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Investigating the Knowledge-Sharing Behavior ina Professional Virtual Community

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INVESTIGATING THE KNOWLEDGE-SHARING BEHAVIOR IN A PROFESSIONAL VIRTUAL COMMUNITY

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ABSTRACT

This research aims at investigating the knowledge sharing-behaviors in a teachers' professional virtual community. Logs data in the entire community and in special interest groups (SIGs) were analyzed. Some typical behaviors were identified by the clustering analysis in this study. The largest group of member belongs to inactive users. They rarely log in the system, are passive in uploading or downloading teaching materials, and almost never post or reply messages. Another group is active in receiving knowledge while reluctant to give knowledge or to respond. The third group frequently login the system, is the most active in sharing knowledge, and actively searching knowledge. However, the third group contains only a small number of members. Furthermore, fifty-five members of the knowledge-sharing group were interviewed using focus group technique to find out qualitative information as to why they are willing to share information and what are their concerns in sharing information.

The results indicated that knowledge sharing is not a common behavior in professional virtual community, and knowledge-sharing culture is difficult to promote even in non-competitive professional communities. Secondly, knowledge cannot flow easily throughout the community even when certain knowledge flow promoting mechanism is provided. Thirdly, professional autonomy may hinder the frequency of interactions with others in professional virtual community. Fourthly, attitudes regarding information ownership are important factors in knowledge sharing of a professional virtual community. Finally, teaching and IT usage experiences are not major factors affecting knowledge-sharing behavior in professional virtual communities.

1. INTRODUCTION

In Taiwan, an educational reform has moved toward nine-year joined curricula plan which integrates teaching scope and essential abilities for students from primary to junior-high education. Within this movement, teachers in primary and junior-high schools are expected to autonomously design courses, flexibly administrate classes and multi-dimensionally evaluate students' learning effectiveness. Since schools have faced the challenges in curriculum and teaching method change, it is an excellent timing for teachers from different schools to exchange experiences and share ideas in strengthening professional abilities, and in turn, to innovate new practices for improving efficacy.

A teachers' professional community website, called SCTNet (Smart Creative Teachers Network, http://sctnet.edu.tw), was established in March, 2000 in providing a cyber opportunity for teachers in compulsory education. With About fifteen thousands

members in July, 2001, SCTNet has grown to be a nonprofit virtual community as intended. On the SCTNet, teachers can share their professional works such as course plans, research results, and teaching resources with members and receive comments in turn. Authors keep the copyright while uploading professional works to the website, and members can freely download. Teachers can also dialogue in specific subject areas on discussion boards, and teachers with similar interests can create special interest groups (SIG) to collaborate their professional works.

While we are moving toward the knowledge economy era, some contemporary school reform efforts suggested a shift from the predominant view of schools as bureaucratic organizations to that of schools as communities [31]. The sense of community, extending from teachers within a school to those across schools, stimulates the formation of teachers' professional community. By virtue of information technology (IT), teachers in different schools across different geographical regions can communicate and collaborate through Internet. A virtual community embedded with professional community characteristics can be built by utilizing IT in the knowledge economy era to shape the new paradigm of professional practice. Vishik and Whinston [36] conclude that "virtual communities" are important in ameliorating the efficiency of the distribution of the electronic information and quality of informational goods.

With all the positive viewpoints and expectations on virtual community, we investigated how members of virtual community behave in terms of taking and giving knowledge. We also like to find out the patterns of knowledge-sharing behavior. SCTNet log data of 15,541 members was analyzed through clustering analysis. Focus group technique was also adopted to collect qualitative data.

2. LITERATURE REVIEW

The following subsections introduce literatures related to teacher's professional community, virtual community, and knowledge sharing.

2.1 Teachers' Professional Community

Professional communities are different from general communities. The members of the former generally have shared norms and values, and they carry out critical reflection and continue the professional dialogues with one another [31][38]. The sense of community, extending from teachers within a school to those across schools, stimulates the formation of teachers' professional communities, and the trend of teachers' professional development is towards forming community of learning in place of past isolation of learning. Thus, some kinds of teachers' professional communities appear, such as "educative community" [4], and so on. No matter what the communities are called, the characteristics distinctive of and critical to teachers' professional community, according to Louis, Marks, and Kruse [21], are (1) shared norms and values, (2) focus on student learning, (3) reflective dialogue, (4) deprivatization of practice, and (5) collaboration.

Scribner, et al. [31] suggested four organizational factors influencing the establishment of professional community: principal leadership, organizational history, organizational priorities, and organization of teacher work. They also indicated that double-loop learning is invaluable to sustain the professional community and "professional learning community" is the desired outcome.

2.2 Virtual Community

Several cyber-communities, or called cyber communities,

electronic communities (e-communities), are rapidly evolving on the Internet. Scientists have used the Internet to share data, collaborate on research, and exchange messages for a long time. In essence, scientists formed interactive research communities that existed not on a physical campus but on the Internet [2]. According to Chang, et al. [5], e-communities can be defined as "social aggregations of a critical mass of people on the Internet who engage in public discussions, interactions in chat rooms, and information exchanges with sufficient human feeling on matters of common interest to form webs of personal relationships." Hagel III and Armstrong [11] take a business perspective and cast virtual communities as "virtual enterprises". Schubert [29] indicates that, "virtual communities describe the union between individuals or organizations who share common values and interests using electronic media to communicate within a shared semantic space on a regular basis. Their communication is thus independent from restrictions of time and place."

Although the virtual community has a great contribution to collecting information and resources, its value in existence is not associated with the collecting work per se. It is really worthy that the virtual community aggregates people and provides like-minded people with an interactive environment where they create mutual trust and understanding climate. Depending on meeting the types of consumer needs, there are four types of virtual communities including interest, transaction, fantasy, and relationship [2].

2.3 Knowledge Sharing

In an attempt to answer why sharing knowledge, Tiwana and Bush [34] employ the Social Exchange Theory [20] to address:

(1) Anticipated reciprocity: expectation that he will receive actionable information and useful information in return. Actionable information has also been appropriately defined as knowledge [8]. The anticipation of future collaboration is also identified as a factor to developing trust between members [15][16].

(2) Reputation and influence within a community: Rheingold [27] suggests that the effect of one's contributions based upon his reputation within the community can also influence, both positively and negatively, his or her willingness to share relevant knowledge with other members of the community. There are some factors, which may increase a contributor's reputation: high quality information, impressive technical details in one's answers, willingness to help others, and elegant writing.

(3) Perception of efficacy: members are more likely to exert greater effort if one or more of the following three conditions apply: (a) their contributions are identified as being important (b) contributions are personally relevant (c) members perceive a clear relationship between contribution and outcome [32]. This perception of efficacy is defined as a community member's belief that his regular, quality contributions have an impact on his community as a whole, and such contributions add to the contributor's reputation.

Scott and Walker [30] and Tampoe [35] employ the Maslow's [22] Needs Hierarchy Theory to tackle the problem. According to the theory, needs hierarchy can be ranked as basic, safety, belongingness, esteem, and self-actualization. They argued that motivation to share comes from Maslow's three highest hierarchical levels. Knowledge workers do not share knowledge because of money or to improve their relations with their co-workers. Instead, their motivation comes from their desire for self-actualization. Hendriks [12] employed the Herzberg's [13] Two Factor Theory to explain the knowledge-sharing motivation. Hygiene

factors are factors do not motivate behavior when they are present, but they will lead to a decreased motivation when absent. Alternatively, motivators will result in an increased motivation when present, such as challenge of work, or sense of achievement. When looking for reasons why people want to share knowledge, one almost automatically turn to lists of motivators rather hygiene factors.

As for factors affecting knowledge sharing, Jarvenpaa and Staples [17][18] identified perceptions of information culture, attitudes regarding information ownership, propensity to share, task interdependence, computer comfort, and perceived characteristics of computer-based information are determinants. Consistent with Constant et al.'s [7] earlier findings, views of information ownership and propensity to share were significantly related to knowledge-sharing behavior on electronic media. They concluded that when knowledge is perceived to be "owned" by the individual, people are more likely to exchange their knowledge for "intangible" returns, such as reputation and self-esteem. Another perspective views knowledge as a public good that is socially generated, maintained, and exchanged within emergent communities of practice [3]. Knowledge is an intangible resource that is treated as a public good and can be shared and spread throughout the community without losing its value, nor being consumed in the process of transfer. In such case, people share knowledge beyond the maximization of self-interest and personal gain, and are motivated by moral obligation [37].

3. RESEARCH METHODOLOGY

On the SCTNet, members with a similar interest can create a SIG to collaborate according to their objectives. The demographic data of members and their various activities in SCTNet are collected for further analysis. Seven and eight variables were extracted from general members and SIGs, respectively. These activity logs are transformed into the variables including frequency of logins, frequency of teaching materials uploaded, frequency of teaching materials downloaded, frequency of teaching materials evaluated, frequency of articles posted on bulletin, frequency of article replied on bulletin, and frequency of message posted on message board. The following activities in SIGs are also tracked: frequencies of teaching materials uploaded in SIGs, frequencies of teaching materials downloaded in SIGs, frequencies of relative sites recommended in SIGs, frequencies of articles posted on bulletin in SIGs, frequencies of article replied on bulletin in SIGs, frequencies of message posted on message board in SIGs, frequencies of message replied on message board in SIGs, frequencies of message mailed in SIGs.

After that the clustering technique was employed to identify knowledge-sharing behaviors. The clustering process is elaborated as follow. First, since variables that are multi-collinear are implicitly weighted more heavily, we have to examine whether the data exhibit violation of the assumption of cluster analysis. The tolerance values are greater than 0.1 and VIF values are less than 10 lend us the credential to conclude that there is no collinearity between the variables. Second, two-stage clustering technique [25] was then applied. Hierarchical cluster procedure based on Ward's method is first applied to compute the squared Euclidean distance. Subsequently, the candidate numbers of clusters and their corresponding centroid are obtained and serve as the input of nonhierarchical clustering. The K-means algorithm is selected to perform the clustering task with calibrated seed points. If the result fails to pass the examination and validation phrases, it is dropped and another run with different setting is thereby proceeded. To profile the clusters with non-metric variables, cross-tabulation

analysis are employed to investigate characteristics of these clusters. All the data are analyzed using SPSS.

Finally, to gain insights into the contextual settings and attitudes towards knowledge sharing of members, two focus groups with 55 members were interviewed. There were 37 female and 18 male among them, with similar composition of total members on SCTNet. Also, two of them have a master degree, the others have a bachelor degree. Their experiences of using SCTNet and personal viewpoints toward knowledge-sharing were asked as well. A questionnaire was also employed to collect personal information, such as the school name, specialties, seniority, IT capability, habit of using IT, and contextual data regarding individual, organization, and environment. The details of data collected are listed in the Appendix.

4. RESEARCH RESULTS

This section discusses the behaviors of regular members and SIG members, separately. Finally, the behaviors of the teachers involved in both settings are also scrutinized.

4.1 Behaviors of Regular Members

Up to July, 2001, there are 15,541 members registered on the SCTNet and the distributions of gender and education are depicted in Table 1(a). Most of the teachers are female with Bachelor's degree.

Seven variables were considered for the clustering analysis. These variables can be grouped into four types of activities, namely, attending, discussion, message posting, and teaching-resources sharing. The definition of each variable is described below. Variables are measured on the basis of one member once he or she joined the community.

Attending

LOGIN- Number of logins.

Discussion

DBPOST- Number of posts on the discussion board.

DBREPLY- Number of reply to discussion posts.

Message

MBPOST- Number of messages on the message board.

Document Sharing

UPLOAD- Number of teaching-resources uploaded to SCTNet.

DOWNLOAD- Number of teaching-resources downloaded from SCTNet.

EVALUATE- Number of comments on teaching resources.

Table 1(b) summarizes the behaviors defined by these four category of variables. Their comparisons between clusters are graphically represented in Figure 1. We can find that download teaching-resources is the most frequent behavior and post on the discussion board is the least frequent. The behavior of knowledge giving such as post on discussion or message board, upload files, comment, and reply on discussion board is significantly less than the behavior of knowledge taking such as login and download files. Members were grouped into four clusters. Each cluster is described as following:

Cluster 1

There are 257 members in cluster 1. As shown in Table 1(b), they like to download teaching-resources but never post any message on the discussion board. They are inactive in all activities except for downloading teaching-resources.

Cluster 2

There are 11 members in cluster 2. They login the system very often and download teaching-resources, but never post on the discussion board or message board and never give any comment. They are very negative

to upload file and reply on discussion board. This cluster

Table 1. Demographic & Log Data of Regular Members

Gender

	Frequency	Percent
Female	10434	67.1%
Male	4886	31.4%
Null	221	1.4%

Education

	Frequency	Percent
Bachelor	13309	85.6%
Master	1773	11.4%
High school	375	2.4%
Null	84	0.5%

(a) Demographic Data

Cluster Number	Members	LOGIN	MBPOST	UPLOAD	DOWNLOAD	EVALUATION	DBPOST	DBREPLY
Cluster 1	257	35.6070	0.0117	0.6226	258.0389	0.2996	0.0000	0.2140
Cluster 2	11	87.7273	0.0000	0.4545	882.5455	0.0000	0.0000	0.0909
Cluster 3	15253	3.0629	0.0153	0.1200	8.3334	0.0208	0.0023	0.0270
Cluster 4	20	20.0500	18.0500	9.8500	65.8500	11.0500	1.2500	22.5000
Average	15541	4.0690	0.0384	0.1410	13.1555	0.0396	0.0039	0.0591

(b) Cluster Information

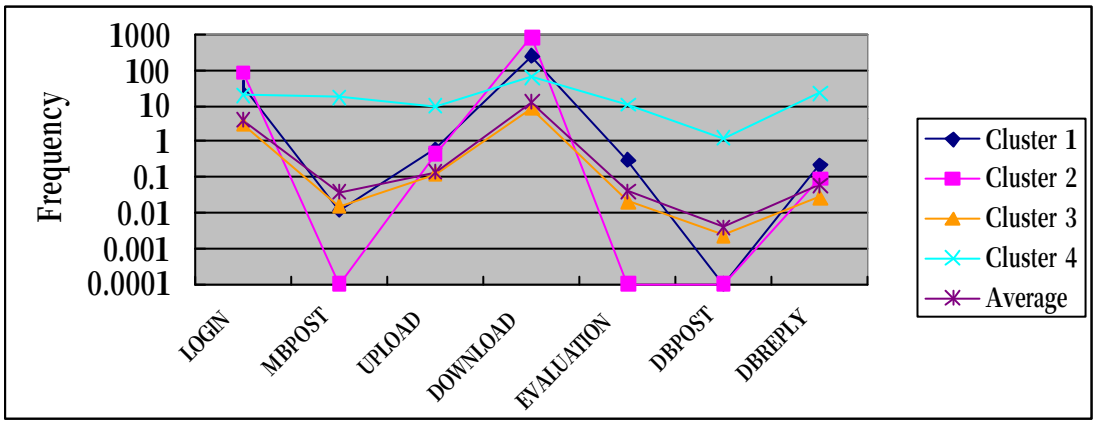

Figure 1. Graphical Comparisons Between Clusters of Regular Members

is similar to cluster 1 except that login and download frequencies are significantly higher.

Cluster 3

Most of the members belong to cluster 3 and they are passive to share knowledge, neither providing nor receiving. The number of logins is significantly lower than that of clusters 1 and 2. They represent inactive or unskilled users.

Cluster 4

Twenty members in cluster 4 are the most active in sharing knowledge. They are delighted to both giving and taking knowledge on the SCTNet. There are only twenty persons in this cluster. It reflects that sharing knowledge on SCTNet is still not a popular behavior.

4.2 Behaviors of SIG members

There are 1,158 members in the SIGs and the frequencies of gender and education degree are depicted as Table 2(a).

Table 2. Demographic & Log Data of SIG Members

Gender

	Frequency	Percent
Female	696	60.1%
Male	398	34.4%
Null	64	5.5%

Education

	Frequency	Percent
Bachelor	958	82.7%
Master	186	16.1%
High school	12	1%
Null	2	0.2%

(a) Demographic Data

Cluster Number	Members	DBPOST	DBREPLY	MBPOST	MBREPLY	UPLOAD	DOWNLOAD	EMAIL	URLREC
Cluster 1	1119	0.4272	1.0349	0.3021	0.2475	0.8177	2.8329	0.5067	0.2163
Cluster 2	39	8.1282	15.3333	5.1026	3.7179	12.0000	123.8462	13.7436	3.3077
Average	1158	0.6865	1.5164	0.4637	0.3644	1.1943	6.9085	0.9525	0.3204

(b) Cluster Information

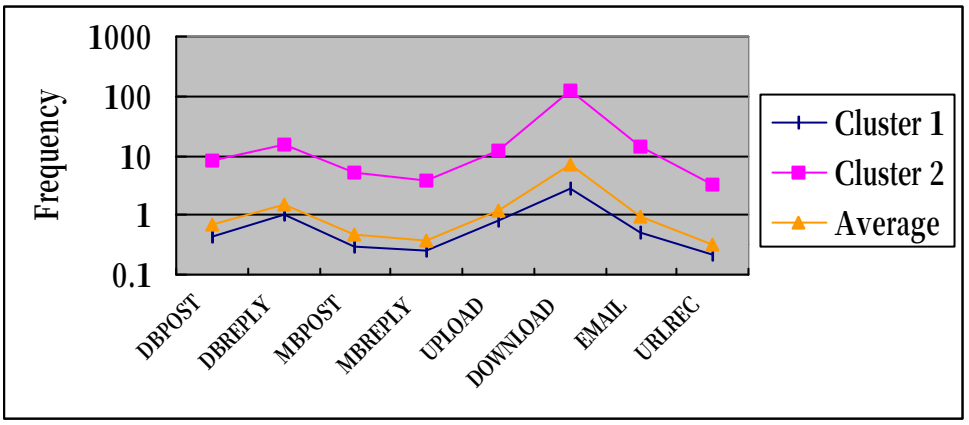

Figure 2. Graphical Comparisons Between Clusters of SIG Members

For SIGs, eight variables are grouped into five categories of activities, namely, discussion, message exchange, document sharing, e-mail sending, and URL recommendation. The definition of each variable is shown below.

Discussion

DBPOST- Number of posts on the discussion board.

DBREPLY- Number of replies to discussion posts.

Message Exchange

MBPOST- Number of messages on the message board.

MBREPLY- Number of message replies to discussion messages.

Document Sharing

UPLOAD- Number of teaching resources uploaded to SCTNet.

DOWNLOAD- Number of teaching resources downloaded from SCTNet.

E-mail Sending

EMAIL- Number of e-mails sent on SCTNet.

URL Recommendation

URLREC- Number of recommended web sites.

Table 2(b) depicts the summary data of all behaviors. Further, visual displays of comparisons between clusters are demonstrated in Figure 2. Generally speaking, the results exhibit similar patterns as the regular members. We can find that file download is the most frequent behavior and web sites recommendation is the least frequent. After cluster analysis, these members can be divided into two clusters. Each cluster is described below.

Cluster 1

Most of the members (1,119 out of 1,158) belong to cluster 1 and they are passive to share knowledge.

Cluster 2

There are 39 members in cluster 2. They represent active knowledge-sharing members. They significantly flourish in the behavior of files download and they are active to reply on discussion board, uploading files, and sending e-mails.

4.3 Behaviors of members in both groups

We now focus on 1,158 members participating in both general community and SIGs. Combining variables in both groups comes up with ten distinct variables. These variables are then grouped into six categories of activities, namely, attending, upload, interaction, feedback, knowledge consumption, and evaluation. The definitions of these six variables are listed below.

(1) **Attending**: The frequency of login (FL) implies the commitment to attend this community.

FL = LOGIN

(2) **Uploading**: The frequency of teaching resources shared (FTRS) means contributing knowledge without conversation or interaction with others. It is defined as the summation of frequencies of resources upload in general community and SIGs:

FTRS = UPLOAD + URLREC

(3) **Interaction**: The frequency of teaching opinions shared (FTOS) means contributing knowledge through conversation or interaction with others. It is defined as the summation of frequencies of articles posting in general community and SIGs:

FTOS = DBPOST + MBPOST

(4) **Feedback**: The frequency of knowledge caring (FKC) is another important behavior to be addressed. It is the interaction within social networks, which is defined as answering or responding efforts spent on strengthening relationships between members, and is defined as follow.

FKC = DBREPLY + MBREPLY +EMAIL

(5) **Knowledge Consumption**: The frequency of knowledge acquisition (FKA) refers to the knowledge utilization behavior and is simply computed by summarizing the frequencies of teaching resources download in both general community and SIGs:

FKA = DOWNLOAD

(6) **Evaluation**: The usefulness and quality of teaching resources are evaluated by members of the community. The frequency of knowledge evaluation (FKE) will facilitate knowledge sharing.

FKE = EVALUATION

Table 3 and Figure 3 summarize results of these six behaviors. We can find that knowledge consumption, feedback, and login are the top three most frequent behaviors. After cluster analysis, the members were grouped into three clusters. Each cluster is described as following:

Cluster 1

Most of the members belong to cluster 1 and they are passive to share knowledge.

Cluster 2

The members in cluster 2 are passionate to attend SCTNet and like to interact with other members and utilize knowledge. Similarly, this knowledge-sharing group accounts only a small percentage of the population.

Table 3. Cluster Information in Both Populations

Cluster	Members	FTRS	FTOS	FKC	FKA	FKE	FL

Number							
Cluster 1	1072	1.6418	0.7724	1.5187	18.4011	0.1129	11.1847
Cluster 2	17	34.2353	52.3529	114.4706	142.4706	12.7059	338.5294
Cluster 3	69	3.0290	1.9855	6.6957	260.3188	1.2899	44.8406
Average	1158	2.2029	1.6019	3.4853	34.6373	0.3679	17.9957

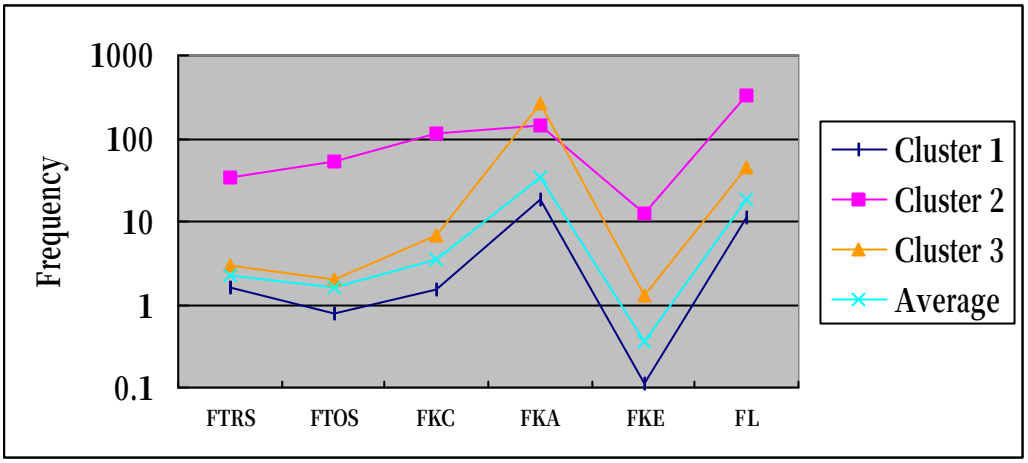

Figure 3. Graphical Comparisons Between Clusters in Both Groups

Cluster 3

Members in cluster 3 only like to receive knowledge and are inactive in any other activities.

Three major groups are discovered, and they can be described in term of few active members, numerous inactive members, and moderate download only members. Besides, knowledge-evaluation is the least popular behavior on the SCTNet. In comparison with results of analyzing regular or SIGs members, the third analysis expose that active members contribute knowledge through conversation or interaction with others frequently, while most members prefer sharing knowledge without interacting with others.

5. DISCUSSION

Through quantitative and qualitative analysis, we interpret the results regarding knowledge-sharing behavior on the SCTNet. These results are discussed as follows.

(1) **Knowledge sharing is not a common practice in the professional virtual community, SCTNet.**

Virtual community is characterized by Armstrong and Hagel III [2] as more interaction-oriented, and schools are viewed as physical professional communities in educational disciplines [31]. Member of professional communities are supposed to carry out critical reflection and continue the professional dialogues with one another [31][38]. Since these teachers are participating in both virtual and physical communities, more professional dialogues between members were expected originally.

However, many researchers indicated that people are unwilling to share knowledge with others [6][14][19][23] [24]. Our results support this argument. Our results show that most members are knowledge consumer, while knowledge-sharing behaviors are relatively unpopular.

Culture has been identified as the principal factor to influence knowledge-sharing (e.g. [1][8][9][28]). Based on a recent Information Week Research survey [10], to promote knowledge-sharing culture in organizations is quite a challenge. Only 11% of IT managers thought it's easy or somewhat easy to change their companies' culture to encourage knowledge sharing and collaboration. The largest group, 74%, considered it's somewhat or very difficult to change the culture.

Investigation by focus group shows that knowledge-sharing within primary school teachers were promoted with great exertion. Under the small-school-small-class policy, only a small number of teachers teach the same course within a school. Therefore, teachers are encouraged to form "teaching groups" to cooperate for course preparation at their schools. However, the cooperative culture is actually unpopular among the schools from which the members belong. Furthermore, their experiences in sharing and collaborating with other colleagues were rare.

The harmonious, non-competitive culture also encourages teachers to be sympathetic. Thereby, they usually take a positive attitude toward others. Although their opinions toward sharing knowledge and helping people are positive, however, our results concluded knowledge-sharing culture is difficult to promote even in non-competitive professional communities.

(2) Knowledge cannot flow easily throughout the community.

Szulanski [33] identified that knowledge is 'sticky' and does not flow easily throughout the organization even when knowledge is made available. From the results analyzed in subsection 4.1 through 4.3, there exists a cluster which contains the majority of members who neither shares nor utilizes knowledge and remain dormant. They even exhibit reluctance to download teaching resources with minor efforts. Moreover, the knowledge evaluation and recommendation mechanism designed to encourage the flow of knowledge are also rarely utilized. Due to a small number of teachers teaching the same courses within a school, most members in focus groups express the necessity of knowledge-sharing across the school boundaries. Their priority of daily schedule is to search for teaching materials on the Internet and to prepare for teaching. Computer facilities are easily available in classrooms and administration offices, and it is convenient for teachers to access SCTNet at school. Since they indeed have the needs to collect teaching resources and do not have difficulty in accessing SCTNet, our results confirmed Szulanski's [33] findings that knowledge cannot flow easily throughout the community even when knowledge is made available and certain knowledge flow promoting mechanism is provided.

(3) Professional autonomy may hinder the frequency of interactions with others in professional virtual community.

The results show that members download teaching resources more frequently than uploading. The behavior of interaction with others is far less than expected. We suspect that the phenomenon may attribute to professionalism. According to Quinn, et al., [26], professionals should have codified body of knowledge, problem-solving capabilities, critical reflection, highly commitment to their work, high level of professional autonomy. Teachers are trained to solve problem on their own, and thus professional autonomy may hinder the frequency of interaction with others unless they feel necessary. The focus group study showed that no matter members were certificated or trainee teachers, their professional perception was high, and most of the participants' professional level was above medium level. We thus argue that professional autonomy may hinder the frequencies of

interactions with others in professional virtual community.

(4) Attitudes regarding information ownership may play important part in professional virtual community.

On the SCTNet, uploaded teaching resources are treated as public goods that can be free downloaded and spread throughout the community. However, the original creator still possess the ownership. According to Constant et al. [7] and Jarvenpaa and Staples [17][18], when knowledge is perceived to be 'owned' by individuals, people are more likely to exchange their knowledge for 'intangible' returns such as reputation and self-esteem. When knowledge is viewed as a public good, people share knowledge beyond the maximization of self-interest and personal gain and motivated by moral obligation [37]. Both viewpoints are supported in the interviews with subjects of focus groups. Most of them are concerned about the ownership of their creation, but with pleasure to upload and see more and more teachers downloading their contributions and exhibit appreciation of such ownership arrangement on the SCTNet.

(5) Experiences play only a small part in influencing knowledge-sharing behavior.

The active knowledge-sharing members identified in this study are not teachers with several years of teaching experiences, nor with high IT usage experiences. Alternatively, most of them are young teachers with few teaching experiences and possess moderate IT capability. In fact, the majority of participants in focus groups regard themselves as low IT self-efficacy in terms of computer efficacy and using IT for teaching. Besides, their habits of using IT are very similar. They spent one to two hours surfing on Internet, four to six days a week. They were searching teaching related materials on the Internet. Due to the time pressure at school, they usually dialed up at home. All of them had their own e-mail accounts and checked mails every two days on average, but did not have the habit to respond mail immediately. They logged on SCTNet half to one hour every day, and four to six days a week. They used SCTNet in various ways, but downloading resources were the most popular. We thus argue that teaching and IT usage experiences do not play a major part in affecting knowledge-sharing behavior in professional virtual community.

6. FUTURE RESEARCH

This study discovered some typical patterns of knowledge-sharing behavior in a professional virtual community. Highly unbalance between knowledge giving and knowledge taking groups reveals a major difficulty in knowledge sharing. Future research can focus on the methods of promoting knowledge sharing. Other professional virtual communities should also be studied to validate findings from this study.

Appendix

The details of the data collected from focus groups regarding different contexts.

Categories	Sub-categories	Concepts
Individual	Professional level	Years of teaching Certificated teachers/trainee teachers Professional perceptions (perceptions of the professional role)

	Attributes affecting time spent on SCTNet	School routine works Teaching loads Schedule priority
	Habit of using IT	Frequency of surfing Internet Place for surfing Habit of using e-mail Frequency of surfing SCTNet Ratio of surfing SCTNet to Internet
	Purpose of surfing	Purpose of surfing Internet Purpose of surfing SCTNet
	Active to call for help	Active to call for help or not
	Propensity to share	Propensity to share
	Individual cooperative attribute	Intention to cooperate with colleagues Preference of teamwork Habit of teamwork Preference of the way to contact
	Experiences of knowledge sharing	With colleagues What to share with colleagues? With members What to share with members?
	IT capability	Computer self-efficacy Ability of IT in education
	Perception of SCTNet	Perceived ease of use Perceived usefulness
Organization	Organization size	Number of classes per grade Number of students per class Number of student in the school
	Culture	Professional dialogue between colleagues Cooperation with colleagues
	Senior management support	Commitment Supporting resources for using IT in teaching
	IT infrastructure	Availability of computer facility Convenience to surf Internet
Environment	Environment	Nature of teachers' work National education policies Incentive systems Supporting resources

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