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The study of the antecedents of knowledge sharing behavior: The empirical study of Yambol online test community

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Abstract

Purpose – The purpose of this paper is to investigate how the factors from environmental level and personal level influence the knowledge sharing behavior and community participation.

Design/methodology/approach – This research study, which consisted of 394 valid respondents who were members of the Yambol online test community, used online survey to collect data. This research used the structural equation modeling to analyze the data with good model fit.

Findings – The results of this research showed the following: the anticipated reciprocal relationship, norm of reciprocity, and anticipated extrinsic rewards had a significant and positive effect on knowledge sharing behavior, respectively; knowledge sharing behavior had a significant and positive effect on community participation; knowledge sharing self-efficacy was the mediator between anticipated extrinsic rewards and knowledge sharing behavior; and community identification moderated the relationship between knowledge sharing behavior and community participation.

Research limitations/implications – This study was a cross-sectional study. Future research can employ a longitudinal study to conduct long-term observations of knowledge sharing behavioral changes among members of the Yambol online test community. Moreover, this study applied social cognitive theory as the basis to explore the antecedents of knowledge sharing behavior of members of the Yambol online test community. Future research can apply a broad range of behavioral theory or combinations of research variables to explore comprehensive factors of knowledge sharing behavior.

Practical implications – From a managerial standpoint, this study can assist professional online learning community in understanding the antecedents of knowledge sharing behavior and community participation from personal and environmental level.

Social implications – Yambol online test community managers can enhance reciprocity relationship between members in the emotional level. In addition, Yambol online test community managers can use the appropriate norm of reciprocity to strengthen the trust of community members and enhance the knowledge sharing behavior of community members in the rational level.

Originality/value – First, most scholars viewed knowledge sharing from perspectives of corporate, organizational, or a typical internet community, but rarely applied a perspective from a professional online learning community to conduct research. Therefore, this research focussed on professional online learning community as the research subject. Second, the literature review revealed that reciprocity divided into anticipated reciprocal relationship and norm of reciprocity. Previous studies have used anticipated reciprocal relationship or norm of reciprocity as research aspects for examining

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reciprocity; however, no other study has evaluated both concurrently. Third, studies on the behavioral dimension have included knowledge sharing behavior and community participation. This study examined the influence of knowledge sharing behavior on community participation. Additionally, community identification was the moderator of the effect of knowledge sharing behavior on community participation.

Keywords Community participation, Anticipated extrinsic rewards, Anticipated reciprocal relationship, Knowledge sharing behaviour, Knowledge sharing self-efficacy, Norm of reciprocity

Paper type Research paper

1. Introduction

The twenty-first century is a knowledge economy era, in which knowledge mastery yields innovation. Rapid technological advances and unlimited internet expansion enables people to search and locate numerous data. Knowledge delivery is no longer limited to schools and books. The internet has advanced tangible geographical and temporal limitations that enable people to cross-knowledge barriers and internet communities have further linked people. Online and mobile learning are optimal learning methods that enable users to learn current trends and avoid overwhelming amount of information.

Regarding online learning activities, the 2014 Digital Opportunity Survey Report published by the Research, Development, and Evaluation Commission, Executive Yuan of Taiwan, showed that 89.6 percent of the internet users searched internet to obtain information (i.e. one-way information searches) (The National Development Council, 2014). Furthermore, Taiwan Network Information Center (2014) conducted the survey of broadband internet usage in Taiwan indicated that Taiwan internet population had a total of 1,763,000 people, approximately 75 percent of the total population. Individual access to the internet which the proportion of increasingly use of mobile devices (with 63.39 percent use smart phones and 72.89 percent use panel computers to browse web pages).

Beyond formal school learning, there are more and more learning institutions offering online studying programs for people (Ho *et al.*, 2010). Online learning integrates information technology and media and adds value to traditional learning models (Henry, 2001). Internet technology improvements and a trend toward online learning have facilitated the thriving development of online learning communities. These communities possess their own internet space and culture for conducting activities (Snyder, 2011). Driven by knowledge management, knowledge innovation has accelerated and online learning communities require continuous management innovation to meet evolving requirements (Huang *et al.*, 2012). The appropriate use of community resources and cohesion, concentration of people's power, and rapid accumulation and development of various knowledge domains are the keys to sustain the growth of professional virtual communities.

Although sharing knowledge was a common human characteristics and could be encouraged (Michailova and Husted, 2003), sharing was also an intangible activity and could not be forced or mandated by others (Bock *et al.*, 2005). When people perceived their knowledge valuable and vital competitive resource or asset, they were reluctant to share knowledge (Lin *et al.*, 2012; Nonaka and Konno, 1998). Therefore, the motivation of this research was to explore the reasons why community members in online learning communities willing to share knowledge with other members.

Self-efficacy was one person's inner conviction that this particular person could arrange and accomplish his actions to fulfill the desired goals (Paek *et al.*, 2011). Self-efficacy and outcome expectations were the primary factors for individual

cognition (Lubans *et al.*, 2012). Reciprocity referred to people's beliefs that kindness and active contributions would be reciprocated (Maxwell *et al.*, 2003). Kankanhalli *et al.* (2005) applied social capital theory as the basis to demonstrate that the reciprocity. Nahapiet and Ghoshal (1998) pointed out that when organization members could use knowledge and participate in knowledge exchanges, a structured link (i.e. structural capital) and a positive relationship (i.e. relationship capital) formed and knowledge sharing behavior occurred.

Vroom (1964) indicated that people expanded effort at their jobs because of their expectations of work performance, rewards, and success. This indicates that when organizations provide rewards that reach member expectations, the rewards influence member behavior. This study adopted the perspective of Bock *et al.* (2005), which considered members perceiving the rewards for contributing extra efforts, knowledge sharing behavior induced.

When applying social cognitive theory to examine knowledge sharing behavior, the anticipation of positive results and a desire to share knowledge does not motivate a person to execute a specific behavior. Significant obstacles were created when people doubted whether they had sufficient capability to conduct a behavior successfully (Hsu *et al.*, 2007). This indicated that knowledge sharing self-efficacy was vital for inducing people to share knowledge (Ye *et al.*, 2006). In addition, studies indicated that rewards and appreciation positively influenced self-confidence (Beattie *et al.*, 2011). People were more likely to share knowledge when they perceived that knowledge sharing behavior strengthened self-efficacy and personal abilities (Kankanhalli *et al.*, 2005). The accumulation of social capital promoted internet knowledge sharing behavior (Chiu *et al.*, 2006).

Continuous knowledge sharing by members and community participation gradually increases the community knowledge base. Participation was a kernel idea and activity in the virtual communities (Ku, 2011). Pai and Tsai (2011) defined virtual community participation as the level of active member participation in community activities and member interactions. Identity referred to a status that people perceived themselves as a member of a group (Nahapiet and Ghoshal, 1998). Ashforth and Mael (1989) maintained that identity for people used member status in an organization to define themselves and the perception of belonging to a group. When people identified with a group, they perceived that they belonged in that group (Mael and Ashforth, 1992). Zhou (2011) stated that social identity was used to describe a psychological status that clarifying a person was not a separate entity but group member (i.e. people define their unique individual attributes by the attributes of their group) (Homburg *et al.*, 2009). When people identified with a community, they actively participate in community activities (Algesheimer *et al.*, 2005). Thus, community identification had a positive influence on knowledge sharing behavior (Nahapiet and Ghoshal, 1998).

In this knowledge innovation era, the convenience of internet access enables people to be active and interact frequently on the internet. Numerous behaviors that require further research have not thoroughly studied in previous studies regarding online learning community platforms. Thus, this study explored various perspectives regarding knowledge sharing behavior in online learning communities and used data to validate the research hypotheses and achieve the following research objectives: investigate antecedents that influence knowledge sharing behavior in online learning communities; examine how anticipated extrinsic rewards and knowledge sharing self-efficacy affect knowledge sharing behavior; investigate whether community identification has a moderating effect in the influence of knowledge sharing behavior on community participation.

2. Literature review and hypotheses

2.1 Virtual learning community and knowledge sharing

2.1.1 Virtual learning community. The new model emphasized social network development, which involved collaborative learning and multidirectional knowledge delivery concepts and builds knowledge based on learners, group interactions, discussions, and understanding (Rolando *et al.*, 2014). With social information and life pace accelerations, learners expected an online learning environment that fulfilled their individual needs (Hua, 2012). A sizable online learning community must establish mutual interests and knowledge objectives, concentrate knowledge sharing strength, and achieve the accumulation and building of knowledge. People could use the internet in various locations to conduct synchronous or non-synchronous online courses (Huang *et al.*, 2012).

2.1.2 Virtual learning community and knowledge sharing behavior. Knowledge sharing referred to knowledge or information dissemination and distribution by one person to other members (Lin *et al.*, 2009). Senge (1997) asserted that knowledge sharing was an effective action that facilitated people's development and understanding of the causes and reasons for an object. Wijnhoven (1998) pointed out that knowledge sharing involved using information media to transmit knowledge. Search engines, online chats, and discussion forums enabled people to share knowledge willingly and actively (Brown and Duguid, 2001) and promoted knowledge sharing for informal virtual communities (Lin *et al.*, 2012).

2.2 Social cognitive theory

Social cognitive theory was a combination of behaviorism and the social learning concepts proposed by Bandura (1986). Social cognitive theory posits that both the extrinsic environment and intrinsic personal beliefs affect human behavior. The particular strategies of accentuating behavioral reinforcement, emotional coping, observational learning, and self-control were from the concept of social cognitive theory (Paek *et al.*, 2011). People must rely on the knowledge, skills, and resources of others when they could not complete tasks personally (Bandura, 2001; Lin and Huang, 2008). A critical core concept in collective agency was collective efficacy, which was people's mutual beliefs in whether a group to which they belonging could successfully achieve an objective (Bandura, 2001).

2.3 Anticipated reciprocal relationship

Numerous previous scholars applied social exchange theory, social capital theory, and theory of planned behavior to interpret knowledge sharing behavior and the necessity of knowledge sharing reciprocity (Chiu *et al.*, 2006; Kankanhalli *et al.*, 2005). Bock *et al.* (2005) examined anticipated reciprocal relationship in social exchange theory, which referred to members' desire to maintain relationships with others, particularly regarding knowledge sharing interactions. A community with reciprocal relationship between members exhibited stronger advantage because members of this particular community had the capacity to influence each other (Chen *et al.*, 2013). Huang *et al.* (2008) agreed that people shared knowledge because they wished to develop favorable relationships with other members or expect to obtain knowledge from other members in the future. Tohidinia and Mosakhani (2010) conducted a study on knowledge sharing behavior in the Iranian oil industry and learned that anticipated reciprocal relationship affected knowledge sharing attitudes. Bock *et al.* (2005) demonstrated that anticipated reciprocal relationship had a significant and positive effect on knowledge sharing

attitudes and that these relationships influenced knowledge sharing intentions indirectly through knowledge sharing attitudes.

The described studies showed that anticipated reciprocal relationship emphasized the maintenance of relationships between people and a factor in social psychology. This study categorized anticipated reciprocal relationship as affective reciprocity and proposed the following hypothesis:

H1. The anticipated reciprocal relationship has a significant and positive effect on knowledge sharing behavior.

2.4 Norm of reciprocity

Shumaker and Brownell (1984) indicated that the norm of reciprocity was a sense of mutual interpersonal benefit. To insure the continuation of reciprocal behavior, people frequently reciprocate actions when they have benefits. Tsai *et al.* (2011) advocated that norm of reciprocity between community members promote cooperation. Reciprocity was a vital factor that ensured the sustainable development of virtual communities and the establishment of a community knowledge bank (Tamjidyamcholo *et al.*, 2013; Wong and Huang, 2011). Previous studies pointed that the norm of reciprocity increased knowledge sharing behavior (Chen and Hung, 2010; Chiu *et al.*, 2006; Tsai *et al.*, 2011; Wasko and Faraj, 2000).

The norm of reciprocity was vital social capital for group members. Social capital maintained relationships and had a positive influence on organizational and community development and the knowledge sharing behavior of members in the community. Thus, this study proposed the following hypothesis:

H2. The norm of reciprocity has a significant and positive effect on knowledge sharing behavior.

2.5 Anticipated extrinsic rewards

In a virtual community, common reward mechanisms were account privileges, virtual currency, prizes, point accumulation, open recognition, levels, and online gaming mechanisms (Krasonikolakis *et al.*, 2014). The Yambol online test community in this study uses virtual currency (i.e. knowledge sharing results in Y coins and Y coins can purchase participation in online tests), point accumulation (i.e. test participation yields experience points), level (i.e. accumulation of a specific level of experience point increases member's level, which ranges from kindergarten to grand master), open recognition (i.e. a success-recognition page, which publishes community member experience in the public office examinations within the site), and game (i.e. members can use to win Y coins by winning the website game championship). Bock *et al.* (2005) defined anticipated extrinsic rewards as members anticipating rewards in return for sharing knowledge. This study defined anticipated extrinsic rewards as the awards or rewards anticipated by community members in the knowledge sharing process. The currency mechanism also strengthened member sense of participation and identification in the virtual community (Chu *et al.*, 2004).

In summary, this study pointed out that when members of the Yambol online test community had high expectations toward anticipated extrinsic rewards in the community, they exhibited increased knowledge sharing behavior. Thus, this study proposed the following hypothesis:

H3. Anticipated extrinsic rewards have a significant and positive effect on knowledge sharing behavior.

2.6 Knowledge sharing self-efficacy

Knowledge sharing self-efficacy referred to knowledge sharers' confidence in whether they could provide valuable knowledge to others in a specific scenario (Ye *et al.*, 2006). People could provide useful information to others, when they had sufficient knowledge and ability (Hsu *et al.*, 2007). Kankanhalli *et al.* (2005) pointed out that when people perceived they had sufficient abilities to contribute knowledge to other members in an organization, this perception inspired people to share knowledge. In addition, Hsu *et al.* (2007) and Ye *et al.* (2006) demonstrated that a person's knowledge sharing self-efficacy had a significant and positive influence on knowledge sharing behavior. Therefore, this study provided the arguments that anticipated extrinsic rewards had a significant and positive influence on knowledge sharing self-efficacy and knowledge sharing self-efficacy influenced knowledge sharing behavior.

In summary, this study theorized that high member anticipated extrinsic rewards in the Yambol online test community increased knowledge sharing self-efficacy. Increased knowledge sharing self-efficacy in members enhanced knowledge sharing behavior. Thus, this study proposed the following hypotheses:

H4. Anticipated extrinsic rewards have a significant and positive effect on knowledge sharing self-efficacy.

H5. Knowledge sharing self-efficacy has a significant and positive effect on knowledge sharing behavior.

2.7 Community participation

Community participation in this study was the same way as by Koh and Kim (2004), which derived from Organ (1988), who studied organizational citizenship behavior and members who actively promoted community development and rendered mutual assistance. The activities of Yambol online test community included personalized online examinations, Grand Champion Competitions, interactive functions, such as Facebook fan pages, and mutual sharing of knowledge and encouragement between members. Factors promoted member participation including altruism, rewards, identification, personal prestige, and personal interests (Fang and Neufeld, 2009). Koh and Kim (2004) learned that in virtual communities, knowledge sharing behavior had a significant and positive effect on community participation. Therefore, this study proposed the following hypothesis:

H6. Knowledge sharing behavior has a significant and positive effect on community participation.

2.8 Community identification

Algesheimer *et al.* (2005) defined internet community identification as community members agreeing to the norms, traditions, rituals, and objectives of the community and their willingness to promote the internet community. Community identification referred to community members perceiving that they had the same attributes as other members did and they were part of the community (Algesheimer *et al.*, 2005). Hsu and Lin (2008) defined community identification as members feeling a sense of belonging to an internet community. The obstacle of departing one person's community was tougher for high community identification than low community identification because high community identification had a stronger sense of embedded self-notion to that

community than low community identification (Chang *et al.*, 2013). Tidwell (2005) indicated that when people strongly identified with a group, they increased their group contributions. Wasko and Faraj (2005) supported that when people identified with a group, they felt an obligation to help others because of their shared membership status. Identity level had a positive and significant effect on knowledge sharing behavior in the community (Chiu *et al.*, 2006). Tsou (2011) used community identification as the moderating variable to explore the influence of a person's intrinsic motivation on knowledge sharing intentions. Thus, this study used community identification as the moderating variable to examine the influence of knowledge sharing behavior on community participation, and proposed the following hypothesis:

H7. Community identification has a significant moderating effect on the positive influence of knowledge sharing behavior on community participation.

In brief, this study investigated the knowledge sharing behavior in online learning communities (Figure 1). First, this study used environmental dimension (i.e. anticipated reciprocal relationship, norm of reciprocity, and anticipated extrinsic rewards) and personal dimension (i.e. knowledge sharing self-efficacy) of social cognitive theory to explore their influences on behavioral dimension (i.e. knowledge sharing behavior and community participation). Second, this study adopted community identification as the moderating variable to explore whether the strength of community identification of the Yambol online test community members influence the effect of knowledge sharing behavior on community participation.

3. Methodology

3.1 Research design and data collection

This study focussed on knowledge sharing behavior pattern of the virtual learning community members. The Yambol online test community is an online learning community and members are from every region of Taiwan. Members of the Yambol online test community are mainly those young people ready for a job or rookies just entering in the job market. The Yambol online test community builds up professional knowledge database through lots of members collecting and sharing examination questions. The Yambol online test community provides all kinds of examination questions for the national test for government jobs, certification for a professional job, and teacher qualification assessments for elementary school or high school, and for individuals learning and performing on online tests. Yambol online test community has

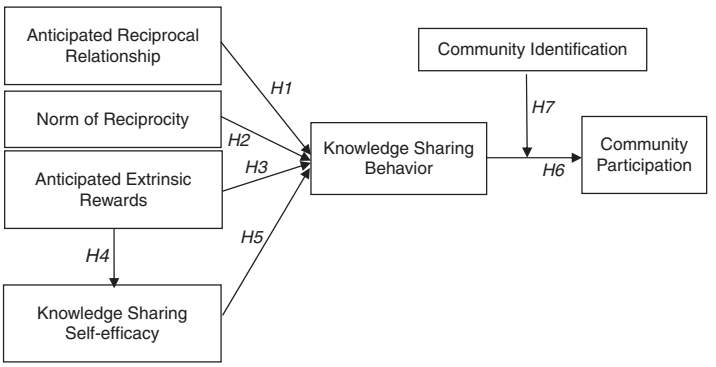

Figure 1.
Proposed model

provided about 400 test subjects and more than 37,000 original examination questions. There are up to ten million tests of examination questions using the original examination questions database. The Yambol membership is about 60,000 with 5.7 million people visiting Yambol online test community per month and the number of revisits reaching 95,000. The Yambol online test community is the most popular internet community platform in Taiwan. Therefore, the target of this research is Yambol online test community members (http://yamol.tw/main.php).

The population of this study was members who have experience in using the Yambol online test community for at least six months. This study conducted a formal survey via an online survey distribution platform called MySurvey (www.mysurvey.tw/index.htm) from October 10 to November 10, 2013. This study applied random sampling method to collect data. In order to increase the number of members to fill out the questionnaire, this study provided virtual currency of Yambol online test community for incentive payments. This study collected 534 samples with 394 valid samples yielding a response rate of 73.78 percent. This study adopted SPSS software, Excel, and AMOS software to conduct the demographics data analysis, exploratory factor analysis (EFA), reliability and validity, and structural equation modeling, respectively. The version of SPSS software, Excel and AMOS software for this study was 17.0, 2007, and 17.0, respectively.

The respondents of this study were across every region of Taiwan. Mainly, they were college students and young people just entering the job market. Members of the Yambol online test community hoped to improve their examination capabilities and obtained better jobs opportunities through online test learning, sharing, and exchange within the Yambol online test community. Most of the respondents were female (67.52 percent). The age of most of the participants was between 25 and 34 years old, which accounted for 55.47 percent of respondents, and the next most popular age was between 21 and 24 years old, which accounted for 30.66 percent. The largest proportion of education background was bachelor/associate degree, which accounted for 74.09 percent, followed by master degree and above which accounted for 18.37 percent. The largest proportion of the living area was the northern area (Taipei city, New Taipei city, Taoyuan city, Hsinchu city, Miaoli County, and Taichung city) which accounted for 42.09 percent, and this was followed by the southern area (Chiayi County, Tainan city, Kaohsiung city, Pingtung County) which accounted for 31.14 percent. There were 42.34 percent of members using the Yambol online test community five to ten times per week, followed by 33.82 percent of members using the Yambol online test community one to five times per week.

3.2 Measure

The measurement items of this study were from scales developed in previous research. The measurement items for norm of reciprocity, knowledge sharing self-efficacy and knowledge sharing behavior were seven-point Likert scales ranging from strongly disagree (1) to strongly agree (7). The measurement items for anticipated reciprocal relationship, anticipated extrinsic rewards, community participation and community identification were five-point Likert scales ranging from strongly disagree (1) to strongly agree (5). The scales for the anticipated reciprocal relationship with five items and anticipated extrinsic rewards with two items, both were from Bock *et al.* (2005). Kankanhalli *et al.* (2005) developed the scales of norm of reciprocity with four items and knowledge sharing self-efficacy with three items. Lin *et al.* (2009) developed three items for knowledge sharing behavior. Koh and Kim (2004) developed community

participation with six items. The scale of community identification has four items developed by Hsu and Lin (2008). Appendix showed the measurement items of these constructs.

3.3 Common method variance

This study extracted nine factors with EFA of Harman's factor test method for all the items. The first factor explained 43.63 percent of the variance (less than 50 percent). In addition, a confirmatory factor analysis (CFA) performed all 27 items in this study. The factor loadings were not significant for all 27 items. Besides, the model fit of the single-factor test was worse ($\chi^2 = 742.829$, df = 298, χ^2/df = 2.493, GFI = 0.858, AGFI = 0.820, NFI = 0.890, CFI = 0.930, IFI = 0.931, RMSR = 0.043 and RMSEA = 0.066) compared with the model fit of the proposed model ($\chi^2 = 507.746$, df = 222, χ^2/df = 2.287, GFI = 0.887, AGFI = 0.860, NFI = 0.910, CFI = 0.947, IFI = 0.947, RMSR = 0.040 and RMSEA = 0.061). The results indicated that common method variance was not a significant problem in this research.

4. Discussion, analysis and results

This research conducted two phases of analysis recommended by Anderson and Gerbing (1988). First, this study performed the measurement model with CFA to test reliabilities and validities of the research constructs. Then, this study conducted the structural model to validate the hypotheses of the research framework. In addition, this study used multi-group causal analysis to test the moderating effects of community identification.

4.1 Measurement model

Anderson and Gerbing (1988) suggested the criteria of convergent validity analysis. Gefen *et al.* (2000) recommended the model fit index to evaluate data. The measurement model showed adequate fit: $\chi^2 = 682.458$, df = 304, χ^2/df = 2.245, goodness-of-fit index (GFI) = 0.874, adjusted goodness-of-fit index (AGFI) = 0.843, nonnormed fit index (NFI) = 0.899, comparative fit index (CFI) = 0.941, incremental fit index (IFI) = 0.941, root mean square residual (RMSR) = 0.023 and root mean square error of approximation (RMSEA) = 0.060. Hu and Bentler (1999) suggested that the model would be acceptable if GFI and AGFI are larger than 0.8. Overall, the measurement model of this study was acceptable.

Table I showed the composite reliability (CR) and average variance extracted (AVE) based on the suggestion of Gaski and Nevin (1985). CR and AVE of each construct was greater than 0.7 and 0.5, respectively. Thus, convergent validity of each construct was acceptable. Discriminant validity exists when the square root of the average of variance extracted for each construct exceeds the correlation coefficient with other constructs (Fornell and Larcker, 1981). This study met the criteria for discriminant validity, indicating good discriminant validity. Table II showed all the correlation coefficients between constructs significant and the discriminate validity existed, suitable for subsequent analysis of structural model.

4.2 Structural model

The model fit for the structural model provided evidence of a good model fit: $\chi^2 = 507.746$, df = 222, χ^2/df = 2.287, GFI = 0.887, AGFI = 0.860, NFI = 0.910, CFI = 0.947, IFI = 0.947, RMSR = 0.040 and RMSEA = 0.061. Hu and Bentler (1999)

Scale/item	MLE Factor loading	MLE Measurement error	CR	AVE
ARR1	0.804***	0.353	0.932	0.732
ARR2	0.833***	0.306		
ARR3	0.876***	0.233		
ARR4	0.878***	0.229		
ARR5	0.885***	0.217		
NR1	0.720***	0.481	0.892	0.674
NR2	0.858***	0.264		
NR3	0.882***	0.221		
NR4	0.814***	0.337		
AER1	0.839***	0.295	0.855	0.747
AER2	0.888***	0.211		
KSSE1	0.787***	0.380	0.833	0.624
KSSE2	0.774***	0.401		
KSSE3	0.809***	0.346		
KSB1	0.792***	0.372	0.815	0.595
KSB2	0.780***	0.391		
KSB3	0.740***	0.452		
CP1	0.746***	0.443	0.907	0.619
CP2	0.810***	0.344		
CP3	0.797***	0.365		
CP4	0.789***	0.377		
CP5	0.803***	0.355		
CP6	0.772***	0.403		
CI1	0.814***	0.338	0.810	0.520
CI2	0.786***	0.383		
CI3	0.668***	0.554		
CI4	0.594***	0.647		

Notes: ARR, anticipated reciprocal relationship; NR, norm of reciprocity; AER, anticipated extrinsic rewards; KSSE, knowledge sharing self-efficacy; KSB, knowledge sharing behavior; CP, community participation; CI, community identification. $\chi^2 = 682.458$; degree of freedom = 304; $\chi^2/df = 2.245$; goodness-of-fit index (GFI) = 0.874; adjusted goodness-of-fit index (AGFI) = 0.843; nonnormed fit index (NFI) = 0.899; comparative fit index (CFI) = 0.941; incremental fit index (IFI) = 0.941; root mean square residual (RMSR) = 0.023; root mean square error of approximation (RMSEA) = 0.060. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

Table I.
Measurement constructs and factor analysis

Variable	Mean	SD	ARR	NR	AER	KSSE	KSB	CP	CI
ARR	4.055	0.602	0.855						
NR	6.286	0.589	0.422***	0.820					
AER	4.221	0.593	0.617***	0.361***	0.864				
KSSE	5.415	0.800	0.506***	0.384***	0.456***	0.789			
KSB	5.120	0.820	0.539***	0.393***	0.521***	0.646***	0.771		
CP	3.845	0.591	0.627***	0.434***	0.509***	0.539***	0.662***	0.787	
CI	4.264	0.507	0.772***	0.521***	0.539***	0.433***	0.461***	0.574***	0.721

Notes: ARR, anticipated reciprocal relationship; NR, norm of reciprocity; AER, anticipated extrinsic rewards; KSSE, knowledge sharing self-efficacy; KSB, knowledge sharing behavior; CP, community participation; CI, community identification. Diagonal elements are the square root of the average variance extracted of each construct; Pearson correlations is shown below the diagonal. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

Table II.
Correlation matrix

suggested that GFI and AGFI should be larger than 0.8. Overall, the structural model showed adequate fit (Baumgartner and Homburg, 1996).

The hypotheses results showed that anticipated reciprocal relationship had a significant and positive effect on knowledge sharing behavior ($\gamma_{21} = 0.249$, $p < 0.001$). The results indicated that members of the Yambol online test community were willing to share knowledge if they maintained good anticipated reciprocal relationship between other members. The result of this study was consistent with the results of past research (Bock *et al.*, 2005; Hendriks, 1999; Huang *et al.*, 2008; Tohidinia and Mosakhani, 2010). The results implied that members of the Yambol online test community increased knowledge sharing behavior when they had anticipated reciprocal relationship between other members. Norm of reciprocity had a significant and positive effect on knowledge sharing behavior ($\gamma_{22} = 0.101$, $p < 0.05$). Members of the Yambol online test community felt that they should help others after gaining knowledge. The results of this study were consistent with previous research investigations (Chen and Hung, 2010; Chiu *et al.*, 2006; Wasko and Faraj, 2000); norm of reciprocity helped to increase knowledge sharing behavior. Anticipated extrinsic rewards had a significant and positive effect on knowledge sharing behavior ($\gamma_{23} = 0.169$, $p < 0.05$). This implied that anticipated extrinsic rewards drove members of the Yambol online test community willing to offer and share knowledge when the rewards reached members' anticipation because of knowledge sharing behavior. The result of this study was consistent with previous research (Bock *et al.*, 2005; Kankanhalli *et al.*, 2005; Vroom, 1964). Anticipated extrinsic rewards had a significant and positive effect on knowledge sharing self-efficacy ($\gamma_{13} = 0.589$, $p < 0.001$). Therefore, it indicated that members of the Yambol online test community improved knowledge sharing self-efficacy if they anticipated extrinsic rewards, same as previous studies indicated that award and appreciation positively affected confidence, then affecting knowledge sharing behavior (Vealey, 1988). Knowledge sharing self-efficacy had a significant and positive effect on knowledge sharing behavior ($\beta_{21} = 0.525$, $p < 0.001$). Members of the Yambol online test community had knowledge sharing behavior when they felt more confident on knowledge sharing self-efficacy. The result of this study was consistent with previous research (Hsu *et al.*, 2007; Kankanhalli *et al.*, 2005; Ye *et al.*, 2006). Member of the Yambol online test community shared his knowledge when he perceived that he had capability and knowledge to provide others. This indicates that members of the Yambol online test community had more knowledge sharing behavior when they had higher knowledge sharing self-efficacy. Knowledge sharing behavior had a significant and positive effect on community participation ($\beta_{32} = 0.809$, $p < 0.001$). The results supported all hypotheses as shown in Figure 2 and Table III. This implied that there would be more community participation when there was more knowledge sharing behavior of members of the Yambol online test community. This study supported previous research that knowledge sharing behavior had a significant and positive effect on community participation in the virtual community (Koh and Kim, 2004). Therefore, knowledge sharing behavior enhanced community participation.

Table IV presented the direct and indirect effects of the community participation analysis. The total effect rankings' on the community participation are described below: knowledge sharing behavior is the highest, followed by knowledge sharing self-efficacy, anticipated extrinsic rewards, anticipated reciprocal relationship, norm of reciprocity, respectively. However, anticipated extrinsic rewards had the highest effect on the community participation for the exogenous constructs, followed by anticipated reciprocal relationship and norm of reciprocity, respectively.

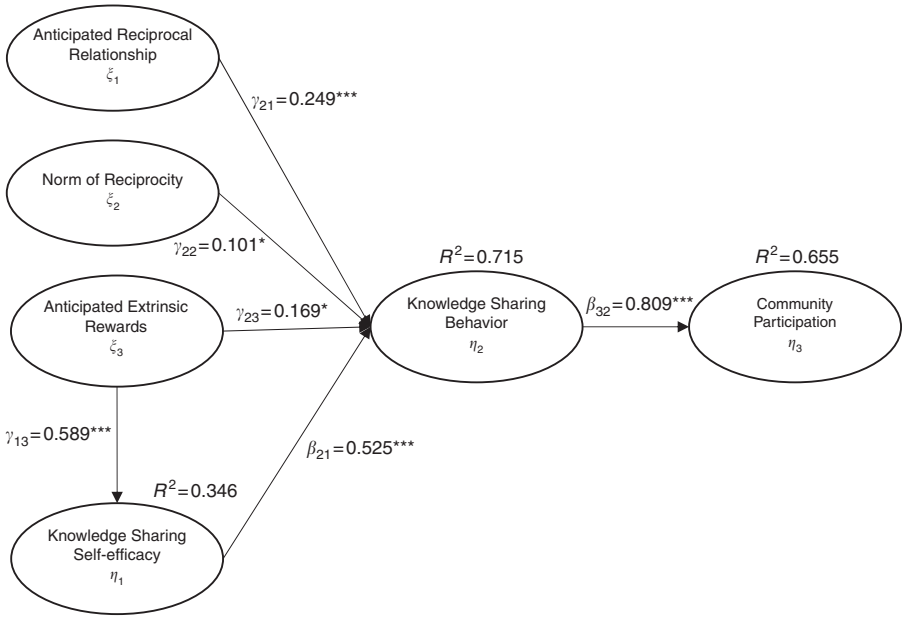

Figure 2.
The research model

Notes: $^{*}p<0.05$; $^{**}p<0.01$; $^{***}p<0.001$

Path				Path coefficient	Hypotheses	Test results
γ_{21}	Anticipated reciprocal relationship	→	Knowledge sharing behavior	0.249***	*H1*	Supported
γ_{22}	Norm of reciprocity	→	Knowledge sharing behavior	0.101*	*H2*	Supported
γ_{23}	Anticipated extrinsic rewards	→	Knowledge sharing behavior	0.169*	*H3*	Supported
γ_{13}	Anticipated extrinsic rewards	→	Knowledge sharing self-efficacy	0.589***	*H4*	Supported
β_{21}	Knowledge sharing self-efficacy	→	Knowledge sharing behavior	0.525***	*H5*	Supported
β_{32}	Knowledge sharing behavior	→	Community participation	0.809***	*H6*	Supported

Notes: Knowledge sharing self-efficacy→$R^2=0.346$; knowledge sharing behavior→$R^2=0.715$; community participation→$R^2=0.655$. Fit index: $\chi^2=507.746$; degree of freedom = 222; $\chi^2/df=2.287$; goodness-of-fit index (GFI) = 0.887; adjusted goodness-of-fit index (AGFI) = 0.860; nonnormed fit index (NFI) = 0.910; comparative fit index (CFI) = 0.947; incremental fit index (IFI) = 0.947; root mean square residual (RMSR) = 0.040; root mean square error of approximation (RMSEA) = 0.061. $^{*}p<0.05$; $^{**}p<0.01$; $^{***}p<0.001$

Table III.
Results of proposed model

4.3 Tests of mediation effects of knowledge sharing self-efficacy

This study further explored the mediating effects of knowledge sharing self-efficacy between anticipated extrinsic rewards and knowledge sharing behavior by using the Sobel test, bootstrapping mediation analysis, and regression analysis.

Test results in Tables V and VI showed that the statistics of Sobel tests were significant (greater than 1.96) (Sobel, 1982) and the 95 percent confidence intervals of 2,000 simulations of bootstrapping did not contain 0, indicated that knowledge sharing self-efficacy was the mediator between anticipated extrinsic rewards and knowledge sharing behavior (Mooney and Duval, 1993).

Furthermore, the regression analysis of Table VII showed that the knowledge sharing self-efficacy partially mediated anticipated extrinsic rewards and knowledge sharing behavior (Baron and Kenny, 1986). This implied that people would increase knowledge sharing behavior more when they expected high anticipated extrinsic rewards in the community (Bock *et al.*, 2005; Kankanhalli *et al.*, 2005; Vroom, 1964). People could provide (Hsu *et al.*, 2007) and share knowledge to other members in the community when they had sufficient abilities to contribute knowledge (Kankanhalli *et al.*, 2005). Meanwhile, a person's knowledge sharing self-efficacy was significant and positive effect on knowledge sharing behavior (Hsu *et al.*, 2007; Ye *et al.*, 2006). However, the effect of anticipated extrinsic rewards on knowledge sharing behavior would be reduced a little bit when knowledge sharing self-efficacy occurred simultaneously. Therefore, this study validated that knowledge sharing self-efficacy was the partial mediator between anticipated extrinsic rewards and knowledge sharing behavior.

Table IV. Direct effect and indirect effect on community participation

Constructs	Direct effect	Indirect effect	Total effect	Total effect ranking	Exogenous variables ranking
Exogenous constructs					
Anticipated reciprocal relationship	–	0.201	0.201	4	2
Norm of reciprocity	–	0.082	0.082	5	3
Anticipated extrinsic rewards	–	0.387	0.387	3	1
Knowledge sharing self-efficacy	–	0.425	0.425	2	
Knowledge sharing behavior	0.809	–	0.809	1	

Table V. Sobel test and bootstrapping of mediation analyses for knowledge sharing self-efficacy

IV	M	DV	IV→DV *c*	IV→M *a*	IV+M→DV *c'*	*b*	Sobel test
AER	KSSE	KSB	0.720	0.615	0.395	0.529	6.994***
SE			0.064	0.065	0.061	0.045	

Notes: AER, anticipated extrinsic rewards; KSSE, knowledge sharing self-efficacy; KSB, knowledge sharing behavior; SE, Standard Error. ***$p < 0.001$

Table VI. Bootstrapping of mediation analyses for knowledge sharing self-efficacy

			Bootstrapping 95% confidence interval			
			Percentile method		Bias-corrected	
IV	M	DV	Lower	Upper	Lower	Upper
AER	KSSE	KSB	0.238	0.424	0.236	0.422

Notes: AER, anticipated extrinsic rewards; KSSE, knowledge sharing self-efficacy; KSB, knowledge sharing behavior

4.4 Moderating effects of community identification

This research used multi-group causal analysis to test the moderating effect of the community identification. The result of groups χ^2 values ($\Delta\chi 2$) was 21.255 ($p < 0.001$), showing a significant difference between high community identification and low community identification. The coefficients of the effect of knowledge sharing behavior on community participation was 0.740 ($p < 0.001$) and 0.710 ($p < 0.001$) for high community identification and low community identification, respectively. This implied that knowledge sharing behavior would enhance the positive effect on community participation for high community identification group. Thus, community identification had a significant moderation between knowledge sharing behavior and community participation. This study supported *H7*. The results indicated that the effect of knowledge sharing behavior on community participation with high community identification was greater than low community identification in the Yambol online test community. The results, similar to previous studies, indicated that personal community identification had a significant influence on community participation and community identification had a significant and positive effect on knowledge sharing behavior (Bergami and Bagozzi, 2000; Chiu *et al.*, 2006) (Table VIII).

Figure 2 indicated the variance explained (R^2) of endogenous variables of this study. The variance explained knowledge sharing self-efficacy, knowledge sharing behavior, and community participation was 34.60, 71.50, and 65.50 percent, respectively. The variance explained why knowledge sharing behavior was high in this study. It indicated that anticipated reciprocal relationship, norm of reciprocity, anticipated

Table VII.
Regression analysis of mediation analyses for knowledge sharing self-efficacy

M	Model	DV	IV	β	t	p
Knowledge sharing self-efficacy	1	Knowledge sharing behavior	Anticipated extrinsic rewards	0.720	11.259	0.000
	2	Knowledge sharing self-efficacy	Anticipated extrinsic rewards	0.615	9.455	0.000
	3	Knowledge sharing behavior	Anticipated extrinsic rewards	0.395	6.508	0.000
			Knowledge sharing self-efficacy	0.529	11.766	0.000

Notes: M, mediator; DV, dependent variable; IV, independent variable

Table VIII.
Moderating effects of community identification

	Model fit index			
	Limited model	Unlimited model	$\Delta\chi^2$	p-value
χ^2(df)	132.453 (60)	111.198 (52)	21.255	0.000
GFI	0.922	0.933		
AGFI	0.883	0.885		
RMSEA	0.060	0.058		

	Community identification (CI)	
	High	Low
H6: knowledge sharing behavior→community participation	0.740***	0.710***

Notes: *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

extrinsic rewards, and knowledge sharing self-efficacy could fully explain the variance of knowledge sharing behavior. Moreover, the variance explained community participation was high too; showed that knowledge sharing behavior also fully explained the variance of community participation.

5. Conclusion and implication

5.1 Conclusion

This study found that the model fits for the measurement model and structural model were adequate. This research validated the theoretical model for the members of the Yambol online test community and the results supported all hypotheses. This study found that there was a direct effect on knowledge sharing behavior factors including the environmental dimension (i.e. anticipated reciprocity relationship, norm of reciprocity, and anticipated extrinsic rewards) and personal dimension (i.e. knowledge sharing self-efficacy). Anticipated extrinsic rewards not only had a direct significant and positive effect on knowledge sharing behavior but also affected knowledge sharing behavior through knowledge sharing self-efficacy. The personal dimension (knowledge sharing self-efficacy) was the most influential variable on the effect of knowledge sharing behavior, followed by anticipated reciprocity relationship of the environmental dimension. Knowledge sharing self-efficacy had partial mediation effect between anticipated extrinsic rewards and knowledge sharing behavior. This study further investigated the effect of knowledge sharing behavior on community participation. The result showed that knowledge sharing behavior had a significant and positive effect on community participation.

For moderator effect, this study used community identification as the moderator of knowledge sharing behavior and community participation and divided community identification into high community identification and low community identification. The results showed that both high and low community identification had significant and positive effects of knowledge sharing behavior on community participation. The high community identification had greater effect of knowledge sharing behavior on community participation than the low community identification. This meant that high community identification of members of the Yambol online test community had stronger influence of knowledge sharing behavior on community participation than the low community identification.

5.2 Academic implication

Most previous studies viewed knowledge sharing from the perspectives of enterprise, organization, or the internet community but rarely from the perspective of professional online learning community. This study focussed on professional online learning communities as the research subject from the perspective of social cognitive theory proposed by Bandura (1986). In this model, the environmental dimension contained anticipated reciprocity relationship, norm of reciprocity, and anticipated extrinsic rewards. The personal dimension comprised knowledge sharing self-efficacy, and the behavioral dimension consisted of knowledge sharing behavior and community participation. This study used the proposed model to understand how environmental and personal dimension affected knowledge sharing behavior and community participation. This study used community identification as the moderating variable to understand whether community identification had a moderating effect on the influence of knowledge sharing behavior on community participation.

In environmental dimension research, previous studies have used anticipated reciprocity relationship or norm of reciprocity as research aspects for examining reciprocity. However, no other study has evaluated both anticipated reciprocal relationship and norm of reciprocity concurrently. This study maintained that anticipated reciprocity relationship primarily involved emotional support between people and classified anticipated reciprocity relationship into emotional category. Norm of reciprocity primarily involved the reciprocity regulation. This study classified norm of reciprocity into rational category. This research used this categorization to understand the influence of emotional and rational reciprocity on knowledge sharing behavior. The significant influence of anticipated reciprocity relationship on knowledge sharing behavior was higher than the norm of reciprocity on knowledge sharing behavior. This indicated that members of the Yambol online test community focussed more on emotional reciprocity than rational reciprocity.

Anticipated extrinsic rewards had a significant and positive effect on knowledge sharing behavior in this research, which supported the result of Kankanhalli *et al.* (2005). Regarding personal dimension, knowledge sharing self-efficacy significantly and positively affected knowledge sharing behavior, which supported the results of previous studies (Hsu *et al.*, 2007; Kankanhalli *et al.*, 2005; Tohidinia and Mosakhani, 2010; Ye *et al.*, 2006; Zhang and Ng, 2012). In addition, this study found that anticipated extrinsic rewards affected knowledge sharing behavior through knowledge sharing self-efficacy. Thus, knowledge sharing self-efficacy was the mediator between anticipated extrinsic rewards and knowledge sharing behavior. Therefore, knowledge sharing self-efficacy was a vital variable in the personal dimension that affected knowledge sharing behavior in the Yambol online test community.

The behavioral dimension included knowledge sharing behavior and community participation. The results showed that the highest effect on community participation was knowledge sharing behavior, followed by knowledge sharing self-efficacy, anticipated extrinsic rewards, anticipated reciprocity relationship, and norm of reciprocity, respectively. Community identification was the moderator of the effect of knowledge sharing behavior on community participation.

5.3 Practical implication

Managers of the Yambol online test community can enhance the reciprocity relationship between members in the emotional level and use the appropriate norm of reciprocity to strengthen the trust and enhance the knowledge sharing behavior of members in the rational level. Members of the Yambol online test community cannot only discuss a message through Facebook and share knowledge through the work zone but also can cheer each other up and establish a cheer up system. Yambol online test community provides the apprentice with five Y coins as long as the members consider an individual as an apprentice and that the master cheers the apprentice up. It strengthens the relationship between members of the Yambol online test community and the sense of trust among members.

The design of the reward system of the Yambol online test community should encourage by surrounding the related behavior of knowledge sharing and focus on enhancing the knowledge sharing self-confidence of members. It will make members share knowledge more effectively, and this will even more effectively enhance community participation and thus attract more like-minded members of the community to make the Yambol online test community more robust. In the Yambol online test community, there is a variety of self-test modes to choose and hold contests of the champion of 100 people in irregular time. Therefore, those members can enhance

strength and confidence through constant practice. Members can offer feedback and discuss the answers of questions through Facebook messaging.

The Yambol online test community should increase members' community identification. Besides the virtual interaction between members through community platform, the Yambol online test community can hold real community activities, such as community members' meeting, which helps members, get to know each other, to facilitate the interaction in the community, and increase community identification. The Yambol online test community even can make some souvenirs with online quiz identification of the Yambol online test community to members, thus increasing community identification.

Yambol online test community gathers people knowledge to build up a huge database of examination questions. Learners can perform online learning and testing and even obtain required assistance anytime and anywhere by only paying a small amount of money or having the service free of charge. Any organization and institution interested in developing knowledge sharing and online learning should adopt the results of this study. It can improve knowledge sharing behavior between community members. Meanwhile, it can enhance community participation of members through community identification in order to heritage the knowledge of organization and institution through knowledge sharing to create synergy effects and build up the organization culture of willing to share knowledge between members.

5.4 Limitations and directions

First, this study was a cross-sectional study. Future research studies could employ a longitudinal study to conduct long-term observations of knowledge sharing behavioral changes among members of professional online learning community. In addition to facilitating the understanding of causal relationships in the structural model, longitudinal study is an effective evaluation tool for conducting subsequent analysis and verification research. Second, this study recommends that future researchers increase the numbers of distribution nodes of the internet survey and provide incentives that are attractive to respondents to obtain large samples. This can involve additional knowledge sharing factors of the internet community members and explore members from differing internet communities. In addition, these studies can determine whether this model will provide the same results. This study used internet survey to collect data. However, members of the Yambol online test community are all users of the internet: therefore, the delivery of the internet survey is still limited and restricted by distributed nodes/platform and time, not being able to comprehensively reach the various levels of community members. Therefore, it may produce measurement bias. The target of this research is the members of the Yambol online test community (http://yamol.tw/main.php). We did not collect data from other online test communities in this study. The inherent limitation of this approach is that this study cannot make the same conclusions for other online test communities. Finally, this study applied social cognitive theory as a basis to explore the factors of knowledge sharing behavioral for members of the Yambol online test community. Although social cognitive theory has been widely applied to explore numerous categories of various behavioral theories, using a single theory to interpret human behavioral factors could bias the results because behavioral factors are complex. Thus, this study recommends that future researchers apply a broad range of behavioral theory or combination of research constructs to explore comprehensive factors of knowledge sharing behavior.

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Appendix. Scale items

Anticipated reciprocal relationship (Bock et al., 2005)

ARR1. My knowledge sharing would strengthen the ties between existing members in the Yambol online test community and myself.

ARR2. My knowledge sharing would get me well-acquainted with new members in the Yambol online test community.

ARR3. My knowledge sharing would expand the scope of my association with other members in the Yambol online test community in future.

ARR4. My knowledge sharing would draw smooth cooperation from outstanding members in the Yambol online test community in the future.

ARR5. My knowledge sharing would create strong relationships with members who have common in the Yambol online test community.

Norm of reciprocity (Kankanhalli et al., 2005)

NR1. When I share my knowledge through the Yambol online test community, I believe that I will get an answer for giving an answer.

NR2. When I share my knowledge through the Yambol online test community, I expect somebody to respond when I am in need.

NR3. When I contribute knowledge to the Yambol online test community, I expect to get back knowledge when I need it.

NR4. When I share my knowledge through the Yambol online test community, I believe that my queries for knowledge will be answered in future.

Anticipated Extrinsic Reward (Bock et al., 2005)

AER1. I will receive money reward in return for my knowledge sharing in the Yambol online test community.

AER2. I will receive additional points for promotion in return for my knowledge sharing in the Yambol online test community.

Knowledge sharing self-efficacy (Kankanhalli et al., 2005)

KSSE1. I have confidence in my ability to provide knowledge that other members in the Yambol online test community consider valuable.

KSSE2. I have the expertise, experiences, and insights needed to provide knowledge that is valuable for other members in the Yambol online test community.

KSSE3. I have confidence in responding or adding comments to messages or articles posted by other members in the Yambol online test community.

Knowledge sharing behavior (Lin et al., 2009)

KSB1. I frequently participate in knowledge sharing activities and share my knowledge with others in the Yambol online test community.

KSB2. I usually spend a lot of time conducting knowledge sharing activities in the Yambol online test community.

KSB3. When discussing a complicated issue in the Yambol online test community, I am usually involved in the subsequent interactions.

Community participation (Koh and Kim, 2004)

CP1. I take an active part in the Yambol online test community.

CP2. I do my best to stimulate in the Yambol online test community.

CP3. I often provide useful information/contents for the members of Yambol online test community.

CP4. I eagerly reply to postings by the help-seeker of the Yambol online test community.

CP5. I take care about the members of Yambol online test community.

CP6. I often help the members of Yambol online test community who seek support from other members.

Community identification (Hsu and Lin, 2008)
CI1. Participating in Yambol online test community would enhance my chance to meet members who have common interests.
CI2. Members on Yambol online test community keep close ties with each other, which is a communication channel to share social lives and information.
CI3. Members in my Yambol online test community have a strong feeling of "one group".
CI4. I am so proud of being a member of Yambol online test community.

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