Access.
2. Using Access provides me with a lot of enjoyment.
3. I enjoy using Access.
4. Using Access bores me.

Control
1. When using Access I feel in control.
2. I feel that I have no control over my interaction with Access.
3. Access allows me to control my computer interaction.

Curiosity
1. Using Access excites my curiosity.
2. Interacting with Access makes me curious.
3. Using Access arouses my imagination.

Personal Innovativeness
1. If I heard about a new information technology, I would look for ways to experiment with it.
2. In general, I am hesitant to try out new information technologies.
3. Among my peers, I am usually the first to try out new information technologies.
4. I like to experiment with new information technologies.

Playfulness
1. When using Access I am Spontaneous.
2. When using Access am Imaginative.
3. When using Access am Flexible.
4. When using Access am Creative.
5. When using Access am Playful.
6. When using Access am Original.
7. When using Access am Inventive.

Normative Influence -Friends
1. Close friends think I should use Access.
2. I will continue using Access if my friends use it.
3. It is important that my friends approve of my use of Access.
4. I achieve a sense of belonging when my friends and I all use Access
5. My friends very much influence my use of Access.

Normative Influence - Classmates
1. My classmates think I should use Access.
2. I achieve a sense of belonging when I can use Access as well as my classmates.
3. I consult my classmates when I do not know how to use Access.
4. My classmates very much influence my decision to use Access.

Normative Influence - Professor
1. My professors think I should use Access.
2. I always follow my professor's advice in using Access.
3. When I do not understand how to use Access I consult my professor.
4. My professor very much influences my decision to use Access.
5. I use Access because my professor approve of it.

Normative Influence – Lab Monitor
1. The lab monitors think I should use Access.
2. When I do not know how to use access, I consult the lab monitors.
3. I use lab monitors because they are experts who enable me to use Access better.