

Analyzing Online Behaviors, Roles, and Learning Communities via Online Discussions

Yu-Chu Yeh

Institute of Teacher Education; Research Center for Mind, Brain & Learning; Center for Creativity and Innovation Studies; National Chengchi University, Taipei 116, Taiwan // ycyeh@nccu.edu.tw

ABSTRACT

Online learning communities are an important means of sharing and creating knowledge. Online behaviors and online roles can reveal how online learning communities function. However, no study has elucidated the relationships among online behaviors, online roles, and online learning communities. In this study, 32 preservice teachers participated in an 18-week instruction program. Analyses of online group discussions revealed the following: (a) of thirteen identified online behaviors, the most common were constructing a positive atmosphere, providing opinions for group assignments, and providing reminders of assignment-related work; (b) of eight online roles identified within a group, the most common roles were information providers, opinion providers, and troublemakers; (c) four online learning communities based on “collaboration” and “participation” were identified. The evolution of these online learning communities indicates the interrelationships among online behaviors, roles, and learning communities.

Keyword

Behavior, Learning community, Preservice teacher, Online discussion, Roles

Introduction

The emergence of learning communities is an interesting and recent pedagogical development in higher education. Various strategies have been developed to foster learning communities in an online setting. The objectives of these strategies include communicating effectively, strengthening social ties, collaborating in small teams, establishing social networks, and collaborating in knowledge construction (e.g., Chang, Chen & Li, 2006; Jones & Issroff, 2005; Wang & Poole, 2004; Yang, Wang, Shen & Han, 2007). Online behaviors and roles that are fundamental to the functioning of online learning communities, however, have seldom been compared (Yang et al., 2007). Moreover, although a few studies (e.g., Cho, Gay, Davidson & Ingraffea, 2007; Lin, Lin & Huang, 2007) have attempted to define online learning community styles or types, none has developed clear criteria for defining online learning community types from a holistic viewpoint. For instance, Lin et al. (2007) classified the products and processes of knowledge sharing and creation in a professional virtual community into six types. However, they did not define these groups according to their characteristics. Although another study by Cho et al. (2007) defined the styles of online learning communities, it only focused on willingness to communicate in learning communities.

Online learning communities are a collaborative means of achieving “shared creation” and “shared understanding,” in which mutual exchange between community members are encouraged to support individual and collective learning (Ludwig-Hardman & Woolley, 2000). Some studies indicate that online learning communities promote active participation, increase academic achievement, contribute to knowledge creation, and improve learner cognitive abilities (e.g., Lin et al., 2007; Ludwig-Hardman & Woolley, 2000; Moller, 1998; Waltonen-Moore, Stuart, Newton, Oswald & Varonis, 2006). However, the question of how these benefits are obtained remains unanswered. Lin et al. (2007) found that for any group to perform well via an online setting, group members must recognize their functional roles in knowledge-related activities, and each functional role requires a corresponding behavior in the processes of knowledge sharing and creation. Therefore, identifying the important online roles and their corresponding behaviors should elucidate how online learning communities function, what online learning communities can be formed, and which online learning communities best benefit learners. This information can help teachers improve their e-learning instruction methods. Briefly, this study examines online roles and corresponding behaviors exhibited in an online learning community and further, based on these analyses, develops objective criteria for categorizing online learning communities.

Online behaviors, roles, and learning communities

Online behaviors and roles

Chang, Cheng, Deng, and Chan (2007) identified the following ten basic elements of structured network learning societies: participants, shared visions, devices, services, rules, relations, manners, learning domains, learning goals, and learning activities. They argued that because participants are the lifeblood of online learning groups, identifying participants by analyzing “roles” is crucial for identifying the interpersonal behaviors of network community members. Similarly, Yang et al. (2007) determined that learning communities inevitably include learners with similar approaches and different interests and that each learning behavior reflects learner interests as well as their resource and information needs. Accordingly, analyzing behaviors and roles in an online learning community is essential for understanding online learning communities.

According to the *Dictionary of Psychology* (Corsini, 2002), a role is “the set of behaviors expected of a person possessing a certain social status” (p. 850). Accordingly, a role is an upper-level concept of a behavior and can comprise a set of behaviors. To date, few studies have analyzed online roles and behaviors or clarified their corresponding relationships. In a study of online learner roles, Lin et al. (2007) compared widely varying examples of inferior and superior consequences of special-interest groups at several group levels. Their analysis of group roles revealed that inferior group roles comprised information/opinion seekers or givers, encouragers, and followers whereas superior group roles included initiators, orienters, encouragers, recorders, gatekeepers, information/opinion seekers or givers, coordinators, and clowns. Lin et al. also found that, for knowledge-creation roles, the inferior group is primarily comprised of idea providers whereas the superior group consists of task performers followed by idea providers and integrators. Similarly, Agre (1998) noted the critical importance of “thought leader” for building trust within a community; thought leaders are individuals who foresee issues, gather positions and arguments, network with people relevant to the issue, and articulate the issue in a manner that provokes thinking by individual community members.

In their further analysis of online behaviors or strategies, Lin et al. (2007) classified collaborative strategies into two categories: task performance and team maintenance. Task performance strategies are related to coordination tasks for problem solving or goal attainment, such as initiating, seeking information/opinions, providing information/opinions, coordinating, orienting, evaluating and recording. On the other hand, team maintenance strategies such as encouraging, gate-keeping, following and clowning build friendly relationships among group members and maintain team coherence. Lin et al. concluded that each functional role requires a corresponding behavior in knowledge-sharing and -creation processes. However, the relationship between roles and behaviors has not been clarified. The present study therefore attempts to elucidate these relationships.

Indices for online learning communities

Cooperation and motivation to participate are two crucial indices for distinguishing between the achievement of online groups (Guzdial & Turns, 2000; Lin et al., 2007). Lin et al. (2007) found that while over 50% of participants in the superior group habitually cooperated, few participants in the inferior group did so. They also indicated that participants in the superior group were more enthusiastic about sharing knowledge than those in the inferior group. Similarly, Ligorio (2001) proposed that when communities are organized into groups consisting of members with different abilities, the overall purpose of the community must be kept in mind along with a sense of collaboration.

According to Ligorio (2001), the collaborative dimension of knowledge building comprises the community of learners model and the community of practices model. In the learners model, each learner is invited to formulate problems and hypotheses, search for solutions, share knowledge, explore new fields, learn about new topics, and adopt new perspectives. In the practices model, learning is a function of an activity, context, culture and social interaction between people with different competencies. Consequently, peripheral participation is legitimate; that is, even when not directly participating in an activity, learners can still benefit from observation, analysis, and discussion of that activity (Ligorio, 2001). Clearly, both the community of learners and the community of practices models assume the interdependence of participants during cognitive learning (Salomon, 1993; 1998). Therefore, collaboration is needed to build knowledge in online learning communities.

The second index of online learning communities, participation, is considered a general measure of successful online discussions (Guzdial & Turns, 2000). Notably, although online learning communities have considerable potential for encouraging students to construct and share knowledge, in most online discussions, only a few key students actively do so (Chang, Chen & Li, 2006). Moreover, frequent messaging does not constitute a genuine community (Guzdial, & Turns, 2000). However, from a meaning-making perspective, the content and context of messages are critically important. In support of this perspective, Havelock (2004) suggested that, although the number and frequency of connections provide a sense of community activity, they say little about how these interactions impact identity formation, meaning-making, and the professional practices of participants. To determine which messages are meaningful, Baym (1998) proposed that message content in a group should contribute to the development of intra-community trust, and such messages are typically characterized by optimism, excitement, clear task orientation, and shared leadership duties. In the same vein, Agre (1998) advocated the importance of facilitating a sense of group trust and participation. Thus, collaboration and meaningful participation are clearly two important indices for measuring the success of online learning communities. These two indices must also be utilized when categorizing learning communities.

Research questions

Because this study is exploratory, only research questions rather than hypotheses are proposed. The principal research questions are as follows.

1. What online behaviors are exhibited during interactive online discussions?
2. What online roles evolve from online behaviors?
3. What are the relationships among online behaviors, online roles, and online learning communities? Specifically, how do online behaviors and online roles evolve into objective criteria for categorizing online learning communities?

The screenshot shows a web browser window displaying a discussion board. The browser's address bar shows the URL <http://elearn.nccu.edu.tw/learn/index.php>. The page title is "批列思考教學(941) - 政治大學網路學園". The main content area is titled "第 1 組 - 小組討論板" (Group 1 - Group Discussion Board). It features a table of posts with the following columns: 篇號 (Post No.), 標題 (Title), 日期 (Date), 張貼者 (Poster), 點閱 (Views), 回覆 (Replies), and 附檔 (Attachments). The table contains 10 rows of posts, with titles such as "Re: 問題情境", "契約", "我找的議題", "助人學生論點(虹君)", "二審法官的論點", "一般民眾的看法", "修正作業已繳交", "娃娃家屬", and "學校部份".

Annotations on the screenshot include:

- A callout box labeled "Group 1-- Group discussion board" pointing to the discussion board title.
- A text box stating: "The 1st level structure: curricular content, curricular information, **curricular interaction**, individual area, and system area." with a dotted line pointing to the navigation and system area.
- A text box stating: "The 2nd level structure: The structure under curricular interaction **group discussion**, thematic discussion, reflection of group learning, video conference setting, online video conference, and video conference list" with a dotted line pointing to the discussion board content.

Figure 1. An example screen of group discussion board

Method

Participants

The study participants were 32 preservice teachers (6 males and 26 females) enrolled in the Instruction in Critical Thinking class in a teacher-training program for secondary school teachers. Among the participants, 14 (43.75 %) were undergraduates, and 18 were graduates (56.25 %). Mean subject age was 23.00 years ($SD = 2.54$ years).

Instruments

The research instrument employed in this study was the e-learning website developed by National Chengchi University. The e-learning interface consists of three levels. The first level includes the functions of curricular content, curricular information, curricular interaction, an individual area, and a system area. The instructional design of this study required that participants complete several group assignments and engage in online discussions. Consequently, “curricular interaction,” particularly the “Group Discussion Board” under this function, became the most frequently used interface. Figure 1 presents an example screen of this Group Discussion Board. Since the interface is written in Mandarin, the main functions of the menu bars are translated.

Procedures and instructional design

An 18-week experimental instruction program based on teaching critical thinking was developed to encourage the formation and use of online learning communities. To achieve these two goals, collaborative problem-based learning (PBL) was incorporated into the experimental program. According to Lee and Kim (2005), collaborative PBL is a method in which learners share a common goal, perform given tasks at the same level, and interact with each other during problem solving. Accordingly, collaborative PBL, which emphasizes the importance of interactive discussions, is ideal for analyzing online learning communities. Specifically, the instructional design had two phases: formation of online learning communities (weeks 1–7) and use of online learning communities (weeks 8–16).

In the first phase, participants were divided into six groups; each participant was allowed to select the group of his or her own choice. Each group consisted of five to six members. However, one participant in Group 4 dropped out during the semester; therefore, Group 4 was comprised of only four participants. During the second week, they started preparing for their group project, which employed collaborative PBL. During this instruction period, the researcher encouraged the formation of online learning communities by assigning group work on the following topics: (1) develop test items for five critical-thinking skills—assumption identification, induction, deduction, interpretation, and argument evaluation; (2) develop a situation-based problem; and (3) apply strategic thinking to everyday problems.

In the second phase, participants were scaffolded to complete the collaborative PBL assignment via online learning communities. The primary group tasks in this instructional period were as follows: (1) find an authentic case for collaborative PBL; (2) define problems in the case; (3) decide roles in the case; (4) develop arguments for each role; (5) present all arguments and a consensus of solutions via concept maps; and, (6) present arguments for each role and role-play the problem-solving process.

The researcher assumed that the instructional design would prompt participants to take advantage of the online discussion board, especially during group discussions. First, participants were from various departments, and each participant was enrolled in several classes. Thus, face-to-face discussions were difficult to organize. Second, participants were asked to discuss group assignments online and then upload their files to the e-learning website during both phases of the study.

Analyses

The Group Discussion Board content was analyzed. As mentioned, an online role can comprise several online behaviors, and not all online behaviors contribute to the formation and function of an online community (Corsini,

2002; Guzdial & Turns, 2000). Restated, among the many online behaviors, only some can be further combined into online roles that contribute to group trust and participation. Further, identifying online roles is critical for understanding an online learning community (Agre, 1998; Lin et al., 2007). Consequently, to achieve the goals of this study, the online behaviors of participants were determined first. These behaviors were then used to determine a set of online roles likely to influence the formation of an online learning community. When determining the number of online roles, the researcher took the related findings in the applicable studies (Agre, 1998; Lin et al., 2007) as a referenced framework and then tried to propose more elaborate categories based on the data obtained in this study. Finally, based on the analyzed roles, different online learning communities were identified. The online behaviors and online roles in this study were identified via discussions of the researcher and two trained graduate students.

Results

Analyses of online behaviors

Table 1 lists the frequencies of discussions on the Group Discussion Board. The analytical results indicate that most discussions were conducted during weeks 8–16 via asynchronous discussions when participants started working on their PBL projects. The mean number of asynchronous and synchronous discussions for each participant was 36.00 and 4.72, respectively.

Table 1. The frequencies and means of online discussions

Group	<i>N</i>	Asynchronous discussions		Synchronous discussions	
		Count	<i>M</i>	Count	<i>M</i>
G 1	5	110	22.00	0	0
G 2	6	202	33.67	25	4.17
G 3	6	176	29.33	30	5.00
G 4	4	170	42.50	0	0
G 5	5	193	38.60	31	6.20
G 6	6	301	50.17	65	10.83
Total	32	1152	36.00	151	4.72

Analyses of interactions in the asynchronous and synchronous discussions identified the following 13 online discussion behaviors.

1. Providing opinions for group functioning: Such behaviors helped the group function effectively and efficiently. For example, “We should upload personal assignments before Sunday night to ensure efficient discussion on Tuesday.”
2. Providing opinions for group assignments: Such behaviors referred to personal responses to member opinions or ideas related to group assignments. For example, “The suggested story is good, but it’s kind of hard to discuss a gang leader.”
3. Encouraging opinions about/responses to group assignments: Such behaviors were observed when the deadline was approaching, but no one had posted any opinions about the assignments. These behaviors were also observed when personal opinions had been posted, but no one had responded to these opinions. For example, “Everyone posts your opinions on the discussion board; the deadline is Monday.”
4. Sharing information: Such behaviors were related to the sharing of information obtained from the teacher, media, magazines, websites or other sources. For example, “I recently read a magazine article that discussed bullies in schools. Maybe ‘bullies in schools’ can be a topic of our project. What do you think?”
5. Clarifying concepts: Such behaviors were performed to clarify misconceptions about an issue. For example, “The test item you proposed is not about ‘assumption identification’; it is about ‘explanation’.”
6. Constructing a positive atmosphere: Such behaviors included giving encouragement and blessings as well as expressing gratefulness, caring, and forgiveness. For example, “Two groups have decided to take ‘bird flu’ as their project topic. You should continue to exercise to help prevent infection of a bird flu.”
7. Answering questions: Such behaviors occurred when a group member had questions about the assignment or distributed work and asked for help on the discussion board. For example, “Julie: ‘I don’t know what I should do.’ Albert: ‘You need to write a learning contract and then upload it to the Web site by Monday.’”

8. Providing reminders of assignment-related work: Such reminders were related to meeting times, assignment content and progress, and distribution of assignments. For example, “When uploading the assignment, don’t forget to list the filename as ‘Group 2’.”
9. Explaining personal problems: Students explaining personal problems typically posted excuses or reasons for being unable to participate in group discussions or unable to finish assigned work on time. For example, “Sorry, I was sleepy last night, so I forgot to upload the file.”
10. Explaining the problems of others: Such behaviors were performed to tell group members why someone could not participate in group discussions or complete their assignment on time. For example, “Teresa has a class until 1:00 p.m., so, she will come later.”
11. Solving problems: Such behaviors were performed to work out problems that could hinder group progress. The most frequently encountered problems were a group member forgetting to upload an assignment or not distributing an assignment to all group members. For example, “The deadline is coming, but John has not uploaded his file. I have just uploaded the file by myself.”
12. Setting schedules: Such behaviors occurred when no group members had proposed a specific time for discussions. For example, “We should discuss our project topic this Friday.”
13. Assigning work: Such behaviors included asking group members to be responsible for certain work or asking for volunteers to complete work. For example, “Is there any volunteer to complete the learning contract?”

These online behaviors were counted (Table 2) to determine their frequency. Of these 13 behaviors, B6 (constructing a positive atmosphere) was the most frequent, followed by B2 (providing opinions for group assignments) and B8 (providing reminders of assignment-related work). The B10 behavior (explaining the problems of others) was the least common.

Table 2. The employed 13 online behaviors

	Type of online behavior												
	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13
Count	19	80	16	36	18	90	10	80	48	3	8	8	10

Note. B1 to B13 represent type 1 to type 13 online behaviors, respectively.

Analyses of online roles

Based on the data obtained in this study, the findings in related studies (Agre, 1998; Lin et al., 2007), and the definition that a role may comprise a set of behaviors (Corsini, 2002), the researcher tried to combine the aforementioned 13 behaviors into some ‘meaning-making’ roles. Finally, the following eight roles were identified.

1. Supervisors (R1): This role comprises B1 and B3. This role was the key to good group functioning. Supervisors gave suggestions about creating high-quality work, requested opinions from group members, set discussion schedules and assigned work to group members.
2. Information providers (R2): This role consists of B4. These group members typically provided and shared information related to assigned work.
3. Group instructors (R3): This role consists of B5. These group members attempted to clarify misconceptions.
4. Atmosphere constructors (R4): This role consists of B6. These group members attempted to construct a positive and harmonious atmosphere of support, caring, and cooperation.
5. Opinion providers (R5): This role is composed of B2. These group members provided opinions that contributed to group work.
6. Reminders (R6): This role is composed of B8. These group members were responsible for reminding others about discussion times, assignment deadlines, and the details for completing group work.
7. Trouble-makers (R7): This role is composed of B9. These group members frequently caused problems that hindered the completion of group work via their absence from group discussions or inability to finish assigned work on time.
8. Problem solvers (R8): This role comprises B7, B10, and B11. These group members attempted to answer questions posed by group members as well as to correct and explain problems caused by group members.

To determine which online roles were employed most frequently, the roles of each participant were counted and the outstanding roles were analyzed from within-group and across-group perspectives. Table 3 presents the details concerning role counts for all participants.

Table 3. Counts and means for online roles

Participant	Type of online role							
	R1	R2	R3	R4	R5	R6	R7	R8
Group 1								
G1-1	3	2	0	1	2	3	1	0
G1-2	1	0	0	0	0	1	0	0
G1-3	1	1	0	1	0	0	0	0
G1-4	0	0	0	0	1	0	0	0
G1-5	1	0	0	0	0	0	2	0
Mean	1.20	0.60	0.00	0.40	0.60	0.80	0.60	0.00
Group 2								
G2-1	3	1	0	5	4	8	4	3
G2-2	4	2	0	9	2	16	0	2
G2-3	1	1	0	5	0	5	5	1
G2-4	0	0	0	1	0	0	0	0
G2-5	1	0	0	1	0	0	0	0
G2-6	2	0	0	3	0	3	0	0
Mean	1.83	0.67	0.00	4.00	1.00	5.33	1.50	1.00
Group 3								
G3-1	2	0	0	1	3	0	5	0
G3-2	0	0	0	0	2	3	0	0
G3-3	1	4	0	2	1	1	3	0
G3-4	1	2	0	5	1	2	2	0
G3-5	4	0	0	1	1	1	3	2
G3-6	7	3	0	4	0	8	0	4
Mean	2.50	1.80	0.00	2.17	1.33	2.50	2.17	1.00
Group 4								
G4-1	1	1	1	3	0	1	3	1
G4-2	0	0	0	1	0	1	1	0
G4-3	2	2	2	0	2	3	1	2
G4-4	0	0	0	4	1	1	1	0
Mean	0.75	0.75	0.75	2.00	0.75	1.50	1.50	0.75
Group 5								
G5-1	2	0	0	6	4	1	0	0
G5-2	3	1	2	0	2	3	1	1
G5-3	1	2	0	4	4	2	2	2
G5-4	0	1	0	6	6	5	1	1
G5-5	1	0	1	0	7	1	0	1
Mean	1.40	0.80	0.60	3.20	4.60	2.40	0.80	1.00
Group 6								
G6-1	5	4	5	8	8	3	3	1
G6-2	0	1	0	3	7	0	4	0
G6-3	4	4	4	8	8	4	0	0
G6-4	2	1	0	2	4	2	2	0
G6-5	0	2	1	5	8	1	3	0
G6-6	0	1	1	2	1	1	1	0
Mean	1.83	2.17	1.83	4.67	6.00	1.83	2.17	0.17
Class								
Total	53	36	17	91	79	80	48	21
Mean	1.66	1.16	0.53	2.84	2.47	2.50	1.5	0.66

An outstanding role within a group was observed when the count of a participant for a certain role exceeded the group mean for that role, and an outstanding role across groups was observed when the count of a participant for a certain role exceeded the class mean for that role. For instance, when analyzed within the group, two participants in Group 3 (i.e., G3-5 and G3-6) were outstanding for R1 (supervisors). Their total number of participation for this role were, respectively, 4 and 7, which were higher than the group mean for this role ($M = 2.50$). However, when

analyzed across groups, three participants in Group 3 (i.e., G3-1, G3-5, and G3-6) were outstanding for R1; their total numbers of participation for this role were 2, 4, and 7, respectively, and these numbers were higher than the class mean for this role ($M = 1.66$). Restated, in Group 3, participants G3-5 and G3-6 were supervisors, and, when examined in the context of the whole class, G3-1, G3-5, and G3-6 were supervisors. Following these calculations, Table 4 presents the numbers and distributions of outstanding roles for each group.

When analyzed within the group, the roles of information providers, opinion providers, and troublemakers were the most numerous (15, 14, and 14, respectively), and the number of group instructors was the lowest (Table 4). When analyzed across groups, the roles of supervisors and troublemakers were the most numerous (both 13), followed by positive atmosphere constructors, reminders, and problem solvers. Group instructor was the least common.

Table 4. Counts for outstanding roles in each group

Group	Type of online role							
	R1	R2	R3	R4	R5	R6	R7	R8
	Within the group							
G1	1	2	0	0	2	0	2	0
G2	3	3	0	3	2	2	2	3
G3	2	3	0	2	2	2	3	2
G4	2	2	2	2	2	1	1	2
G5	2	3	2	3	2	2	3	4
G6	3	2	2	3	4	3	3	1
Total	13	15	6	13	14	10	14	12
	Across groups							
G1	1	1	0	0	0	1	1	0
G2	3	1	0	1	1	4	2	3
G3	3	3	0	2	1	2	4	2
G4	1	1	2	2	0	1	1	2
G5	2	1	2	3	4	2	1	4
G6	3	3	4	4	5	2	4	1
Total	13	10	8	12	11	12	13	12

Note. R1 to R8 represent type 1 to type 8 online roles, respectively.

Online learning communities

This study attempted to define online learning community types based on two indices: collaboration and participation. These indices were evaluated based on the aforementioned roles. In terms of collaboration, the number of roles was counted to represent a group member's discussion frequency. Specifically, if most group members had similar discussion frequencies, the group was considered "high collaboration," whereas if the discussion frequencies of group members varied significantly, the group was considered "low collaboration." Based on this central idea, this study first summed up the roles contributing to collaboration within each group. Means and standard deviations were then calculated for each group. According to Baym (1998), sense-making message content contributes to the development of intracommunity trust. Troublemakers are clearly harmful to group collaboration; this role was therefore eliminated when summing up collaborative roles in each group. Specifically, the sum of cooperative roles = the sum of all roles – the sum of troublemakers (Table 5).

Table 5. The counts of online roles and collaborative roles

Group	Type of online role								Sum	
	R1	R2	R3	R4	R5	R6	R7	R8	Roles	Collaborative roles
G 1	6	3	0	2	3	4	3	0	21	18
G 2	11	4	0	24	6	32	9	6	92	83
G 3	15	9	0	13	8	15	13	6	79	66
G 4	3	3	3	8	3	6	6	3	35	29
G 5	7	4	3	16	23	12	4	5	74	70
G 6	11	13	11	28	36	11	13	1	124	111

Note. R1 to R8 represent type 1 to type 8 online roles, respectively.

Since the total online discussion count varied greatly between groups, directly comparing SDs between groups would have been inappropriate. Therefore, the coefficient of relative variability (CV) rather than SD was employed to compare individual differences within a group and further helped determine the degree of collaboration for each group. Notably, CV represents the ratio of SD to mean ($CV = SD \cdot 100 / M$). The analytical results indicated that Group 1 and Group 2 had comparatively large CVs, 117.19 and 96.49, respectively. Thus, these groups were regarded as “low collaboration.” The other groups were regarded as “high collaboration.” (Table 6)

Table 6. The Ms, SDs, and CVs for collaborative roles

Group	<i>n</i>	Minimum	Maximum	Total	<i>M</i>	<i>SD</i>	CV
G 1	5	1	11	18	3.60	4.22	117.19
G 2	6	1	35	83	13.83	13.35	96.49
G 3	6	5	26	66	11.00	7.67	69.71
G 4	4	2	13	29	7.25	4.57	63.08
G 5	5	11	19	70	14.00	3.16	22.59
G 6	6	6	34	111	18.50	11.78	63.66

As collaboration was measured according to a within-group perspective, the degree of participation was defined from an across-group perspective. The rationale for this difference is that a participant may have had high participation in comparison with other group members but low participation in comparison with the entire class. This typically occurred when the entire group had low participation. On the other hand, a participant may have had low participation compared with that of his/her group but high participation compared with that of the entire class; this generally occurred when the entire group had high participation. Additionally, since being a trouble-maker is a participation type, this role was included when determining the participation for each group. Restated, the sum of all roles for each group was considered indicative of its participation. Thus, “high participation” in this study was defined as a mean role of a group higher than that of the class, and “low participation” was defined as a mean role of a group lower than that of the class. The analytical results demonstrated that Groups 2, 5, and 6 were classified as having “high participation”, and Groups 1, 3, and 4 were classified as having “low participation” (Table 7).

Table 7. Group means and class means for online roles

Group	Type of online role								Total	<i>n</i>	Mean
	R1	R2	R3	R4	R5	R6	R7	R8			
G 1	6	3	0	2	3	4	3	0	21	5	4.20
G 2	11	4	0	24	6	32	9	6	92	6	15.33
G 3	15	9	0	13	8	15	13	6	79	6	13.17
G 4	3	3	3	8	3	6	6	3	35	4	8.75
G 5	7	4	3	16	23	12	4	5	74	5	14.80
G 6	11	13	11	28	36	11	13	1	124	6	20.67
Class	53	36	17	91	79	80	48	21	425	32	13.28

Note. R1 to R8 represent type 1 to type 8 online roles, respectively.

Based on the above analysis, a two (collaboration vs. participation) by two (high vs. low) model was proposed. Specifically, four online learning communities were identified: active collaboration, passive collaboration, individualized participation, and indifference (Figure 2). The four online learning community types and their distributions are as follows.

1. Active collaboration (high cooperation and high participation): Groups 5 and 6.
2. Passive collaboration (high cooperation and low participation): Groups 3 and 4.
3. Individualized participation (low collaboration and high participation): Group 2.
4. Indifference (low cooperation and low participation): Group 1.

As Table 7 shows, the active collaboration communities were typically high on R4 and R5; the passive collaboration communities were common in using R4, R6, and R7; the individualized participation community was high on R4 and R6; and the indifference community was high on R1.

		Collaboration	
		High	Low
Participation	High	Active collaboration	Individualized participation
	Low	Passive collaboration	Indifference

Figure 2. Types of online learning communities

Discussion

This study examines three questions concerning online behaviors, online roles, online learning communities, and their interrelationships. The analytical findings in this study indicate that the three questions are satisfactorily answered. Although this is an exploratory study, it evolves from a pilot study (Yeh, 2005) of 48 preservice teachers enrolled in the same course a year before this study was conducted. The identification of seven online roles in that pilot study provides a framework for this study. To generate a more comprehensive list of online roles than what is presented in the pilot study, this study deliberately starts by analyzing online behaviors. Moreover, to further clarify the relationships among online behaviors, online roles, and online learning communities, an elaborate instructional design is utilized and objective analyses based on online discussions are applied. As expected, the high frequencies of discussions (Table 1) suggest that the instructional design in this study successfully motivates participants to take advantage of online discussions, especially asynchronous discussions. Such participation is essential for objectively analyzing online behaviors and roles of participants as well as for learning community types.

Formation of an online learning community depends on the effectiveness of online learning behaviors (Palloff & Pratt, 1999) and the meaningfulness of exchanged messages (Baym, 1998; Havelock, 2004). Based on these rationales, this study only considers meaningful messages when analyzing online behaviors. The messages not focused on the discussed topics or issues and those not representing personal thoughts (e.g., a simple answer, “Yes”) are screened out. Further, rather than focusing on a specific perspective such as collaborative strategies (Lin et al., 2007), this study analyzes participant behaviors from a holistic perspective. Accordingly, 13 online behaviors are identified. The most frequently utilized behaviors are constructing a positive atmosphere, providing opinions for group assignments, and providing reminders of assignment-related work.

Lin et al. (2007) found that group members recognize their functional roles in knowledge-related activities. Accordingly, Lin concluded that each functional role requires a corresponding behavior to act during the knowledge sharing and creation processes. However, Lin et al. did not further analyze the corresponding relationships between roles and behaviors. Analytical findings in this study provide empirical and descriptive evidence supporting the conclusions obtained by Lin et al. By further integrating the 13 behaviors, the empirical evidence in this study shows that 8 important roles exist in online learning communities, and all participants play multiple roles during online discussions. The analytical results also demonstrate that, although some roles are composed of multiple behaviors, some comprise only one behavior. Moreover, this study analyzes the outstanding roles from different perspectives. From the within-group perspective, the most frequently utilized roles are information providers, opinion providers, and trouble-makers; on the other hand, the most frequently used roles determined using the across-group perspective are supervisors, trouble-makers, positive atmosphere constructors, reminders, and problem solvers. Among these roles, trouble-makers clearly hinder the formation and functioning of online learning communities. Unfortunately, this role typically exists in online learning communities, as the analytical findings in this study suggest. In the within-group context, “group instructor” is the least common role. This analytical finding is expected. Group instructors assist in resolving misconceptions and organizing gathered information. Although such a role is critical for knowledge construction in online settings, not everyone can play this role (Ludwig-Hardman & Woolley, 2000; Waltonen-Moore et al., 2006). As Chang et al. (2007) suggested, identifying participants by analyzing “roles” is

essential for understanding the interpersonal behaviors of network community members. The findings obtained in this study are valuable for further analyses of online learning communities.

To define online learning community types, this study employs two indices—collaboration and participation—which have been suggested by many researchers (Agre, 1998; Baym, 1998; Collison, Elbaum, Haavind & Tinker 2000; Havelock, 2004; Ligorja, 2001; Lin et al., 2007). The index of collaboration is derived from the sum of collaborative roles (the sum of all roles – the sum of troublemakers) and CVs, while the index of participation is evaluated based on the mean of total online roles. The analytical results reveal the following four online learning communities: active collaboration, passive collaboration, individualized participation, and indifference. It is also found that while R4 (atmosphere constructors) is commonly found in active collaboration, passive collaboration, and individualized participation communities, R5 (opinion providers) seems to be the key role for distinguishing the active collaboration communities from the other communities. Moreover, R1 (instructors) is exclusively eminent in the indifference community. More specifically, the behavior of constructing a positive atmosphere is commonly used in the active collaboration, passive collaboration, and individualized participation communities; the behavior of providing opinions for group assignment is critical for establishing the active collaboration communities; and the behavior of providing opinions for group functioning and that for encouraging opinions about/responses to group assignments are eminent in the indifference community. It is also found in this study that the active collaboration communities (Group 5 and Group 6) have best performance in the assigned tasks while the indifference community (Group 1) has the worst performance when evaluated by their final grades. When examining the online roles in Table 7, it is determined that the active collaboration communities have all the eight types of roles although the frequencies of these roles are high on R4 (atmosphere constructors) and R5 (opinion providers) and low on R8 (problem solvers). On the other hand, the indifference community is high on R1 (supervisors) and R6 (reminders), but is missing on R3 (group instructors) and R8 (problem solvers). These findings are in line with findings of Lin et al: ‘encouragers’ exist in both the inferior and superior group, the superior group consists of a greater variety of roles than the inferior group, and the superior group habitually cooperates while the inferior group does not. Accordingly, the relationships among online behaviors, online roles, and types of online learning communities are closely related.

Moreover, the analytical findings in this study suggest that collaborative PBL is a useful tool for exploring online learning communities when instructional activities are well designed. The finding that most groups have frequent online discussions also supports the conclusion obtained by Hann, Glowacki-Dudka, and Conceicao-Runlee (2000), who advocated that cooperative PBL contributes to the formation of online learning communities.

Conclusion and suggestions

To date, no study has clearly identified the important online roles and their corresponding behaviors, nor has a study defined the online learning community types from a holistic perspective. Moreover, objective indices have not been proposed for categorizing online learning communities. This study therefore attempts to pioneer an examination of these areas. To achieve this goal, an 18-week instructional program is employed and the findings are inspiring. The principal findings are as follows.

First, 13 important online behaviors and 3 commonly used online behaviors (constructing a positive atmosphere, providing opinions for group assignments, and providing reminders of assignment-related work) are identified. Second, eight online roles and three common online roles (information providers, opinion providers, and troublemakers) are identified; moreover, the eight roles and their corresponding relationships with online behaviors are elucidated. Third, a two (collaboration vs. participation) by two (high vs. low) model is proposed and four online learning community types (active collaboration, passive collaboration, individualized participation, and indifference) are recognized. These types of online learning communities should be representative, for they carefully evolve from a pilot study, an elaborate instructional design, and, most importantly, specific objective criteria based on online behaviors and online roles. Based on this elaborate evolving process, it is strongly believed that online behaviors, online roles, and online learning communities are closely related.

To conclude, the analytical results of this study are valuable since the instructional design and analyses in this study are deliberately constructed and applied; however, the number of online behaviors and online roles may vary with different discussion content and different participants. Therefore, in addition to replicating the analytical results of this study in a different context, future studies may compare and contrast online behaviors, roles, and communities

across various contexts. Additionally, realizing what online learning community type is most beneficial to learners would enhance the effectiveness of online learning. Consequently, further study can verify the relationship between learning effects and the online learning community types identified in this study.

Acknowledgments

The author would like to thank the National Science Council of the Republic of China, Taiwan for financially/partially supporting this research under Contract No. NSC-94-2520-S-004-001.

References

- Agre, P. E. (1998). Designing genres for new media: Social, economic, and political contexts. In S. G. Jones (Ed.), *Cybersociety 2.0: Revisiting computer-mediated communication and community* (pp. 69-99). Thousand Oaks, CA: Sage.
- Baym, N. K. (1998). The emergence of online community. In S. G. Jones (Ed.), *Cybersociety 2.0: Revisiting computer-mediated communication and community* (pp. 69-99). Thousand Oaks, CA: Sage.
- Chang, B., Cheng, N. H., Deng, Y. C. & Chan, T. W. (2007). Environmental design for a structured network learning society. *Computers & Education*, 48, 234-249.
- Chang, C. K., Chen, G. D. & Li, L. Y. (2006). Constructing a community of practice to improve coursework activity. *Computers & Education*, 50, 235-247.
- Cho, H, Gay, G., Davidson, B, & Ingraffea, A. (2007). Social networks, communication styles, and learning performance in a CSCL community. *Computers & Education*, 49, 309-329.
- Collison, G., Elbaum, B., Haavind, S. & Tinker, R. (2000). *Facilitating online learning: Effective strategies for moderators*. Madison, WI: Atwood Publishing.
- Corsini, R. (2002). *The dictionary of psychology*. New York, NY: Brunner-Routledge.
- Guzdial, M. & Turns, J. (2000). Effective discussion through a computer-mediated anchored forum. *Journal of the Learning Sciences*, 9, 437-469.
- Hann, D., Glowacki-Dudka, M. & Conceicao-Runlee, S. (2000). *147 Practical tips for teaching online groups: Essentials of web-based education*. Madison, WI: Atwood Publishing.
- Havelock, B. (2004). Online Community and Professional Learning in Education: Research-Based Keys to Sustainability. *AAE Journal*, 12(1), 56-84.
- Jones, A. and Issroff, K. (2005). Learning technologies: Affective and social issues in computer-supported collaborative learning. *Computers & Education*, 44, 395-408.
- Liguria, M. B. (2001). Integrating communication formats: Synchronous versus asynchronous and text-based versus visual. *Computers & Education*, 37, 103-125.
- Lin, F., Lin, S. & Huang, T. (2007). Knowledge sharing and creation in a teachers' professional virtual community. *Computers & Education*, 50, 742-756.
- Ludwig-Hardman, S. & Woolley, S. (2000). Online learning communities: Vehicles for collaboration and learning in online learning environments. *Proceedings of World Conference on Educational Multimedia, Hypermedia and Telecommunication, 2000*, 1556-1558.
- Moller, L. (1998). Designing communities of learners for synchronous distance education. *Educational Technology Research and Development*, 46(4), 115-122.
- Palloff, R. & Pratt, K. (1999). *Building learning communities in cyberspace*. San Francisco, CA: Jossey-Bass Publishers.
- Salomon, G. (1993). *Distributed cognitions: Psychological and educational consideration*. Cambridge: Cambridge University Press.
- Salomon, G. (1998). Novel constructivist learning environments and novel technologies: some issues to be concerned with. *Research Dialogues in Learning and Instruction*, 1(1), 3-12.
- Waltonen-Moore, S., Stuart, D., Newton, E., Oswald, R. & Varonis, E. (2006). From virtual strangers to a cohesive online learning community: The evolution of online group development in a professional development course. *Journal of Technology and Teacher Education*, 14, 287-311.
- Wang, M. J. & Poole, M. (2004). Nurturing a dynamic online learning community among teens. *The International Journal of Learning*, 9, 859-870.
- Yang, F., Wang, M., Shen, R. & Han, P. (2007). Community-organizing agent: An artificial intelligent system for building learning communities among large numbers of learners. *Computers & Education*, 49, 131-147.