

Provided for non-commercial research and education use.  
Not for reproduction, distribution or commercial use.



This article appeared in a journal published by Elsevier. The attached copy is furnished to the author for internal non-commercial research and education use, including for instruction at the authors institution and sharing with colleagues.

Other uses, including reproduction and distribution, or selling or licensing copies, or posting to personal, institutional or third party websites are prohibited.

In most cases authors are permitted to post their version of the article (e.g. in Word or Tex form) to their personal website or institutional repository. Authors requiring further information regarding Elsevier's archiving and manuscript policies are encouraged to visit:

<http://www.elsevier.com/copyright>



Contents lists available at ScienceDirect

## Teaching and Teacher Education

journal homepage: [www.elsevier.com/locate/tate](http://www.elsevier.com/locate/tate)

# Integrating collaborative PBL with blended learning to explore preservice teachers' development of online learning communities

Yu-chu Yeh<sup>a,b,c,\*</sup><sup>a</sup> Institute of Teacher Education, National Chengchi University, 64, Chih-nan Road, Sec. 2, Taipei 116, Taiwan<sup>b</sup> Research Center for Mind, Brain & Learning, National Chengchi University, 64, Chih-nan Road, Sec. 2, Taipei 116, Taiwan<sup>c</sup> Center for Creativity and Innovation Studies, National Chengchi University, 64, Chih-nan Road, Sec. 2, Taipei 116, Taiwan

## ARTICLE INFO

## Article history:

Received 29 October 2009

Received in revised form

4 June 2010

Accepted 7 June 2010

## Keywords:

Blended learning

Collaborative PBL

Online communities

Online discussion

Preservice teacher

Teacher training

## ABSTRACT

This study integrated collaborative problem-based learning (collaborative PBL) with blended learning to explore the emerging process and function of online learning communities among preservice teachers. Thirty-two preservice teachers participated in a 16-week instruction program. Analyses of online group discussions and portfolios found that (a) the integrated approach facilitated the preservice teachers' formation of online learning communities; (b) the preservice teachers' online learning communities emerged via four stages: motivation and acquaintance, socialization and belongingness, information exchange and consensus, and tacit understanding and development; and (c) six factors influenced the development of the preservice teachers' online learning communities.

© 2010 Elsevier Ltd. All rights reserved.

## 1. Introduction

Online learning communities are a collaborative means of achieving shared creation and shared understanding in which mutual exchange between community members is encouraged to support individual and collective learning (Ludwig-Hardman & Woolley, 2000). Building online learning communities has become an important element of innovation in higher education: it contributes not only to active participation, the creation of knowledge, and improved achievement and thinking but also to individuals' understanding of themselves and others (Havelock, 2004; Ludwig-Hardman & Woolley, 2000; Moller, 1998). To facilitate the building of online learning communities, many researchers have stressed the implementation of collaborative learning activities (e.g., Masumbuku, 2007; Yang, Wang, Shen, & Han, 2007). Collaborative problem-based learning (PBL) is featured as a student-centered instructional strategy in which students collaboratively solve problems and reflect on their experiences via interactions; it can be an ideal approach to community building.

Moreover, it has been found that blended learning that combines face-to-face instruction and e-learning is a more effective teaching approach than a pure e-learning approach (Osguthorpe & Graham, 2003). Therefore, integrating collaborative PBL into blended learning with an elaborative instructional design should contribute to the building of online learning communities.

Online community building has been explored extensively in various educational systems but has not been considered in preservice teacher education. To date, little attention has been paid to the development process of learning communities (Yang et al., 2007), and little research has been conducted to examine what factors may influence the development of learning communities among preservice teachers. Accordingly, research findings pertaining to these aspects are valuable for preservice teacher education.

Specifically, this study attempts to achieve its three-fold purpose by integrating collaborative PBL with blended learning: first, to understand whether incorporating collaborative PBL into blended learning is an effective teaching approach for building an online learning community among preservice teachers; second, to identify specific stages through which preservice teachers build an online learning community; and third, to explore factors that influence preservice teachers' development of an online learning community.

\* Institute of Teacher Education, National Chengchi University, 64, Chih-nan Road, Sec. 2, Taipei 116, Taiwan. Tel.: +886 2 29393091x66134; fax: +886 2 29387765.

E-mail address: [yeyeh@nccu.edu.tw](mailto:yeyeh@nccu.edu.tw)

## 2. Collaborative PBL, blended learning, and online learning communities

Online learning communities are a collaborative means of achieving knowledge creation in which interactions among community members are encouraged as a means of supporting individual and collective learning. Many researchers (Guzdial & Turns, 2000; Ligorja, 2001; Lin, Lin, & Huang, 2008) have indicated that cooperation is crucial to the performance of an online learning community. Accordingly, learning approaches that emphasize cooperation or collaboration are ideal for encouraging the building of online learning communities. Of such approaches, collaborative PBL is one of the best choices.

PBL is a teaching technique that requires students to solve problems in a certain situation (Delisle, 1997). During the process, students are responsible for framing a problem and using their knowledge to solve it (Engel, 1997). Eggen and Kauchhak (2001) claim that PBL strategies typically have the following characteristics: (1) lessons begin with a problem, and solving the problem is the focus of the lesson; (2) students are responsible for investigating the problem, designing strategies, and finding solutions; and (3) the teacher scaffolds students to solve the problem. For example, a teacher can give students an assignment about a “bully on campus” and scaffold students to help them understand the concept, investigating the bully problem and finding solutions. Because PBL usually involves working in cooperative groups and thinking about real-world problems (Jordan & Porath, 2006), “collaborative PBL” has become a more widely-used term.

Similarly, collaborative PBL is a student-centered instructional strategy in which students collaboratively solve problems and reflect on their experiences via interaction. In collaborative PBL, learners have a common goal and strive to solve problems through interaction. This process is expected to help students develop problem-solving abilities and collaborative skills (Ram, Ram, & Sprague, 2004). Usually, learners engaged in collaborative PBL experience personal and social cognitive conflicts within the context of a discussion. Their goal is to collectively solve these conflicts by explaining the reasoning behind their thinking (Lee & Kim, 2005). In other words, collaborative PBL is a product of social interaction that is fashioned through negotiation and mutual understanding. Recently, collaborative PBL has been used in online settings. Lee and Kim (2005), however, suggest that although a web-based collaborative PBL environment certainly has the potential to help individuals cultivate their ability to solve problems in practical situations, it offers learners relatively fewer opportunities to solve problems through face-to-face interaction than do traditional classrooms. In a case study involving ITESM-CCM, the most competitive private higher education institution in Mexico, Mortera-Gutiérrez (2006) found that when instructors made their e-learning platform the main engine of their courses and totally discarded face-to-face instruction, their teaching was ineffective. Blended learning, which combines face-to-face instruction with e-learning, can maximize the benefits of both face-to-face and online methods (Osguthorpe & Graham, 2003). Therefore, it is expected that the complementary use of blended learning will help collaborative PBL to become considerably more effective in building online learning communities than occurs under an approach that involves purely face-to-face instruction or e-learning.

### 3. Development of an online learning community

#### 3.1. Process of forming an online learning community

To date, very few researchers have proposed specific processes or stages of online community building. Brown (2001) identified

three levels of community based on grounded theory design: (1) making online acquaintances; participants who find similarities begin interacting on a regular basis; (2) community conferment: participants are identified as members of the community of learners; and (3) camaraderie: it is achieved after long-term or intense association with others involving personal communication. Brown also found that each of the three levels of community involved a greater degree of engagement in the class; those who felt connected placed a high priority on the class, desired to learn from others, participated frequently, and demonstrated respect for all participants. Thus, increased levels of community were accompanied by increased participation in class.

Lately, Salmon's (2002) E-tivities model of the emerging process of online learning communities has been broadly discussed. The E-tivities model includes 5 stages as follows. (1) Access and motivation: this stage focuses on exploring the technology and access to it; winning the learner's trust is the main goal. Participants' attitudes towards computers and their ability to obtain effective help are two influential factors during this stage. (2) Socialization: this stage puts an emphasis on social processes and community building; participants seek to establish their online identities and then find others with whom they can interact. (3) Information exchange: this stage involves exchanging information and performing tasks; participants share information relevant to assigned tasks and show supports for each person's goals. (4) Knowledge construction: this stage is characterized by knowledge development; discussion activities and group dynamics play major roles as well. The interactions among group members become more collaborative, and effective communication depends on the establishment of shared understanding. (5) Development: reflection and group learning are central during this stage. Participants reflect on their learning processes and seek to achieve personal goals. The major underlying assumptions of the model are that online learning includes a complex interaction among neural, cognitive, motivational, and social processes; that learning is a transformation whose energy and impetus emerge in leaps and bounds; and that the participants involved learn about the use of computer networking and the topic through interactions with other people.

Both Brown's (2001) and Salmon's (2002) models indicate specific stages of online community building and indicate influential factors at each stage, which helps teachers to design a course with online networking and to learn how participants exploit the system during each stage. While Salmon's model is more elaborate than Brown's, it requires more empirical support. Moreover, when participants and instructional design vary, the community-building process and its corresponding influential factors may be different. Notably, neither Brown nor Salmon's model is proposed via the integration of a specific instructional strategy, and neither of the two models is based on blended learning. When collaborative PBL and blended learning are integrated into an instructional program, what stages of online community building will emerge, and what factors are influential during each stage? These questions are central to this study.

#### 3.2. Factors that influence an online learning community

There are many factors that influence the building and functioning of an online learning community. Chang, Cheng, Deng, and Chan (2007) identified ten basic elements involved in establishing a structured network learning society: participants, shared visions, devices, services, rules, relations, manners, learning domains, learning goals, and learning activities. In the same vein, Cho, Gay, Davidson, and Ingraffea (2007) find that both psychological (individual communication styles) and

structural factors (pre-existing friendship networks) significantly influenced the way distributed learners created collaborative learning social networks. These propositions clearly demonstrate the complexity of influential factors in an online learning community.

Among the factors influencing a successful online learning community, motivation to participate is considered a general measure (Guzdial & Turns, 2000). Cho et al. (2007) report that willingness to communicate is a strong indicator of communication behaviors. Similarly, Agre (1998) note the importance of facilitating a sense of group trust and participation. Notably, although online learning communities hold considerable potential in encouraging students to construct and share knowledge, only a few key students actively do so in most online discussions (Chang, Chen, & Li, 2006). The second prominent factor in creating a functional online learning community is cooperation. Cooperation has been found to be crucial for distinguishing between the achievements of online groups (Guzdial & Turns, 2000; Lin et al., 2008). Lin et al. (2008) find that while over 50% of participants in the superior group habitually cooperated, only a few participants in the inferior group did so. They also indicated that participants in the superior group were more enthusiastic about sharing knowledge than were those in the inferior group. Similarly, Ligorja (2001) proposes 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.

In addition, Havelock (2004) has suggested that meaning-making is a central process for any community. Meaning-making is especially discussed during message-sharing. Although the amount and frequency of message-sharing usually determine the sense of community activity, the authors say little about how these interactions impact meaning-making and the professional practices of participants. Meaningful messages 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 (Baym, 1998).

Finally, the notion of what makes an online community successful is complicated but may be determined by sociability and usability (Parr & Ward, 2006). Parr and Ward (2006) suggest that three interrelated issues need to be addressed to maximize the possibility of developing a functioning online learning community. First, a clear need has to be identified for the electronic community to address. Second, there has to be a shared understanding regarding the value of the online community. Third, there are preconditions that enable or facilitate the development of professional communities, and these include openness to improvement, trust, mutual respect, the availability of expertise, supportive leadership, and socialization into the community.

#### 4. Research questions

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

1. Could incorporating collaborative PBL into blended learning be an effective teaching approach to building an online learning community among preservice teachers?
2. How would preservice teachers build an online learning community?
3. What factors would be influential to preservice teachers' development of an online learning community?

## 5. Method

### 5.1. Participants

The 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. The mean age of the participants was 23.00 years ( $SD = 2.54$  years). They 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.

### 5.2. Instruments

#### 5.2.1. E-learning platform

This study employed an e-learning platform (<http://elearn.cc.nccu.edu.tw/>) developed by National Chengchi University. The e-learning platform consisted of two levels. The first level included a communication center, assessment center, information center, personal area, and public zone. The instructional design of this study required that participants complete many group assignments and engage in online discussions. Consequently, the "communication center," particularly for "group discussion", became the most frequently used. Fig. 1 presents an example screen for this group discussion board.

#### 5.2.2. Peer evaluation form

A peer evaluation form was employed at the end of this study to evaluate within-group participation on all the group assignments. The response items included (1) had not participated at all; (2) had only participated in a few assignments; (3) had participated in most of the assignments; and (4) had participated in all of the assignments.

### 5.3. Procedures and instructional design

A 16-week experimental instruction program based on teaching critical thinking was developed to encourage the formation and employment of online learning communities. To achieve these goals, the participants were scaffolded to practice collaborative PBL and to complete collaborative PBL assignments via blended learning. Specifically, the instructional design included two stages: stage I (weeks 1–7), in which the formation of online learning communities was facilitated via group assignments; and stage II (weeks 8–16), in which online learning communities were enhanced via PBL assignments. The instructional goals, teaching strategies, and learning activities are manifested in Fig. 2.

The main learning activities employed in stage I were getting familiar with the e-learning platform and group members, constructing a learning contract, and developing critical-thinking tests followed by online discussions. The major learning activities that took place in stage II included completing a series of collaborative PBL assignments and a group portfolio illustrating the learning process. The experimental instruction was conducted by the researcher. During the instructional period, the researcher conducted two hours of class instruction each week followed by group assignments that required online discussion. All group assignments were graded.

Moreover, throughout the entire instructional period, the participants were encouraged to conduct online asynchronous and synchronous discussion, although only participation in asynchronous discussion on critical-thinking tests was graded. An online synchronous discussion is a direct discussion wherein all parties involved are online at the same time. In contrast, an asynchronous

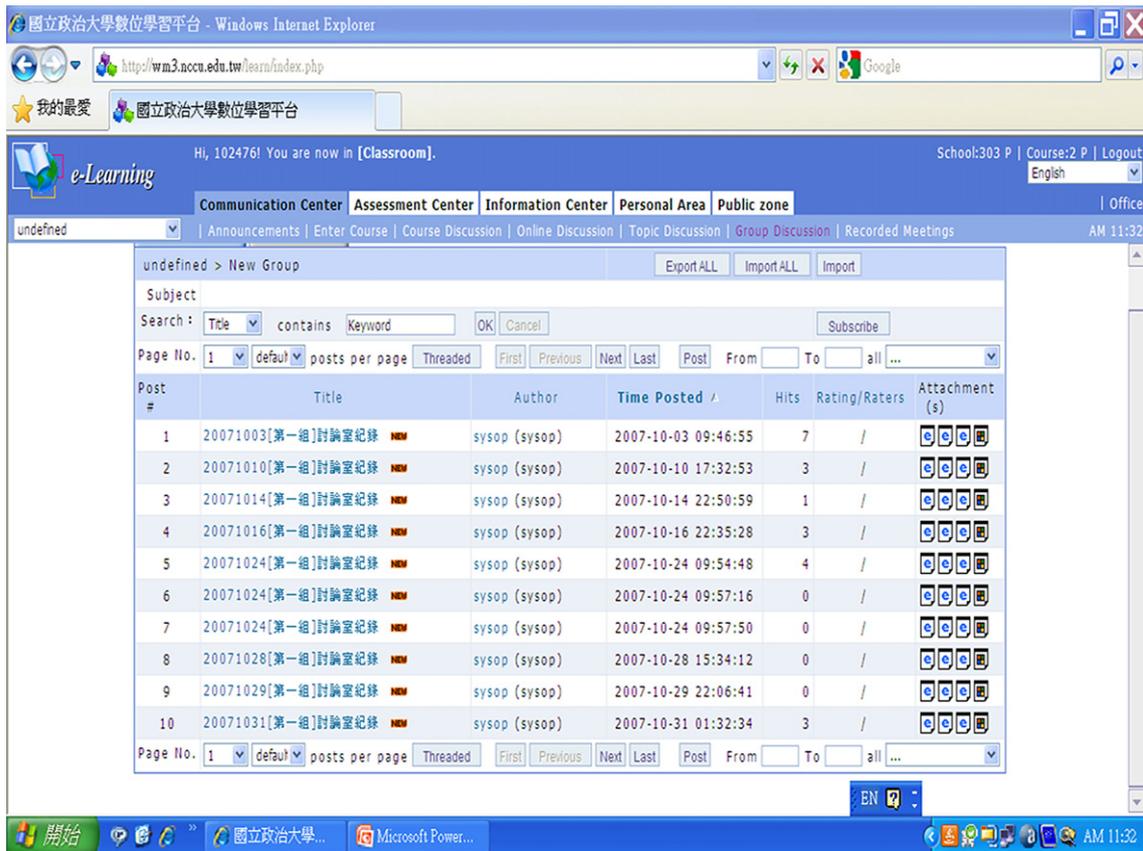


Fig. 1. An example screen of group discussion board.

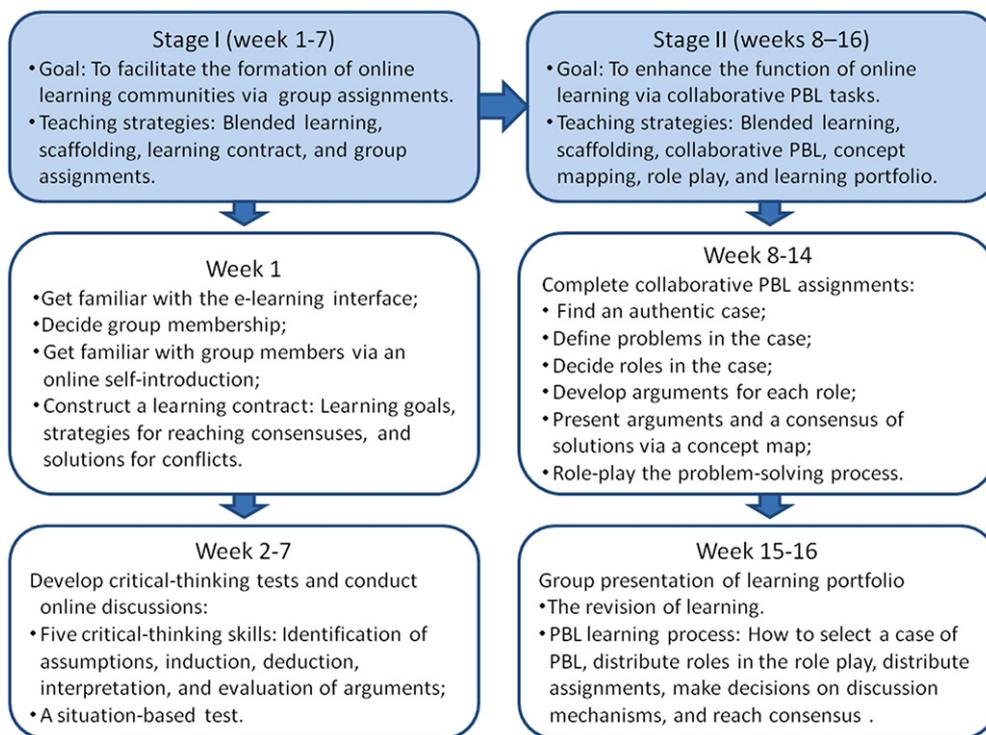


Fig. 2. Instructional design.

discussion does not require that all parties involved in the discussion be online at the same time. Because synchronous discussions could not be recorded in the employed e-learning platform, only asynchronous discussions were analyzed in this study.

5.4. Analyses

The first step that we took in addressing the research questions of this study was to analyze the content of asynchronous discussions recorded automatically via the e-learning platform. Then, each group's learning portfolio was analyzed to obtain in-depth information and triangulate the findings in asynchronous discussions. Therefore, all of the data analyzed in this study were collected directly from the participants. Because content analysis of the online discussions and learning portfolios was the primary method employed in this study, descriptive statistics for the online discussion were also presented to provide specific supporting evidence. During the content analysis, all records were first integrated into tables chronologically under the framework of the three questions proposed in this study. Then both a qualitative content analysis approach and a quantitative content analysis approach were employed. With regard to qualitative content analysis, the emergent coding based on Stemler's (2001) suggestions was employed. Specifically, the researcher and a trained graduate student first independently reviewed the records and came up with an initial checklist of categories and concepts. Then, we compared the notes and revise the initial checklists, after which we used a consolidated checklist to independently apply coding and finally checked the consistency of the coding. When inconsistencies occurred, discussions were conducted to reach a consensus. As for the quantitative content analysis, categories and counting frequencies were employed for some important questions to describing the *manifest content* (Bos & Tarnai, 1999).

6. Results

6.1. Emerging process of online learning communities

6.1.1. Analyses of asynchronous group discussions

The chronological process for the asynchronous group discussions that took place in each group during stage I and stage II is shown in Table 1. Overall, six activities were found in stage I: (1) seeking group membership based on their own choice; (2) becoming acquainted with the other group members; (3) discussing group assignments; (4) finding problems; (5) solving problems; and (6) building a constructive atmosphere. However, only two activities were found across groups: seeking group membership and discussing group assignments. Despite their commonalities, the groups varied in the processes they went through. After the groups were formed, participants were encouraged to become acquainted with their fellow group members by introducing

themselves online, but only half of the groups (G2, G3, and G5) engaged in this activity. Moreover, three groups (G2, G3, and G5) experienced difficult solving problems and did not reach a consensus. The most frequent problems encountered were as follows: (1) assignment completeness: the group members knew that the deadline was coming, but some had not completed the assignment yet (G2, G3, and G5 suffered from this problem); and (2) responsibility: the assignments were completed by a few group members; for example, the assignments of G2 were mainly completed by two group members at the beginning, and three group members in G6 did not post their required assignments because their computers had broken down. However, four groups (G2, G3, G4, and G5) actively tried to build a constructive atmosphere by giving praise or encouragement, which enhanced belongingness and socialization.

During stage II, all groups went through the following processes under the scaffolding of the researcher: (1) reaching a consensus, (2) discussing PBL assignments, and (3) completing a PBL project. The participants were instructed to complete their PBL projects and upload their projects to the assigned website. All groups did this on time, which implies that they had come to a consensus and achieved effective problem solving.

With regard to mechanisms for reaching consensus, we note that most groups emphasized the importance of distributing assignments fairly (G2, G4, G5, and G6). Major suggestions related to this concern included taking turns or distributing assignments evenly (G4 and G6) and considering personal willingness or competence (G2, G4, and G6). Moreover, most groups (G1, G2, G3, and G6) suggested the need to reach consensus by conducting sufficient, regular discussions.

During the PBL assignments, the participants were instructed to apply PBL to a realistic problem, developing arguments from different viewpoints, representing their arguments via a concept map, and role-playing their arguments in class. Their discussions therefore mainly included these subjects. Based on the results, two different discussion activities were found to occur in groups. First, two groups (G3 and G6) engaged in online discussion to develop the role-play script. Secondly, three groups (G2, G5, and G6) discussed their performance during the role-playing and tried to build a constructive atmosphere by providing praise or encouragement.

6.1.2. Analyses of learning portfolios

The researcher also instructed each group to reflect on the learning process and upload a learning portfolio to the assigned website. All groups reported that they had a reached problem-solving consensus after frequent discussion during stage II, which led to good tacit understanding and therefore allowed them to communicate effectively. They also reported that the process of reaching a consensus during problem solving inspired them to think critically and enhanced their self-improvement in two ways: (a) they became "empathetic" with regard to others' arguments

Table 1  
Frequency and means of asynchronous discussions.

Group	n	Discussions on group discussion board				Total	Discussions in other areas		Total		
		Stage I		Stage II			Count	M	Count	M	
		Count	M	Count	M	Count					M
G1	5	22	4.40	27	5.40	49	9.80	61	12.20	110	22.00
G2	6	80	13.33	64	10.67	144	24.00	58	9.67	202	33.67
G3	6	36	6.00	75	12.50	111	18.50	65	10.83	176	29.33
G4	4	28	7.00	72	18.00	100	25.00	70	17.5	170	42.50
G5	5	51	10.2	75	25.00	126	25.20	67	13.4	193	38.60
G6	6	115	19.17	104	17.33	219	36.50	82	13.67	301	50.17
Total	32	332	10.38	417	13.03	749	23.41	403	12.59	1152	36.00

instead of “egocentric”; and (b) they changed their communication style from an “emotional response” to “rational thinking” regarding others’ arguments. Moreover, they reported that their frequency of communication via email or phone increased dramatically during stage II.

## 6.2. Factors influencing an online learning community

Integrating the content analysis of each group’s learning portfolio and asynchronous group discussions, the following activities were found to be influential in the formation and function of online learning communities.

### 6.2.1. Participation in online discussion

A high degree of meaning-making participation is the key factor for a successful online learning community. This study therefore first analyzed the participants’ meaning-making participation in discussion on an asynchronous discussion board. Meaning-making participation in this study refers to the message content of online discussion as it contributes to the development of intra-community trust (Baym, 1998). The frequency for asynchronous discussion in this study was 1152 ( $M = 36.00$ ). This finding revealed that most groups engaged in online discussion frequently. A close examination found that most discussions were conducted, especially at stage II, via a group discussion board ( $M = 23.41$ ) (see Table 1).

### 6.2.2. Discussion mechanisms

To complete the PBL project, all groups had to gather information necessary for solving the selected problem and examine the appropriateness and rationality of the gathered information via interpersonal inquiry and debate. Analyses of group discussions indicate that two groups significantly changed their discussion mechanism. G3 initially used a lot of synchronous discussion, but when the group members found that it wasted time when all group members could not be online as promised, they began to use more asynchronous and face-to-face discussions. G6 also increased face-to-face discussions after discovering that its members were susceptible to distraction when conducting discussions online late at night, although the frequency of the online discussions remained high.

Analyses of learning portfolios also indicated that all groups performed these tasks via online and face-to-face discussions, although the frequency and timing of the discussions varied from group to group. For example, all groups started to increase their frequency of face-to-face discussion during stage II; however, some groups started earlier (G1, G4, and G6) and some started later (G2, G3, and G5). The main function of face-to-face discussions was reported to be facilitating in-depth dialogue as well as multiple-perspective thinking. G1 and G6 reported that the purpose of online discussions was mainly to share information and opinion; G3 reflected that such discussion was primarily used to distribute assignments as well as to provide a framework for discussions and writing reports; and G5 reported that it was mainly employed to (1) share conclusions from face-to-face discussions, (2) share assignments when a group member could not participate in face-to-face discussions, and (3) share opinions and information before face-to-face discussions. As for the schedule of online discussion, most groups routinely talked online and conducted extra discussions as needed.

### 6.2.3. Cooperation among group members

When high cooperation was defined as “most group members [having] similar online discussion frequencies” and low cooperation was defined as “the online discussion frequency of group members varying significantly” (Yeh, 2010), G2 was the least cooperative; most of their assignments were completed by two group members. Moreover, peer evaluation revealed that G1 and

G2 had cooperation problems. Analyses of asynchronous group discussions also indicated that the frequency of such discussion in G1 was far behind that of the other groups (see Table 2). On the other hand, peer evaluation showed that G5 and G6 were the most cooperative. It was found that G5 and G6 not only had a high frequency of discussion but also had put great effort into building a constructive atmosphere, which may have contributed to the cooperation among group members. In addition, an analysis of overall performance on group assignments found that G5 and G6 had the highest mean scores ( $M_s = 91.25$  and  $91.00$ ), while G1 and G2 had comparatively lower mean scores ( $M_s = 89.75$  and  $89.75$ ).

### 6.2.4. Consensus and problem solving

Analyses of asynchronous group discussions indicated that all groups achieved consensus during stage II. Four groups emphasized the importance of distributing assignments fairly, and four groups suggested reaching consensus by conducting sufficient discussions or staging them routinely. As for solving conflicts, the most common strategies used were trying to communicate open-mindedly, voting, and accepting the decision of the majority (see Table 3).

Analyses of learning portfolios indicated that all groups followed a similar pattern to develop a consensus. Specifically, all group members first collected related information; then they presented personal findings, arguments, and conclusions in discussions; and finally, they reached a consensus. Except for G2 and G4, which had to vote to reach their final decisions, all groups reached their consensus naturally after discussion. Moreover, although methods of distributing assignments varied among groups, one commonality was found. Some groups distributed assignments by taking turns (G3, G4, and G6) and some by negotiating (G3, G4 and G6). When conflicts arose, most groups drew lots to solve the problems (G2, G4, and G6).

The participants were also instructed to create a learning contract that included their learning goals, objective goals, mechanisms for reaching consensus, and strategies for solving conflicts. They were asked to construct this learning contract at the beginning of the experimental instruction and to reflect on its effectiveness at the end of the instruction. All groups responded in their learning portfolios that the learning contract contributed to their achievement of a consensus, problem solving, and learning goals.

### 6.2.5. Composite of group members

In this study, the participants were instructed to find group members based on their own interests. Among the six groups, two groups were composed of members from three different majors, and four groups consisted of members from four different majors. Analyses of asynchronous group discussions and learning portfolios found that the homogeneity among the group members influenced the speed at which they reached a consensus; specifically, groups with greater homogeneity were more likely to develop belongingness and therefore could reach a consensus more easily than those with lower homogeneity.

### 6.2.6. Types of assignments

At stage I, the participants were requested to develop critical-thinking tests, and at stage II, they were requested to select a problem suitable for PBL. The selected PBL problem had the following features. (1) It was ill-structured; that is, the problem had multiple solutions and has no correct answers. (2) It was connected to life experience: it provoked deep thinking and stimulated a high level of motivation to participate. (3) It was relevant to the curriculum: the problem would have to do with an educational issue because this course is about teaching. After brainstorming possible problems for the PBL project, most groups selected the problem by voting.

Analyses of asynchronous group discussions found that, with the exception of G1, all groups had a high frequency of online

**Table 2**  
The content and process for online discussions during stage I and stage II.

Group	Stage I	Stage II
G1	Seek group membership → discuss group assignments	Reach consensus → discuss PBL assignments → complete a PBL project
G2	Seek group membership → develop acquaintance with group members → build a constructive atmosphere → discuss group assignments → identify problems → solve problems	Discuss PBL assignments → reach consensus → discuss PBL assignments → complete a PBL project → reflect on role-play performance and build a constructive atmosphere
G3	Seek group membership → develop acquaintance with group members → discuss group assignments → build a constructive atmosphere → discuss group assignments → identify problems → solve problems → discuss group assignments → solve problems → discuss group assignments → build a constructive atmosphere → discuss group assignments	Reach consensus → discuss PBL assignments → identify and solve problems → discuss PBL assignments → complete a PBL project → discuss the script for role-play
G4	Seek group membership → discuss group assignments → build a constructive atmosphere	Discuss PBL assignments → reach consensus → discuss PBL assignments → complete a PBL project
G5	Seek group membership → develop acquaintance with group members → discuss group assignments → build a constructive atmosphere → identify problems → solve problems → discuss group assignments	Discuss PBL assignments → reach consensus → discuss PBL assignments → complete a PBL project → discuss the script for role-play → reflect on role-play performance and build a constructive atmosphere
G6	Seek group membership → discuss group assignments	Discuss PBL assignments → reach consensus → discuss PBL assignments → reach consensus → identify and solve problems → discuss PBL assignments → complete a PBL project → discuss the script for role-play → reflect on role-play performance and build a constructive atmosphere

Note: these processes were identified chronologically based on discussions on the group discussion board. Each step may involve several discussions.

discussions (see Table 2). Moreover, the types of assignments also influenced their discussion mechanisms. As stated earlier, both G3 and G6 increased their number of asynchronous discussions during stage II. Analyses of learning portfolios also revealed that all groups engaged in both online and face-to-face discussions when the assignments needed more discussion.

**7. Discussion**

This study was conducted to answer questions concerning the effectiveness of incorporating collaborative PBL into blended learning for online community building, the stages in the formation

of an online learning community, and factors influencing a well-functioning online learning community in a teacher-training program. The analytical results of asynchronous discussions and learning portfolios indicate that all three questions posed were successfully answered.

*7.1. The effects of collaborative PBL on online community building*

The analytical results of this study indicate that collaborative PBL is an effective teaching approach for engaging preservice teachers in building an online learning community. The instructional design in this study included stages I and II. The major

**Table 3**  
The mechanisms used to reach consensus and strategies for solving conflicts.

Mechanisms or strategies	Group						Total
	G1	G2	G3	G4	G5	G6	
Mechanisms used to reach consensus							
Sufficient or routine discussions	✓⊙	✓	✓⊙		⊙	✓⊙	4
Distributing assignments fairly	⊙	✓⊙	⊙	✓⊙	✓⊙	✓⊙	6
Distributing assignments based on personal willingness or personal competence		✓		✓		✓	3
Posting conclusions of discussions when less than three people participated			✓				1
Preparing for assignments before discussion					✓	✓	2
Posting personal opinions every week					✓	✓	2
Giving feedback honestly during discussions					✓	✓	2
Participating in discussions on time						✓	1
Discussing seriously but harmoniously						✓	1
Reminding others about assignments						✓	1
Strategies for solving conflicts							
Being open-minded for varied opinions		✓	✓	✓	✓	✓	5
Voting	✓	✓⊙		✓⊙			3
Accepting the decision of the majority		✓	✓			✓	3
Taking turns			⊙	✓⊙		✓⊙	3
Drawing lots		⊙		⊙		⊙	3
Persuading people in an argument to calm down		✓	✓				2
Negotiating			⊙	✓⊙		⊙	3
Analyzing problems rationally	✓						1
Explaining personal opinions						✓	1

Note. ✓ represents online discussion. ⊙ represents learning portfolio. When both ✓ and ⊙ are presented, the frequency is counted as 1.

strategies used in stage I were blended learning, scaffolding, learning contracts, and group assignments; those employed in stage II included blended learning, scaffolding, collaborative PBL, concept-mapping, role-play, and learning portfolios. Specifically, to enhance cooperation and facilitate consensus and problem solving, the participants were asked to construct a learning contract; to facilitate discussion and problem-solving skills, the participants were asked to complete a series of group assignments; to strengthen empathy and friendships among group members, the participants were instructed to role-play the PBL process; to encourage self-reflection on the learning process, the participants were asked to create a learning portfolio; and finally, to help in completing the PBL project, the participants were guided step by step via blended learning. The analyses of asynchronous discussions and learning portfolios revealed that all groups engaged frequently in interactive discussions when they started to work on the PBL project and that gradually, online learning communities were developed. Therefore, the extent to which collaborative PBL served to facilitate the building of learning community may very well be attributed to the teaching approach and supplementary strategies used in this study. Moreover, the findings in this study support the argument that bounded learning communities emerge in direct response to guidance provided by an instructor (Daniel, Schwier, & Ross, 2007) and that technologies combined with procedures designed to facilitate cooperative learning can lead to the building of learning communities (Yang et al., 2007).

In addition, as Mortera-Gutiérrez (2006) puts it, the combination of face-to-face instruction and communication technology in a blended learning environment creates a myriad of educational possibilities that reflect a certain pedagogical richness. However, the aim of using blended learning approaches is to find a harmonious balance between online access to knowledge and face-to-face human interaction (Osguthorpe & Graham, 2003). The findings in this study indicate that such a harmonious balance has been reached.

### 7.2. *The emerging process of online learning communities*

According to the analyses of asynchronous group discussions and learning portfolios from stage I, most participants actively sought group membership and tried to become acquainted with their group members. They also started to interact online and build a sense of belongingness within the group. However, they did not reach a consensus during that stage or developed the tacit understanding necessary for effective problem solving. During stage II, all groups started to function smoothly. They started to reach consensus easily via frequent information exchange and discussion. Finally, group members developed a tacit understanding of each other, which lead to the co-creation of knowledge and the achievement of personal development.

Integrating the findings in this study, we can assert that an online learning community in which collaborative PBL is incorporated into blended learning in a teacher-training program may be developed in four stages. The four stages are as follows: (1) motivation and acquaintance: participants actively seek group membership and try to become acquainted with each other; (2) socialization and belongingness: group members start to interact via online discussions and gradually develop a sense of belonging within the group; (3) information exchange and consensus: via frequent information exchange in performing tasks, group members set up rules as necessary to reach consensus and execute efficient problem solving; and (4) tacit understanding and development: group members have a thorough tacit understanding of each other and therefore can communicate well and achieve learning goals effectively, which enhances their personal development via knowledge-sharing and knowledge construction.

This four-stage model of community building is more elaborate and specific than Brown's (2001) three-level community building and Salmon's (2002) E-tivities model. The three levels that Brown identified were making online acquaintances, community conferment, and camaraderie; the five stages that Salmon proposed were access and motivation, socialization, information exchange, knowledge construction, and development. The major differences between the processes proposed here and those identified by Brown and Salmon have to do with the absence/presence of the stages of developing belongingness, reaching consensus, and developing tacit understanding. The findings in this study support Brown's finding that when students reach the highest level of community, they start to communicate outside of online discussions (usually by telephone or email). The findings of this study reveal that the bonds among group members strengthened as the groups completed more group work and that their frequency of communication via email or phone increased. In other words, they were transformed from strangers into communities.

### 7.3. *Factors influencing an online learning community*

#### 7.3.1. *Meaning-making participations*

Cuthell (2002) indicates that the more the community members participated, the more the virtual community developed. Cho et al. (2007) also reports that willingness to communicate is a strong indicator of communication behaviors. However, many researchers (e.g., Agre, 1998; Havelock, 2004) have emphasized that meaning-making participation in online discussion, rather than just frequent discussion, is central to successful online communities. Meaning-making participation in group discussion contributes to the development of intra-community trust, and such discussions are typically characterized by optimism, excitement, clear task orientation, and shared leadership duties (Baym, 1998). This study analyzed the participants' meaning-making participation in asynchronous discussion and found that the participants exhibited a high degree of meaning-making participation ( $M = 36.00$ ). The findings in this study suggest that a high degree of meaning-making participation in online discussions is essential to a well-functioning online learning community and contributes to learning achievement when collaborative PBL and blended learning are employed.

#### 7.3.2. *Establishment of discussion mechanisms*

This study found that all groups conducted both online and face-to-face discussions during stage II. The participants used online discussion frequently for two reasons: first, online discussions help to solve the problem of being unable to get together in a short period of time; and second, the group discussion board enables group members to share their final versions of assignments conveniently. It is obvious that the participants preferred to use the group discussion board as the instrument for discussing group assignments. Therefore, while the face-to-face discussions served to facilitate in-depth discussions, online discussions helped the group members to communicate in a timely manner and to complete assignments effectively. Accordingly, face-to-face and online discussions are complementary; the good use of both can facilitate problem solving and the establishment of online learning communities. Again, these findings support the power of blended learning (Mortera-Gutiérrez, 2006) and the importance of finding a harmonious balance between online and face-to-face interactions in using blended learning (Osguthorpe & Graham, 2003).

#### 7.3.3. *Cooperation among group members*

This study found that when a group was highly cooperative, it had a constructive community atmosphere and better performance (G5 and G6). On the other hand, when a group was not cooperative

(G1 and G2), it had problems becoming a real community. Moreover, it was found that the highly cooperative groups exhibited better performance on group assignments than their counterparts. These findings support the argument that cooperation is a crucial index for distinguishing between the achievement of online groups (Guzdial & Turns, 2000; Lin et al., 2008) and that a good online learning community should share ideas routinely, express opinions honestly, and cooperate thoroughly (Collison, Elbaum, Haavind, & Tinker, 2000). Moreover, it was found that establishing a constructive atmosphere during cooperation (e.g., G5 and G6) is important for building an online learning community.

7.3.4. Achievement of consensus and problem solving

Disagreements or conflicts during group discussions are inevitable. Solving such problems quickly is critical to the function of an online learning community. The findings in this study reveal that the mechanisms for reaching consensus during problem solving were well established across groups. A consensus was more likely to be reached when sufficient or routine discussions were conducted and assignments were distributed fairly. Moreover, the findings in this study clearly indicate that making a learning contract helped group members to find a common goal, improve cooperative learning and tacit understanding, improve motivation and commitment, and solve conflicts and problems. The online learning communities therefore gradually established themselves and started to function well. The findings in this study also suggest that being “open-minded” is the most critical strategy for solving conflicts; other important strategies included voting, taking turns, accepting the decision of the majority, negotiating, and drawing lots.

7.3.5. Similarity of group members

It was found in this study that a group with highly similar majors was more likely to develop belongingness and therefore had an easier time than the other groups in reaching consensus in problem solving. Brown (2001) indicates that the first stage of

building a community involves getting acquainted based on certain similarities. The similarities may have to do with location or academic background, commitment or motivation, or circumstances. Duffy (2000) indicates that shared history encourages group identity, which enhances reproducibility and eventually leads to the future development of community. Havelock (2004) also claims that participants' prior knowledge and learning experiences have a great impact on their community participation. The findings in this study are in line with these arguments and suggest that similarity among group members contributes to the development of belongingness and the function of an online learning community, especially when collaborative PBL is emphasized.

7.3.6. Types of assignments

The findings in this study indicate that various types of assignments influenced the frequency of online discussions and discussion mechanisms, which may have further influenced the building of learning communities. Specifically, most groups significantly increased their asynchronous group discussions (and all groups increased their face-to-face discussions) during stage II, when they stated to work on the PBL assignment. Obviously, the group assignments at this stage motivated the participants to interact frequently. The findings in this study are in line with Hann, Glowacki-Dudka, and Conceicao-Runlee's (2000) claim that online discussions, group assignments or projects, and cooperative problem solving contribute to the building of online communities. In conclusion, the content and types of group tasks are critical to the formation and functioning of learning communities.

7.4. Summary: a four-stage model of online community development

When collaborative PBL is integrated into blended learning in a teacher education program, an online learning community may be built in four stages: (1) motivation and acquaintance; (2)

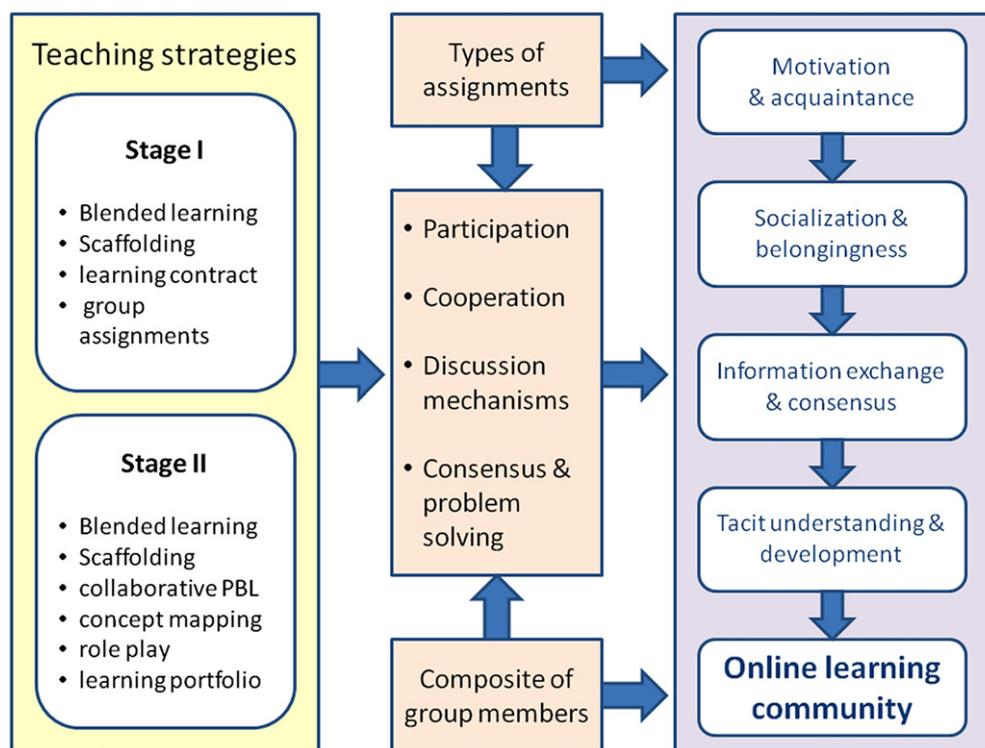


Fig. 3. A four-stage model of online community development.

socialization and belongingness; (3) information exchange and consensus; and (4) tacit understanding and development. In addition, influential factors for community development may include (1) meaning-making participation in online discussions; (2) good use of discussion mechanisms; (3) a high degree of cooperation among group members; (4) efficient ways of reaching consensus and solving problems; (5) similarities among group members; and (6) group assignments requiring substantial interaction and discussion. Moreover, employing such strategies as blended learning, scaffolding, a learning contract, group assignments, collaborative PBL, concept-mapping, role-play, and learning portfolios can influence the degree of participation and cooperation, the establishment of discussion mechanisms, the development of consensus, and the efficiency of problem solving, which may further facilitate the formation and development of an online learning community. Finally, types of assignments and the combination of group members can have both direct and indirect effects on community formation and development (see Fig. 3).

## 8. Conclusions and suggestions

This study integrates collaborative PBL with blended learning to explore whether such an approach is effective for building an online learning community among preservice teachers and, furthermore, to identify specific stages in the process through which preservice teachers build an online learning community. The study has also considered the influential factors at play during the community-building process. The findings in this study suggest that the integrated approach employed can effectively facilitate the formation and development of an online learning community among preservice teachers. Moreover, based on the empirical data of this study, a four-stage model of online community development is proposed, and six influential factors for online community development are identified. Notably, both direct and indirect relationships among the variables included in the model are suggested. This model can be used not only to provide insight into what happens within an online learning community during each stage but also to scaffold participants' development of holistic learning. Therefore, the goals of this study have been thoroughly achieved, and the findings in this study should be inspiring and valuable for preservice teacher education.

Specifically, the implications of this study in preservice teacher education are: First, when a teacher education program is aimed to facilitate the development of an online learning community, scaffolding learners through the four process found in this study should be taken into consideration. Second, integrating collaborative PBL with blended learning is a powerful approach for online community building because it facilitates participation, cooperation, group consensus, discussions, and problem solving. Third, problem-based group assignments and a homogenous group contribute to frequent discussions and high efficiency of reaching consensus and problem solving. Fourth, multiple strategies (e.g. scaffolding, collaborative PBL, learning contract, group assignment, role-play, and learning portfolio) must be employed to facilitate the development of an online learning community.

To minimize the limitations of content analysis as used in this study, the researcher employed descriptive statistics and triangulation to maximize the reliability and validity of the study. With regard to triangulation, varied sources of data (online discussions, peer evaluation and portfolios) were collected, and systematic and careful data analyses were made by two researchers. Further studies might develop questionnaires to verify the four-stage model as well as the importance of the influential factors identified in this study. Future studies can also verify the findings in this study in varied contexts and populations as well as find other factors that

influence the formation and function of online learning communities.

## Acknowledgements

The author would like to thank the National Science Council of the Republic of China, Taiwan for financially 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. 35–68). Thousand Oaks, CA: Sage.
- Bos, W., & Tarnai, C. (1999). Content analysis in empirical social research. *International Journal of Educational Research*, 31, 659–671.
- Brown, R. E. (2001). The process of community-building in distance learning classes. *Journal of Asynchronous Learning Networks*, 5(2), 18–35.
- 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.
- Cuthell, J. (2002). MirandaNet: a learning community—a community of learners. *Journal of Interactive Learning Research*, 13(1/2), 167–186.
- Daniel, B. K., Schwier, R. A., & Ross, A. H. (2007). Synthesis of the process through learning discourse in a virtual learning community. *Journal of Interactive Learning Research*, 18(4), 461–477.
- Delisle, R. (1997). *How to use problem-based learning in the classroom*. Alexandria, VA: Association for Supervision and Curriculum Development.
- Duffy, J. (2000). Knowledge management: to be or not to be? *Information Management Journal*, 34(1), 66–67.
- Engen, P. D., & Kauchhak, D. P. (2001). *Educational psychology: Windows on the classroom* (5th ed.). Upper Saddle River, NJ: Merrill Prentice Hall.
- Engel, C. E. (1997). Not just a method but a way of learning. In D. Boud, & G. E. Feletti (Eds.), *The challenge of problem-based learning* (pp. 17–27). London: Kogan Page Limited.
- 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. *Association for the Advancement of Computing in Education*, 12(1), 56–84.
- Jorden, E. A., & Porath, M. J. (2006). *Educational psychology: A problem-based approach*. Boston, MA: Allyn and Bacon.
- Lee, M., & Kim, D. (2005). The effects of the collaborative representation supporting tool on problem-solving processes and outcomes in web-based collaborative problem-based learning environments. *Journal of Interactive Learning Research*, 16(3), 273–293.
- 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. (2008). 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. In *Proceedings of world conference on educational multimedia, hypermedia and telecommunications*, 2000 (pp. 1556–1558).
- Masumbuku, E. (2007). Collaborative eLearning: bridging the digital divide in education "a model of internet connectivity in rural community an African context". In *Proceedings of world conference on educational multimedia, hypermedia and telecommunications 2007* (pp. 1178–1185).
- Moller, L. (1998). Designing communities of learners for synchronous distance education. *Educational Technology Research and Development*, 46(4), 115–122.
- Mortera-Gutiérrez, F. (2006). Faculty best practices using blended learning in e-learning and face-to-face instruction. *International Journal on E-Learning*, 5(3), 313–337.
- Osguthorpe, R. T., & Graham, C. R. (2003). Blended learning environments: definitions and directions. *The Quarterly Review of Distance Education*, 4(3), 227–233.
- Parr, J., & Ward, L. (2006). Building on foundations: creating an online community. *Journal of Technology and Teacher Education*, 14(4), 775–793.

- Ram, P., Ram, A., & Sprague, C. (2004). A web-based system to bring PBL into your classroom. In *Proceedings of Society for Information Technology and Teacher Education international conference, 2004* (pp. 3007–3012).
- Salmon, G. (2002). *E-tivities – The key to active online learning*. London: Kogan Page.
- Stemler, S. (2001). An overview of content analysis. *Practical Assessment, Research & Evaluation*, 7(17). Retrieved 22.03.10 from <http://PAREonline.net/getvn.asp?v=7&n=17>.
- 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.
- Yeh, Y. (2010). Analyzing online behaviors, roles, and learning communities via online discussions. *Journal of Educational Technology and Society*, 13(1), 140–151.