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Examining the Factors Influencing Participants' Knowledge Sharing Behavior in Virtual Learning Communities

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ABSTRACT

Increasing organizations and educational institutions have implemented virtual learning communities to encourage knowledge sharing. However, this task can not be accomplished simply by grouping people together and telling them “sharing your knowledge will make you learn better”. This research attempts to examine the factors influencing knowledge sharing from the perspective of human behavior. Theory of Planned Behavior is integrated with social network ties and empirical findings from virtual learning community literature to develop the research model. The current research model comprises eight hypotheses to explore questions of whether social network ties, learners' attitude toward knowledge sharing, learners' beliefs of their capabilities in performing online knowledge sharing, and subjective norms relate to knowledge sharing intention, which leads to actual behavior in a virtual learning environment. This study empirically validates the hypothesized relationships using a field survey of college students and MBA students enrolling courses conducted in a virtual learning community. Attitude, subjective norm, Web-specific self-efficacy and social network ties are shown to be good predictors of knowledge sharing intention which, in turn, is significantly associated with knowledge sharing behavior. Knowledge creation self-efficacy does not significantly impact knowledge sharing intention.

Keywords

Virtual learning community, Theory of planned behavior, Social network

Introduction

The explosion in Web based technology has led to increasing volume and complexity of knowledge, which stimulates the proliferation of virtual learning communities (VLCs). They are information technology based cyberspaces in which individuals and groups of geographically dispersed learners accomplish their e-learning goals (Yang et al., 2007). Such kind of communities has become growing initiatives during the past years in business organizations, educational institutions, and governments to pursue and mobilize knowledge via the Internet.

Despite the proliferation of virtual learning communities in modern life, very little is known about factors leading to their success or failure. The objective of VLCs is to enhance learning performance by encouraging participants to exploit or explore knowledge. Therefore, whether learners can share knowledge by raising good questions, recommending good articles, providing ideas and helping others resolve problems over Internet become critical in enhancing their learning performance. As Leonard (1995) indicated, valuable knowledge collects in individuals' head and is embodied in machines, software, and routine processes. The participants of learning activities in VLCs need to understand precisely what knowledge will fulfill their needs, and to keep this knowledge on the cutting edge, deploy it, leverage it in performing their tasks, and spread it across the community.

While knowledge sharing has been found to be a motivation for using emergent virtual communities (VC) (Wasko & Faraj, 2000), a range of barriers has been found impeding online knowledge sharing. The barriers having been discussed in VC literature include poor quality of community websites, members' lack of social relationship ties in the social network, their lack of capabilities in using community websites and involving in knowledge sharing, and the cognitive process such as negative attitude toward sharing knowledge online (Chen, 2007; Malhotra & Galletta, 2004; Sangwan, 2005). These barriers, however, have received little attention in VLC literature. Although some recent VLC studies have explored the importance of individuals' attitude or self-efficacy in performing online knowledge sharing, their results only demonstrated the roles of an individual's belief and capabilities in performing such behavior, without considering the effects of an individual's centrality in a social network and the opinions provided by others in such network (subjective norm). Wasko and Faraj (2005) pointed out that an individual's structural position in an electronic network of practice will influence his or her willingness to contribute knowledge to others. Given the social characteristic of virtual learning communities, this study suggests that attitude, self-

efficacy, social network ties and subjective norm will collectively shape knowledge sharing behavior. The Theory of Planned Behavior (TPB) is used as the underlying framework for developing the research model.

TPB has been one of the most influential theories in explaining and predicting behavior, and it has been shown to predict a wide range of behaviors (Sheppard et al., 1988). TPB posits that individuals' behavior is determined by behavioral intention and perceived behavioral control. Behavioral intention is determined by attitude toward behavior (ATT), subjective norm (SN), and perceived behavioral control (PBC) (Ajzen, 1985). Attitude toward behavior reflects one's favorable/unfavorable feelings of performing a behavior. Subjective norm reflects one's perception of relevant others' opinions on whether or not he or she should perform a particular behavior. Perceived behavioral control reflects one's perceptions of the availability of resources or opportunities necessary for performing a behavior (Ajzen & Madden, 1986). Recently, some academicians found that TPB can be used as a theoretical guidance for explaining knowledge sharing intention (e.g., Bock et al., 2005) or online behavior. In investigating online consumer behavior, Pavlou and Fygenson (2006) further suggested that the nature of PBC comprises two distinct dimensions: self-efficacy (SE) and controllability. SE is defined as individual judgments of a person's capabilities to perform a behavior. Controllability is defined as individual judgments about the availability of resources and opportunities to perform the behavior. Bandura (1997) suggested that self-efficacy is one of the major cognitive forces guiding behavior

Despite an emerging interest among IS researchers toward the knowledge sharing phenomenon, there is only a limited and fragmented understanding of online knowledge sharing behavior in virtual learning communities. Although TPB has been used to explain human behavior in different situation, it can not fully explain the online knowledge sharing behavior in the VLC setting. The three characteristics of a VC are as follows (Weigand et al., 2000). First, it consists of a group of people with shared interests. Second, the role of the enabling (Internet) technologies is more than just passively capturing and representing information. They should also help unify the community by actively engaging users in defining and integrating the information resources of the community. Third, the members of the community should not be forced to use the technologies. The participants in most VLCs include teachers and learners. These people share a common goal of learning by sharing knowledge over Internet. Learners' capabilities in using the website functions to acquire and provide knowledge are essential prerequisites for performing online knowledge sharing in such environment. The lack of confidence in using the website functions may diminish learners' intention to perform online knowledge sharing.

On the other hand, to encourage learners to use the VLC website as a communication channel, meaningful content must be continuously created to enrich the resource of the VLC's electronic knowledge repository. Learners' capabilities in creating useful knowledge to others are also important in a VLC where people are expected to learn anytime anywhere. According to social cognitive theory, one's belief about his or her capabilities in performing a particular behavior is defined as self-efficacy (Bandura, 1997). It has been found to vary across activities and situational circumstance. Prior literature has discussed several types of self-efficacy related to learning performance, such as mathematics self-efficacy (Banta, 1989; Pajares, 1996), computer self-efficacy (Compeau and Higgins, 1999; Marakas et al., 1998), etc. Marakas et al. (1998) and Agarwal et al. (2000) both suggested that a distinction be made between general computer self-efficacy (an individual's judgment of efficacy across multiple computer application domains) and software-specific self-efficacy (individual's feeling of self-efficacy relative to a specific software package). This study hence focuses on web-specific self-efficacy (WBSE) and knowledge creation self-efficacy (KCSE) for the current research purpose. WBSE refers to a learner's beliefs about his or her capabilities in using the functions of the VLC website. KCSE refers to a learner's beliefs about his or her capabilities in articulating the ideas and experiences, synthesizing knowledge from different sources, and learning from others by embodying explicit knowledge into tacit knowledge.

Moreover, knowledge experiences network effects as its value increases as more people share it. Online knowledge sharing behavior in VLCs has some notable differences compared to face-to-face group discussion conducted in traditional classrooms. The spatial and temporal separation between learners and teachers increases difficulties of effective ideas exchange. Therefore, the ties that connect individuals in a network are required for the sharing of knowledge. The concept of social network ties is derived from social capital theory (SCT) which has been widely applied in social science disciplines. In SCT-based literature, social network ties are defined as channels for information and resource flows (Tsai & Ghoshal, 1998). Yang et al. (2007) utilized the concept of social network ties to develop a peer-ranking mechanism that is useful for helping learners find quality learning content and trustworthy learning collaborators. Wiberg (2007) suggested the concept of learning through networks as a challenging concept

for addressing user-driven technologies that support social, collaborative and creative learning processes in, via, or outside typical educational settings. Tomsic and Suthers (2006) suggested that the formation of new collaborative ties is more significant for learning through information sharing in social networks than raw frequency of interaction. The ties that link the members of a social network like a VLC can be helpful for encouraging individuals to engage in knowledge sharing activities.

This study hence aims to better explain online knowledge sharing behavior in VLCs by extending the TPB with social network ties and dividing the self-efficacy into two sub-dimensions: learners' knowledge creation self-efficacy and learners' web specific self-efficacy. The proposed research model posits that attitude toward online knowledge sharing, subjective norm, learners' knowledge creation self-efficacy, learners' web-specific self-efficacy, and social network ties jointly determine learners' knowledge sharing intention which, in conjunction with learners' knowledge creation self-efficacy and learners' web-specific self-efficacy determines knowledge sharing behavior.

Literature Review and Research Model

Virtual Learning Community

The rise of the electronic-learning (e-learning) has been considered to be an important stimulus for the interest in virtual learning communities (VLCs) during the last decade. A VLC is the information technology based cyberspace in which individuals and groups of geographically dispersed learners accomplish their e-learning goals. It is also a place with socially constituted values and expectations (Burnett & Dickey, 2003). One of the VLCs' purposes is to encourage knowledge sharing so that valuable knowledge embedded in the network can be effectively explored. Most of the learners participate in VLCs with the expectations that they can acquire and share valuable knowledge to fulfill their needs.

Consistent with the growing interest in online cooperation and virtual organizing, there has been an exponential growth of VLC studies. For example, Daniel et al. (2003) addressed the importance of social capital in enhancing learning performance in virtual learning communities. Haythornthwaite (1998) found that centrality in a network may correlate with performance or satisfaction measures. Piccoli et al. (2001) found that students in the virtual learning environment will report higher levels of computer self-efficacy than their counterparts in the traditional learning environment. Markland (2003) pointed out that the 'new alliances' approach is most effective at individual as well as at group level for information resource seeking in virtual learning communities. Wellman et al. (1996) asserted that computer-supported social networks can maintain strong, supportive ties as well as increase the number and diversity of weak ties in virtual communities. These ties make on-line communications more uninhibited and creative. Wasko and Faraj (2005) investigated why people share their knowledge with others in electronic network of practice. They found that both reputation and centrality have significant influences on the helpfulness and volume of knowledge contribution. Finally, Koh and Kim (2004) investigated the relationship between community knowledge sharing activity and the loyalty toward the virtual community service provider. The results indicated that the level of community knowledge sharing activity may be a proper proxy for the state of health of a virtual community.

Prior studies have provided evidence demonstrating the importance of knowledge exchange in enhancing the learning performance. While knowledge sharing has been found to be a motivation for using emergent VCs (Wasko & Faraj, 2000), little research has examined what is required for effective knowledge sharing in VLCs. Davenport and Prusak (1998) indicated that sharing knowledge is often unnatural; hoarding knowledge and looking suspiciously upon knowledge from others are the natural tendency. Most people are reluctant to share their knowledge due to the fears of losing superiority. This human nature necessitates a study to examine the human-related factors of online knowledge sharing. In recent years, considerable studies have elaborated on the investigation of the determinants of individual's knowledge sharing behavior in the communities of practice or virtual communities. Virtual learning community is, however, one specific type of VC and has so far received little attention on what can influence participants' knowledge sharing behavior. Based on a review of virtual learning community and information system (IS) literatures, this study integrates the concept of social network ties into the Theory of Planned Behavior to provide a model which aims to better explain substantial portion of variance of such behavior in the VLC context.

To develop the research model, the VLC and IS literatures were reviewed to identify factors that potentially affect knowledge sharing in virtual learning communities. This section elaborates on the theory base and derives the hypotheses. The research model is depicted in Figure 1.

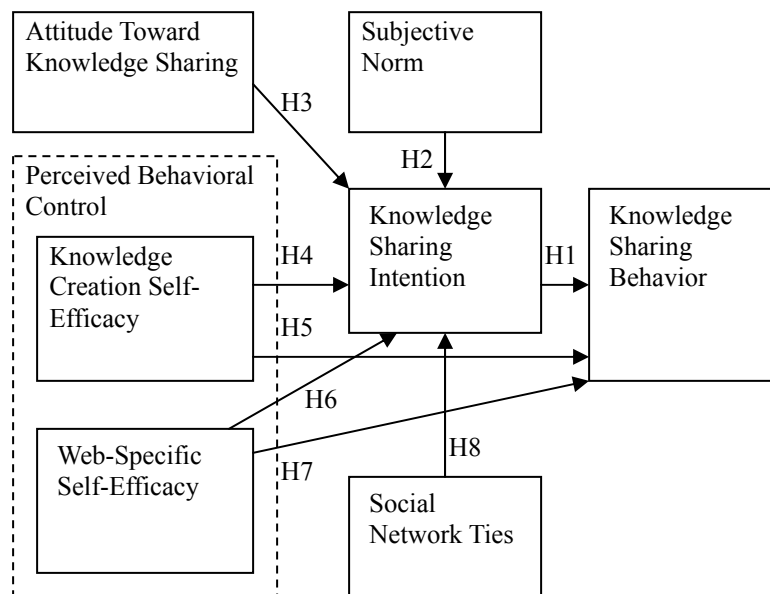


Figure 1. Research model

Intentions and Actual Behavior of Knowledge Sharing

Behavioral intention has long been found to be significantly associated with actual behavior. According to the theory of planned behavior (Ajzen, 1991), behavioral intentions are motivational factors that capture how hard people are willing to try to perform a behavior. TPB suggests that behavioral intention is the most influential predictor of behavior; after all, a person does what she intends to do (Pavlou & Fygenson, 2006).

Prior literature has corroborated the relationship between the two variables. For example, in a meta-analysis of 87 studies, an average correlation of .53 was reported between intentions and behavior (Sheppard et al., 1988). Results of Pavlou and Fygenson's (2006) longitudinal study validated the predictive power of TPB in online behavior and showed strong associations between get-information intention and get-information behavior, and between purchase intention and purchase behavior. Also, the Theory of Implementation Intentions (Gollwitzer, 1999) holds that a goal-driven behavior automatically activates a set of goal-enabling (implementation) intentions that help realize the behavior (Sheeran & Orbell, 1999). In this study, receiving good grades is learners' common goal and sharing knowledge online is a goal-driven behavior which can be realized if learners intend to perform such behavior. A positive relationship between intentions to share knowledge online and its actual behavior is thus expected.

H1: Knowledge sharing intention positively influences online knowledge sharing behavior.

Subjective Norm

Subjective norm suggests that behavior is instigated by one's desire to act as important referent others act or think one should act (Pavlou & Fygenson, 2006). Applied to the focal behavior, SN reflects participant perceptions of whether the behavior is accepted, encouraged, and implemented by the participant's circle of influence. The literature suggests a positive relationship between SN and intended behavior, and empirical work has shown that SN influences behavioral intentions toward system use (Karahanna et al., 1999). SN has been shown to be an important determinant of acceptance behaviors in numerous studies (Karahanna & Straub, 1999; Srite & Karahanna, 2006; Taylor & Todd, 1995; Thompson et al., 1991; Venkatesh & Davis, 2000; Venkatesh & Morris, 2000; Venkatesh et

al., 2003). Bock et al. (2005) conducted a survey with thirty organizations to test a knowledge sharing model. Results suggested that subjective norm has significant influence on knowledge sharing intention. Raaij and Schepers (2006) conducted a survey with 45 Chinese participants in an executive MBA program. They found that subjective norm has indirect effects on the use of virtual learning communities. One's social environment is a valuable source of information to reduce uncertainty and determine whether behaviors are within rules and are acceptable. Therefore, subjective norms may, through informational and normative influences, reduce uncertainty with respect to whether use of a system is appropriate (Evaristo & Karahanna, 1998; Srite & Karahanna, 2006). A positive relationship between SN and intentions to share knowledge online is thus expected.

H2: Subjective norm positively influences knowledge sharing intention.

Attitude

Attitude has long been shown to influence behavioral intentions (Ajzen & Fishbein, 1980). This relationship has received substantial empirical support (Pavlou & Fygenson, 2006). For example, Bock et al. (2005) conducted a survey with thirty organizations to test a knowledge sharing model. Results suggested that attitude toward knowledge sharing positively and significantly influence behavioral intention. Brown and Venkatesh (2005) employed the TPB framework to propose a model presenting factors influencing household technology adoption. They concluded that attitude toward IT usage positively influences technology adoption intention. Galletta et al. (2006) investigated the interacting effects of website delay, familiarity and breadth on users' performance of information search. They found a positive and significant relationship between attitude and behavioral intention. Kolekofski and Heminger (2003) proposed a model that defines the influences on one's intention to share information. Using the workers in a unit of a large governmental organization as samples, their study confirmed that attitude influences intention to share information. Finally, the integrated model proposed by Wixom and Todd (2005) empirically validated the strong association between attitude toward IS use and intention to use IS.

Consistent with these studies, Bhattacharjee and Premkumar (2004) found that attitude is important to predict the intention of continuing use of the computer-based training system usage and rapid application development software; attitude is one of the key perceptions driving users' IT use behavior. Agarwal and Prasad (1999) expanded on their prior studies, which utilized learning theory and various individual difference variables, to address possible causes for inconclusive results of prior studies. They found that attitude is an important antecedent of individuals' behavioral intention. Following the TPB literature, a positive relationship between attitude and intentions to share knowledge online is expected.

H3: Participants' attitude toward online knowledge sharing positively influences knowledge sharing intention.

Perceived Behavioral Control

In this study, perceived behavioral control refers to the learner's perceived ease or difficulty of telling story and experiences, writing documents, expressing opinion. Some researchers have suggested that PBC composes two distinct dimensions: self-efficacy (SE) and controllability (e.g., Pavlou & Fygenson, 2006). Pavlou and Fygenson (2006) defined self-efficacy as individual judgments of a person's capabilities to perform a behavior, and controllability as individual judgments about the availability of resources and opportunities to perform the behavior. Given that each participant has equal opportunities to access the anytime, anywhere available resource in a VLC, this study focuses on self-efficacy to discuss its role in the formation of learners' decision to perform knowledge sharing.

Self-efficacy has been found to vary across activities and situational circumstance. For example, Joo et al. (2000) found that Internet self-efficacy is able to predict students' performance on search task in Web-based instruction. Thompson et al. (2002) concluded that task-specific Internet self-efficacy has a significant effect on online search performance. Marakas et al. (1998) indicated that task-specific computer self-efficacy is an individual's perception of efficacy in performing specific computer-related tasks within the domain of general computing. Other types of self-efficacy such as social self-efficacy (Sherer et al., 1982), teaching self-efficacy (Gibson & Dembo, 1984), math self-efficacy (Banta, 1989) have been applied in various domains to explore their predictive powers on task

performance, one's decision on what behaviors to undertake, and the level of commitment and persistence in attempting those behaviors.

Web-Specific Self-Efficacy and Knowledge Creation Self-Efficacy

In their TPB-based study, Pavlou and Fygenson (2006) found that self-efficacy is a good predictor of online consumer behavior. In examining electronic knowledge repositories (EKR), Kankanhalli et al. (2005) proposed knowledge self-efficacy (KSE) which can be manifested in the form of people believing that their knowledge can help to solve job-related problems, improve work efficiency, or make a difference to their organization (p122.). They found that KSE is positively related to EKR usage by knowledge contributors. Given that a VLC is an Internet-technology-based environment, when learners are required to learn in such setting, they need to be capable of using the website functions, and exploiting or exploring existing knowledge resource. Exploitation involves capturing existing knowledge and transferring and deploying knowledge in other similar situations, while exploration needs sharing and synthesizing existing knowledge, and creating new knowledge. These processes are defined by Nonaka (2000) as the methods of knowledge creation. Therefore, this study focuses on two types of learner self-efficacy: Web-specific self-efficacy (WBSE) and knowledge creation self-efficacy (KCSE).

WBSE refers to a learner's beliefs about his or her capabilities in using the functions of the VLC website. KCSE is defined as a learner's beliefs about his or her capabilities to articulate the ideas and experiences, synthesize knowledge from different sources, and learning from others by embodying explicit knowledge into tacit knowledge. The learners that have higher WBSE and KCSE will gain greater benefit by participating in VLC activities than those that have lower WBSE and KCSE. These cognitive beliefs affect how learners process knowledge and learn through a VLC. Thus, it seems plausible that learners' beliefs about their capabilities in using the website functions and creating new knowledge in VLCs could influence their propensity to undertake knowledge-based activities in such environment. Positive relationships between two types of self-efficacy and intentions and behavior of online knowledge sharing are thus expected.

H4: Knowledge creation self-efficacy positively influences knowledge sharing intention.

H5: Knowledge creation self-efficacy positively influences knowledge sharing behavior.

H6: Web-specific self-efficacy positively influences knowledge sharing intention.

H7: Web-specific self-efficacy positively influences knowledge sharing behavior.

Social Network Ties

Virtual learning communities provide a suitable environment for those seeking for knowledge-based communication. Learners in a VLC may or may not know each other, yet they sometimes communicate actively through the cyberspace. With no immediate benefit to the knowledge contributors, and free-riders are able to acquire the same knowledge as everyone else (Wasko & Faraj, 2005, p.35), why learners exchange ideas and experience with strangers is not well understood. Some academicians (Cohen & Prusak, 2001; Kankanhalli et al., 2005; Nahapiet & Ghoshal, 1998; Wasko & Faraj, 2005) have attributed such behaviour to social network ties, an important attribute of social capital derived from the Social Capital Theory.

Social network ties are channels for information and resource flows (Tsai & Ghoshal, 1998). They can be considered as a bond between two people based on one or more relations they maintain in a social network (Haythornthwaite, 1998). Academicians have addressed the importance of social interaction ties in the creation or exchange of knowledge and mobile learning. For example, Chen et al. (2008) proposed the architecture of a mobile learning management system which can better support mobile learning for a small group of learners with effective social interaction. Tsai and Ghoshal (1998) found that social interaction ties had direct positive impacts on the extent of interunit resource exchange. Chen (2007) found that social interaction ties can enhance individuals' intentions to perform online knowledge sharing. Finally, Yang et al. (2007) suggested that posting and responding to messages can help to create social-interaction ties among the members of a VLC, these ties are helpful for encouraging online knowledge sharing. A positive relationship between social network ties and the intentions of online knowledge sharing is hence expected.

H8: Social network ties positively influence knowledge sharing intention.

Research Methodology

Data Collection

Data for this study were collected in two phases from 396 full-time senior college students and MBA students who enrolled in two courses (enterprise resource planning and electronic business) that were conducted over a Web-based learning platform and physical classrooms. These students majored in different areas (information management, business administration and graduate school of management). Instructors upload the course material and the topic to be discussed one week prior to each class and students read the material, upload their completed homework assignments and share their opinions or ideas in the discussion forum. The students then meet in the physical classroom to receive the scored homework assignments and comments from the instructors. Generally, students in the same class knew each other; those who were in different classes but enrolled in the same course might not know each other. All of the subjects had received a basic training of WWW use prior to the survey (in the first two years of their college life).

In the first week of the semester, the instructors explained how the course activities will be conducted and how learners' performance will be evaluated at the end of the semester. The first-phase survey questionnaires measuring learners' attitude towards knowledge sharing and their self-efficacy were administered to learners in the second week. The second-phase survey questionnaires concerning subjective norms, social network ties, knowledge sharing intention and knowledge sharing behavior were given to learners in the last week and responses were collected in the same week.

The instrument was examined to ensure content validity and reliability within the target context. A pretest of the questionnaire was performed using 3 experts in the IS area to assess logical consistencies, ease of understanding, question item sequence adequacy, and context fitness. Necessary modifications were made according to the comments collected from these experts. Furthermore, a pilot study was conducted using another 2 PhD. students and 5 master students who had taken courses conducted in a virtual learning community. Comments and suggestions on question item content and structure were solicited and proper modification was made accordingly.

Construct measurement

Most of the scales were drawn from prevalidated measure in VC or KM literature. Specifically, knowledge sharing behavior was measured by the items adapted from Davenport and Prusak (1998) and Wasko and Faraj (2005). Intention of knowledge sharing was measured by the items adapted from Bock et al. (2005) and Kankanhalli et al. (2005). Items for measuring the attitude and subjective norm were adapted from prior related research (Bock et al., 2005; Brown & Venkatesh, 2005; Pavlou & Fygenson, 2006; Srite & Karahanna, 2006). The instruments for knowledge creation self-efficacy and web-specific self-efficacy were adapted from Kankanhalli et al. (2005) and Pavlou and Fygenson (2006). Finally, social network tie was measured by items adapted from prior related research (Nahapiet & Ghoshal, 1998; Tsai & Ghoshal, 1998; Yli-Renko et al., 2002). For the aforementioned measures, a seven point Likert type was used, with anchors ranging from 1 (strongly disagree) to 7 (strongly agree). Appendix A shows all the measurement items.

Data Analysis

Measurement Model Testing

Construct validity for the seven measurement scales with a LISREL confirmatory factor analysis (CFA) was assessed. The measurement model in the CFA was revised by dropping items, one at a time, which shared a high degree of residual variance with other items, according to the standard LISREL methodology (Gefen, 2000; Gerbing & Anderson, 1988). Items were dropped depending on reported standardized residuals, that is, those showing a significant degree of shared non-specified variance among the measurement items. Composite reliability was then

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examined using the Cronbach's alpha values. As listed in Table 1, all of these values were greater than 0.82, well above the recommended threshold value of 0.7.

Table 1. Descriptive statistics and construct reliability

Table 1: Descriptive Statistics and Construct Reliability				
Construct and Scale Items	Item Mean	Std. Deviation	Factor Loading	Construct Reliability
Attitude (ATT)				
ATT1	4.44	0.64	0.74	0.82
ATT2	4.36	0.63	0.78	
ATT3	4.33	0.64	0.73	
ATT4	4.44	0.57	0.75	
Subjective Norm (SN)				
SN1	4.05	0.76	0.81	0.82
SN2	3.98	0.84	0.81	
SN3	4.08	0.74	0.71	
Knowledge Creation Self-Efficacy (KCSE)				
KCSE 1	3.89	0.79	0.72	0.84
KCSE 2	3.90	0.87	0.80	
KCSE 3	3.93	0.79	0.78	
KCSE 4	3.93	0.81	0.74	
Web-specific Self-Efficacy (WBSE)				
WBSE1	3.93	0.80	0.75	0.88
WBSE 2	3.92	0.74	0.72	
WBSE 3	3.82	0.90	0.79	
WBSE 4	4.10	0.69	0.74	
Social Network Ties (SNT)				
SNT1	4.09	0.82	0.72	0.82
SNT2	3.99	0.76	0.76	
SNT3	4.20	0.70	0.73	
SNT4	4.23	0.70	0.72	
Knowledge Sharing Intention (INT)				
INT1	4.24	0.68	0.75	0.86
INT2	4.35	0.64	0.76	
INT3	4.25	0.63	0.80	
INT4	4.16	0.73	0.80	
Knowledge Sharing Behavior (BEH)				
BEH1	4.51	0.59	0.82	0.84
BEH2	4.35	0.61	0.85	
BEH3	4.44	0.62	0.73	
BEH4	4.43	0.62	0.79	

Discriminant validity was evaluated through comparison of the AVE of construct pairs to the squared correlation between construct pairs. Fornell and Larcker (1981) recommended a test of discriminant validity, where the AVE should exceed the squared correlation between that and any other construct. All of the items in Table 2 exhibited that all AVEs are greater than the highest squared correlation (0.481) between construct pairs. The overall results provide support for acceptable discriminant validity of constructs.

Table 2. Discriminant Validity

Construct	Squared Correlations and AVEs						
	ATT	SN	KCSE	WBSE	SNT	INT	BEH
ATT	.71						
SN	.233(**)	.79					
KCSE	.142(**)	.448(**)	.69				

WBSE	.152(**)	.440(**)	.438(**)	.77			
SNT	.212(**)	.372(**)	.355(**)	.332(**)	.62		
INT	.481(**)	.302(**)	.265(**)	.277(**)	.352(**)	.89	
BEH	.469(**)	.244(**)	.180(**)	.190(**)	.250(**)	.446(**)	.79

1. *: Correlation is significant at the 0.05 level (2-tailed).

**: Correlation is significant at the 0.01 level (2-tailed).

2. Diagonal elements represent the Average Variance Extracted (AVE), while off diagonal elements represent the squared correlations among constructs. For discriminant validity, diagonal elements should be larger than off-diagonal elements.

Structural Model Testing

For models with good fit, it is suggested that chi-square normalized by degrees of freedom ($\chi^2/\text{d.f.}$) should not exceed 5 (Bentler & Bonett, 1980). Etezadi-Amolo and Farhoomand (1996) and Henry and Stone (1994) both suggested that the recommended thresholds of GFI and AGFI are 0.80. Chau (1996) indicated that the NNFI and CFI with values greater than 0.85 are moderate fit indices. For the current CFA model, $\chi^2/\text{d.f.}$ was 2.54, NFI was 0.95, NNFI was 0.93, CFI was 0.95, GFI was 0.92, AGFI was 0.89. SRMSR was 0.03, slightly above the recommended value (see Table 3). These figures signify an adequate model fit.

Table 3. Goodness of Fit Statistics

Construct	Guideline	Fit Indices
$\chi^2/\text{d.f.}$	≤ 5.0	2.54
NFI	≥ 0.85	0.95
NNFI	≥ 0.85	0.93
CFI	≥ 0.85	0.95
GFI	≥ 0.80	0.92
AGFI	≥ 0.80	0.89
SRMSR	≤ 0.1	0.03

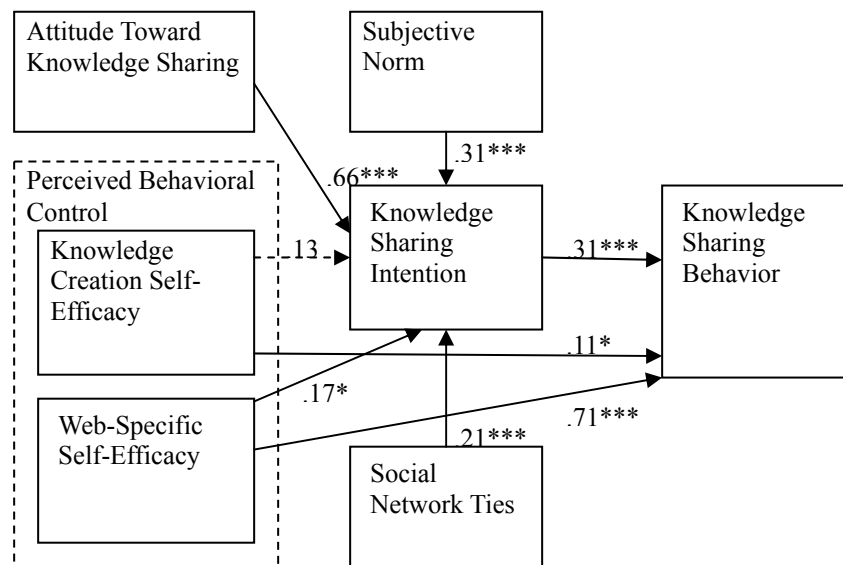


Figure 2. Structural model test

The path significance of each hypothesized association in the research model and variance explained (R^2 value) by each path were examined. All the paths were significant except the one pointing from knowledge creation self-efficacy to knowledge sharing intention. Knowledge sharing behavior (BEH) was predicted by knowledge sharing intention, web-specific self-efficacy and knowledge creation self-efficacy, which jointly explained 52% of the behavior variance. Knowledge sharing intention was predicted by subjective norm, attitude, web-specific self-efficacy, knowledge creation self-efficacy and social network ties, which jointly explained 59% of the intention variance. As can be seen from Figure 2, hypothesis H4 was not supported whereas the rest of the hypotheses were all supported.

Discussion

Summary of results

The proposed research model provides a framework for understanding online knowledge sharing behavior in virtual learning communities. Learners' initial attitude toward sharing knowledge through the Web site of the VLC is shown to be significantly associated with their intentions of performing such behavior. This is consistent with Bhattacharjee and Premkumar (2004)'s findings that IT users' attitude toward IT usage will affect their intentions of subsequent IT usage. The positive and significant relationship between subjective norm and intention suggests that the opinions from teachers, friends or classmates help to form an atmosphere which facilitates the earnestness of joining in online discussion to acquire or apply knowledge. This result corroborates the subjective norm-intention relationship that was found by prior TPB studies conducted in various contexts. For example, a survey conducted by Bock et al. (2005) indicated that based on a sample of thirty organizations the subjective norm showed a significant influence on knowledge sharing intention.

The result also shows that Web-specific self-efficacy positively and significantly influences the intention. According to social cognitive theory (Bandura, 1997), an individual would strive for goals that he judges himself capable of attaining and avoid goals that he perceives as being too difficult. Self-efficacy theory also suggests a positive link between users' a priori perceived level of self-efficacy and their desire to engage in a particular activity (Hunton & Beeler, 1997). The current finding echoes with Hunton and Beeler's (1997) finding which suggests a significant and positive association between user self-efficacy and the desire to participate in target activities. Hence, an individual with beliefs in his efficacy will set more difficult goals for himself and thus mount the level of motivation needed to reach higher levels of performance. Other positive and significant relationships (hypotheses 5 and 7) observed in this study suggest that Web-specific self-efficacy and knowledge creation self-efficacy are important antecedents leading to knowledge sharing behavior. This finding is consistent with the findings of Marakas et al. (1998) and Compeau and Higgins (1999) which show that task-specific self-efficacy exerts strong influence on actual behavior of the target task.

Social network ties appear to be positively and significantly associated with knowledge sharing intention. This implies that once an individual build up relationships with other VLC members that he feels comfortable to share his ideas, thoughts, or story, his intention of performing such behavior will be stronger. This result supports previous findings of VC (Chen, 2007) and VLC (Yang et al., 2007) studies which suggest that social interaction ties help to enhance community members' intention to share knowledge online. Finally, a significant relationship is observed between knowledge sharing intention and the actual behavior. This is consistent with the result of a TPB-based electronic commerce study (Pavlou & Fygenson, 2006) which finds a significant association between online get-information intention and get-information behavior. The current results prove the explanatory power of TPB in the VLC context.

Against prior expectation, the relationship between knowledge creation self-efficacy and knowledge sharing intention does not prove previous conjecture. People engage in volitional behavior because it is self-relevant; it has subjective meaning and importance to the individual (Rejeski et al., 2005). Contributing knowledge online can be a semi-volitional behavior in VLCs given that performing online knowledge sharing weighs heavily in performance assessment. Therefore, a possible explanation of this result is that learners consider sharing knowledge online as a mean to achieve the end of earning the course credit, those with low self-efficacy in expressing ideas, applying knowledge, or responding messages may still have high intentions to strive for the goals.

Conclusion and Implications

Enhancing learning performance through the setting of virtual learning communities has become an emergent trend in educational institution as well as business organizations. Although the target subject in this study includes senior college students and MBA students who took courses conducted in the VLC setting, the research findings can be applicable to knowledge workers in business organizations and communities of practice. For business organizations, the goals of putting into practice such training policy are to train their personnel in a more efficient manner. For educational institutions, cultivating learners' capabilities in exploring and exploiting knowledge from the unlimited resource in a virtual learning community can help them not only learn more efficiently, but also learn 'how to learn' in the digital economy era. However, business managers or instructors need to foster an atmosphere of community where individuals hold positive attitude about interacting with strangers on Internet. Moreover, prerequisite training for using the VLC website functions and knowledge creation capabilities in the VLC setting is also required to achieve its intended goals.

This study suffers from a major limitation. We focus on learners' capabilities, attitude, centrality in the social network, and opinions from others in the network to explain the social behavior. Other virtual community studies (e.g., Chen, 2007) have found that website quality is an important variable influencing users' intentions to participate in VC activities. Prior IS research suggested that the website quality encompasses three dimensions-information/knowledge quality, system quality and service quality. Therefore, further studies are suggested to explore the impact of the VLC website quality, including knowledge quality and system quality, on learners' knowledge sharing behavior.

Although some VLC studies have examined the impact of learners' attitude or self-efficacy alone on learning performance, to our best knowledge, little VLC research has provided a comprehensive theoretical model grounded on related theories. This research is one of the earliest VLC studies which consider the characteristics of virtual learning communities and integrate the concept of social network ties, theory of planned behavior and two types of self-efficacy to advance the understanding of online knowledge sharing behavior in the VLC setting.

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Appendix A. Measurement items

Construct	Measure
Attitude Toward Knowledge Sharing	
ATT1	I believe that sharing knowledge with others is useful for learning new knowledge.
ATT2	I believe that sharing knowledge with others will help me learning more efficiently.
ATT3	I believe that sharing knowledge with others gives me the opportunity to learn from more people.
ATT4	I believe that sharing knowledge with others is useful for enhancing my learning performance.
Subjective Norm	
SN1	My teacher thinks that I should share my knowledge with other members in the virtual learning community.
SN2	My friends think that I should share my knowledge with other members in the virtual learning community.
SN3	My classmates think that I should share my knowledge with other members in the virtual learning community.
Knowledge Creation Self-Efficacy	
KCSE1	I feel confident clearly expressing my ideas in the virtual learning community.
KCSE2	I feel confident responding others' messages in the virtual learning community.
KCSE3	I feel confident articulating my ideas into written, verbal or symbolic forms.
KCSE4	I feel confident applying my knowledge to help others resolve their problems.
Web-Specific Self-Efficacy	
WBSE1	I feel confident acquiring sufficient resource and knowledge from the Web site of the virtual learning community.
WBSE2	I feel confident efficiently utilizing the resource provided by the virtual learning community, such as discussion forum, recommended articles and e-papers.
WBSE3	I feel confident posting messages in the Web bulletin board.
WBSE4	I feel confident browsing information over the Web site of the virtual learning community.
Social Network Ties	
SNT1	I maintain close social relationships with some members in the virtual learning community.
SNT2	I intensively exchange ideas with some members in the virtual learning community.
SNT3	I know some members in the virtual learning community on a personal level.
SNT4	I have frequent communication with some members in the virtual learning community.
Knowledge Sharing Intention	
INT1	I intend to frequently share my ideas with other members in the virtual learning community.
INT2	I will always provide my know-where or know-whom at the request of other members in the virtual learning community.
INT3	I will try to share my expertise from my education or training with other members in an effective way.
INT4	I intend to share my resolution of others' problems to earn more course credit.
Knowledge Sharing Behavior	
BEH1	I usually spend a lot of time sharing knowledge with other members in the virtual learning community.
BEH2	I usually actively share my knowledge with other members in the virtual learning community.
BEH3	I usually involve myself in discussions of various topics rather than specific topics.
BEH4	I usually respond to others' comments on my messages.