EMERGING INNOVATIVE TEACHER EDUCATION FROM SITUATED COGNITION IN A WEB-BASED ENVIRONMENT

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ABSTRACT
In this paper, the authors first discuss the main rationales of situated cognition and its connections with innovation in teacher education. The challenges that might occur in applying situated cognition in teacher education programs, including insufficient opportunities for cognition apprenticeship, limited social interactions, and constraints in microteaching, are then presented. Correspondingly, this paper suggests three principles—enhancing peripheral participation, strengthening cognitive apprenticeship, and forming special interest groups online—in order to integrate situated cognition with a Web-based environment as a way to overcome the defects of conventional teacher education programs. Further, a recent application trial is described as a demonstration of how to innovate teacher education using a Web-based environment. Finally, a group of pre-service teachers participated in the research, and their perceived usefulness of the Web-based environment were measured and discussed. The results substantiate the applicable principles to establish a Web-based environment to support the course in teacher education. These outcomes are believed to contribute to both teacher education and educational technologies in the contemporary milieu of education.
Keywords: Situated cognition, Teacher education, Web-based learning environment, Pre-service teacher

INTRODUCTION

Many teacher educators emphasize the idea that situated cognition can bring benefits in improving career competence (Brown, Collins, & Duguid, 1989; Lave & Wenger, 1991; McLellan, 1996). According to this notion, the theory of situated cognition is appropriate for depicting pre-service teachers' professional development in teacher education. Practical experience is especially accentuated as a way to enrich these trainees' cognition in an authentic teaching context. It is, hence, suggested that pre-service teachers need a teacher education program that provides not only pedagogical knowledge but also teaching experience. In other words, pre-service teachers can better improve their teaching competence in an authentic classroom setting. In an authentic teaching context, being apprentices of experienced teachers can give them a real understanding of what successful teaching is. In this context, pre-service teachers can observe, imitate, explore, and reorganize the ideas that they have formulated about teaching. The role of the teacher education program will, thus, not be that of a teaching resource presenter; rather, it will be that of an opportunity provider that serves to enhance the growth of pre-service teachers' knowledge about teaching. In teacher education program, pre-service teachers cannot wait until they graduate and become in-service teachers to acquire authentic teaching experience. Therefore, teacher educators at the university level still need to seek innovative ways to implement programs that provide practical teaching experience for pre-service teachers.

In recent decades, the application of information and communication technology (ICT) has brought a great impact and created a new paradigm in education. Among ICT applications, the World Wide Web (WWW), in particular, has contributed to developments in educational enterprise (Brooks, 1997). Teacher education should not be concerned only with improving the competence of pre-service teachers in using ICT; more importantly, it should be concerned with whether innovation can be brought to conventional teacher education programs through the use of a Web-based environment. In conventional teacher education, teaching practice is thought of

as the most important part of preparing a teacher for his or her career. Before becoming interns, pre-service teachers will utilize all of the knowledge that they have acquired to attain the experience of being a teacher in a "real" classroom context. In university, teacher educators and mentors (invited experienced in-service teachers) both play essential roles at this stage in nurturing pre-service teachers' professional development.

When it comes to improving pre-service teachers' teaching with ICT, there are several limitations in applying situated cognition. First, even though the mentors are experienced teachers, this does not guarantee that they are familiar with or interested in teaching with ICT. Second, pre-service teachers cannot observe or experience authentic teaching with ICT in secondary schools because of a lack of hardware, software, and administrative support. Third, teacher educators tend to focus more on conventional teaching techniques, such as the organization of teaching materials or classroom management. The demonstration and discussion of teaching with ICT is comparatively compressed in the course design of teacher education programs. In this situation, pre-service teachers have relatively few opportunities to enrich their experience of teaching with ICT or to verify the ideas that they might have about teaching with ICT. Ultimately, this diminishes the possibility of developing competence to cope with modern teaching demands. As a result, the application of situated cognition in teacher education should be carefully examined and revised from the original thesis. With a proper design, ICT can offer teacher educators more opportunities to establish a learning environment that can effectively nourish the teaching competence of pre-service teachers. The purpose of this study is to propose principles to establish a Web-based environment that support teacher education via the rationale of situated cognition. In order to substantiate the feasibility of the principles, this study intended to answer following research questions:

1. How do the pre-service teachers perform teaching practice in a Web-based environment that emerged from situated cognition?
2. How do pre-service teachers perceive the usefulness of a Web-based environment applied in teacher education course?

LITERATURE REVIEW

Challenges in Incorporating Situated Cognition into Teacher Education

The main philosophy of situated cognition is the idea that knowledge is situated in an authentic context and that learning is an actively cognizing process that interacts with this context (Brown et al., 1989). The rationale of situated cognition implies a way to interpret how pre-service teachers nurture their teaching competence in teacher education. However, there are still challenges in applying situated cognition in conventional teacher education, and these will also inevitably emerge when teacher education programs innovate. The challenges are reviewed in the following sections.

Insufficient Cognition Apprenticeship in Instructional Design

Instructional design is the first step that a teacher engages in in the practice of teaching. However, such design is a complex undertaking consisting of several kinds of teaching activities, including: (1) analysis of students' needs; (2) knowing the goals of teaching development; (3) making decisions about teaching content; (4) arranging teaching procedures; and (5) evaluating the effects of teaching (Bennett, 1997). Pre-service teachers usually lack authentic teaching experience even though they may have acquired content knowledge and pedagogical knowledge. Without proper guidance or training, pre-service teachers will utilize past experiences in the classroom to imagine how their teaching will take shape. Many factors that will influence the quality of their teaching are ignored, such as students' prior knowledge, proper teaching models, or reliable representation. A successful teacher education program will concentrate on the benefits that instructional design activities can offer (Hacker & Niederhauser, 2000; Niederhauser & Stoddart, 2001). Teacher educators and mentors will utilize what they have gained from their professional experience to offer comments on pre-service teachers' instructional design, such as the design of lesson plans. In conventional teacher education programs, this is a way of enhancing pre-service teachers' cognition apprenticeship. Pre-service teachers' competence with regard to teaching practice is also nurtured in this way, but ideal cognition apprenticeship is not easy to accomplish in a traditional classroom setting, even in a university. The number of pre-service teachers is far larger than the number of teacher educators. In most cases, there are 10-20 pre-service teachers in a program, but only one or two teacher educators support pre-service teachers' instructional design. Considering the limited time and effort that is possible, teacher educators' guidance might be diminished and insufficient. It seems that educators need a more effective means for the support of cognition apprenticeship in training pre-service teachers.

Limited Social Interactions within the Community

Social interactions are suggested as a way to promote members' professional development in a community

composed of pre-service teachers and teacher educators (Smylie, Allensworth, Greenberg, Harris, & Luppescu, 2001; Schlager, Fusco, & Schank, 2002). Such interactions are also treasured resources for bringing about reforms in teaching. In teacher education programs, a seminar form of discussion is usually used to enhance interactions in the community. Pre-service teachers have the opportunity to present what they have learned from the activities of the program, which would include observation of teaching, teaching preparation, and engaging in teaching. However, oral interaction in a class has its natural drawbacks. The interactions can only occur in class, and discussions about any particular teaching issue might attract only a limited number of members. These interactions might be quickly wiped from their memories. As a result, the benefits and opportunities of joining in such discussions are uneven or unfairly distributed. This will weaken the function of social interactions within the community for learning how to teach. Further, members of the community are unlikely to share a repertoire that can support professional development. As a result, the second challenge is the limitation of social interactions among the members of the teacher education community.

Constraints in Microteaching

Microteaching was proposed by Allen and Ryan (1969), and the idea is widely accepted in the field of teacher education. It can be described as a scaled-down and simulated teaching activity in a teacher education program. Microteaching is usually conducted with simple concepts or in a single class hour in a university as a teaching trial, not in an actual elementary or high school setting. Before pre-service teachers become interns, microteaching helps them to mature by gaining teaching experience. Microteaching is a decisive opportunity for pre-service teachers to prepare themselves for teaching successfully after they graduate from the teacher education program. The students in a microteaching course are the peers of the pre-service teacher who is performing the microteaching. During such activity, pre-service teachers are expected to draw on the teaching knowledge that they have acquired, including knowledge for practice, knowledge in practice, and knowledge of practice (Cochran-Smith & Lytle, 1999). Since the process is different from observing other teachers and from imagining what should be taught, pre-service teachers involved in microteaching can directly engage in teaching activities. Hence, microteaching can be treated as a core practice in a community of teaching practice. If the pre-service teachers can successfully complete the activity, they can be on their way toward full participation in the community of practice. Their performance in microteaching is also an indicator that can be used to evaluate whether pre-service teachers are well-prepared for actual teaching. For most pre-service teachers, microteaching is a new experience. They are expected to spend considerable quantities of time and effort to accomplish the activity. Thus, it is not possible for them to perform microteaching too often during a semester. In other words, the opportunities they have to try out different teaching contents, methods, and representations are diminished. Further, teaching with ICT in a traditional classroom setting is naturally limited (Rodrigues, Marks, & Steel, 2003). This also limits pre-service teachers' experience in teaching and utilizing ICT in the classroom.

Facing these challenges, teacher educators need to find ways to overcome them and further improve pre-service teachers' professional development in the contemporary era of ICT. In the current study, the authors proposed a rationale to derive innovative teacher education from situated cognition and established a Web-based environment to accomplish the aim of enhancing pre-service science teachers' teaching competence.

METHODOLOGY

This study aims to know how the pre-service teachers perform teaching practice in a Web-based environment and to reveal how they perceive the usefulness of such an innovative teacher education program via a survey. The research participants, context, data collection, and analysis are described in the following sections.

Participants

This study invited 29 pre-service teachers as participants. All of these participants were majoring in biology. 23 of them were undergraduate students, and the other 6 were graduate students. When the study was conducted, all of the participants were in the last year before graduating from the university and becoming teacher interns. In the authors' nation, they had to complete a one-year-long course titled *Science Teaching Practice* before graduating from teacher education program in the university in order to become teacher interns. The pre-service teachers seldom have teaching experiences prior to becoming teacher interns in middle schools. They were expected to organize what they have learned at the university, both content knowledge and pedagogical knowledge, to fulfill the learning goal of the Science Teaching Practice course.

Description of the Research Context

In this study, the authors proposed three principles to innovate a teacher education program in which pre-service teachers can be trained in a manner that fits better with a situated cognition rationale. The principles are shown

in Table 1, including enhancing peripheral participation, strengthening cognitive apprenticeship, and forming special interest groups online. Based on the principles, a Web site denominated as Technology Enhanced & Assisted Curriculum Headquarter (TEACH) was established in accordance with our approach and applied to provide support to the pre-service teachers taking part in the course activities of teacher education and facing the challenges discussed in previous sections. Pre-service teachers were then expected to transform their teacher knowledge in a more mature and profitable manner by participating in and working with TEACH. The following sections will indicate how the three proposed principles are applicable in TEACH.

Table 1. Principles to innovate a teacher education program with the situated cognition rationale

Principles	Support provided by TEACH	Challenge to be overcome		
		Insufficient cognition apprenticeship	Limited social interactions	Constraints in microteaching
Enhancing peripheral participation	Stepwise guidance for designing lesson plans; automatic transformation of lesson plans to online course arrangements; shared repertoire database	○		○
Strengthening cognitive apprenticeship	Embedded expert knowledge in guiding procedures for designing lesson plans; virtual implementation of online courses; online review system for lesson plans and online courses	○		○
Forming special interest groups online	Course-wide discussion forum to support additional social interaction	○	○	

Enhancing peripheral participation

According to the rationale of situated cognition, learners shall form, modify, and construct their own knowledge through a process of observation, imitation, and practice (Lave & Wenger, 1991; McLallan, 1996; Schlager & Fusco, 2003). These processes are described as “legitimate peripheral participation” in a community aimed at learning. A learner can achieve the goal of learning when his or her participation status successfully shifts from the peripheral to the core of the community. That is to say, inexperienced learners can eventually possess expertise with effective participation in a community of mutual practices. As the pre-service teachers engage in teacher education program, the community comprised by these trainees, experienced school teachers, and teacher educators naturally attempt to provide potentially sufficient opportunities to make the procedures of participation explicit. However, this does not guarantee pre-service teachers’ efficient participation with their limited course hours in the conventional learning environment. In order to improve the current teacher education course’s fit with the situated cognition rationale, this study incorporate TEACH into the course and integrate the following functional support within it:

(a) Stepwise guidance for lesson plan design. TEACH provided a stepwise authoring system for designing lesson plans. Pre-service teachers can start their teaching practice from such design work. In this authoring system, pre-service teachers are asked to fill out sequenced forms (see Figure 1) to conceive each part of a

lesson plan, including teaching topic, goals, teaching model, teaching equipment, learning activities, and assessment, as well as to arrange them in a flow chart to show the sequence of design work. In the sequenced procedure, the system will provide relevant hints and explicit prompts in each design stage. For example, in the stage of deciding on the teaching topic, the system will show related concepts and national standards that are relevant to the teaching topic selected by the pre-service teacher. After completing the lesson plan designs, the authoring system automatically generates a Web page-based lesson plan. The designed lesson plans are an individual's artifacts and stored in a personalized space in TEACH. Furthermore, if pre-service teachers add multi-media files as teaching materials, these materials can be hyperlinked into the lesson plan and easily retrieved.

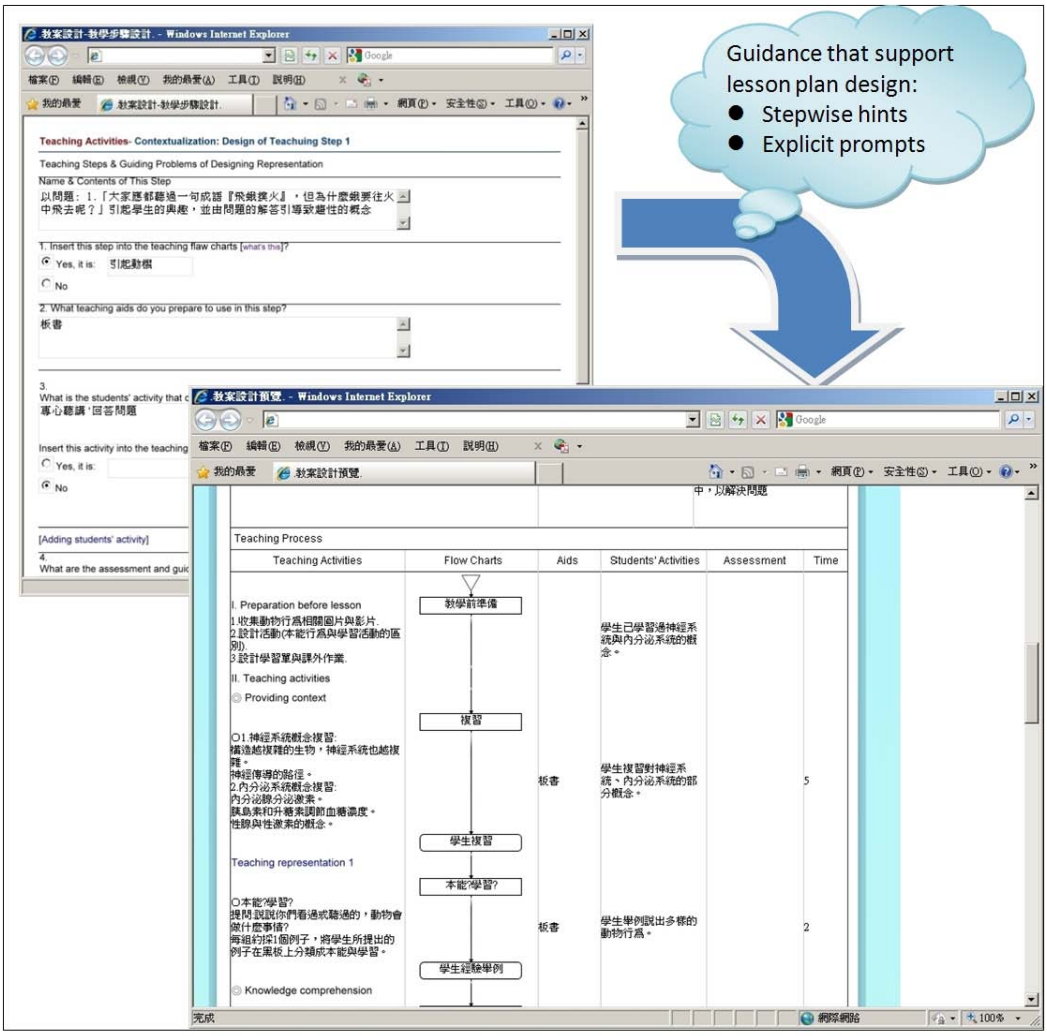

Figure 1. The process of online lesson plan design in TEACH

(b) Automatic transformation from lesson plan to online course arrangement. TEACH provides another authoring system for creating online courses based on the lesson plan. While the pre-service teachers complete the lesson plan design on TEACH, they can decide whether to create online courses based on their lesson plans. If so, TEACH can automatically analyze their lesson plans and break the teaching process into several "nodes of teaching" in a tree map form. Pre-service teachers can continue to design online course activities by adding the instructional modules that refer to the nodes of teaching. The instructional modules offered by TEACH include tutoring, online notebooks, forums, assignments, tests, and concept maps. With these modules, the pre-service teachers can easily generate Web-based courses with a tree map structure, as shown in Figure 2. This authoring system requires neither programming nor Web page design abilities. Pre-service teachers can design online courses directly without preparing lesson plans first on TEACH if they wish.

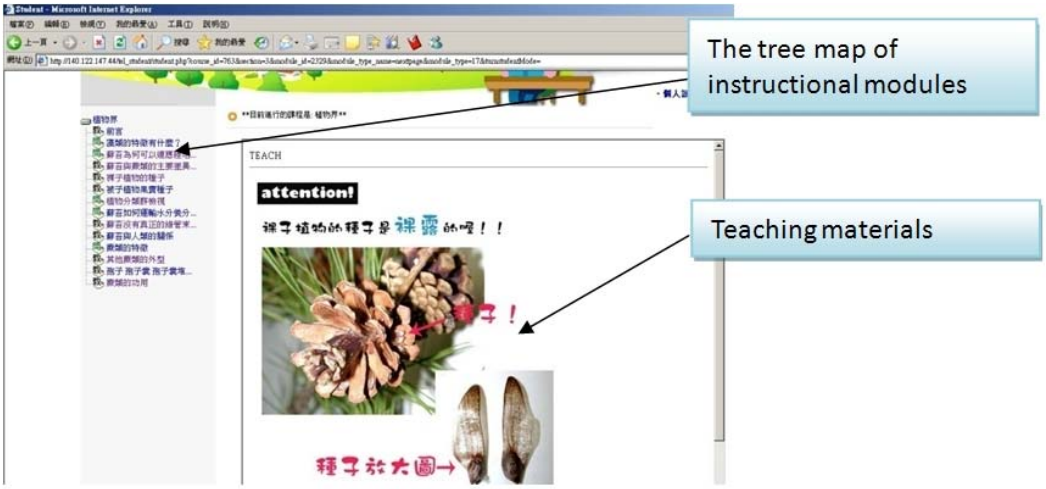

Figure 2. A screen shot of an online course that students can see

(c) Shared repertoire database. When pre-service teachers engage in designing instructional activities online, they need many teaching resources to support their design works. Such teaching resources include video clips, still pictures, sounds, JAVA simulation, Flash animations, and concept maps. In addition, the lesson plan and online course that described in previous section also comprise a part profitable teaching resources. Pre-service teachers can decide whether to share their own teaching resources with other users in TEACH. When pre-service teachers contribute these teaching resources to the community, they are asked to provide tags and descriptions. Such information can support the construction of a shared repertoire database and function as searching index. As a result, the shared repertoire not only attracts pre-service teachers' interest in retrieving useful resources but also provides them with opportunities to deliberate peers' intention to use such resources in teaching design.

Since the functional support provides the pre-service teachers with increased experiences in instructional design and sharing repertoire, the preparation of teaching in TEACH affords extra opportunities outside of the conventional classroom context to enhance these trainees' peripheral participation. With peripheral participation in teaching practice, pre-service teachers are guided to engage in a consecutive learning process that fits with the situated cognition rationale.

Strengthening cognitive apprenticeship

The term 'cognitive apprenticeship' refers to a learning process in which a master tutors her/his apprenticeship in competence. In the field of education, cognitive apprenticeship is particularly emphasized in expert preparation. The rationale specifically concentrates on learners' nurturing professional competence. Inexperienced apprentices learn through a process of internalizing what they have perceived from experts who possess proficient literacy and are able to perform skillful career work. For teachers, instruction is also a dexterous employment that depends on their professional knowledge and competence. This undoubtedly leads to the idea that teacher education is under a similar situation in nurturing pre-service teachers to become "experts" of instruction. Cognitive apprenticeship is, then, proper to include in explaining the relationship between teacher educators and pre-service teachers in current teacher education.

However, it is not easy to fulfill all individuals' learning needs in a conventional teacher education course because of the limited ratio of teacher educators to pre-service teachers. This is a key point, as a Web-based agent can provide support and be what the authors expected to accomplish in TEACH as a supplement. Hence, the authors arranged the following functionalities to strengthen apprenticeship in teacher education via TEACH. First, a great deal of teacher knowledge and instruction-related information are embedded in the design procedure in TEACH. For instance, when pre-service teachers conduct design work for lesson plans, TEACH provides specific guidance in accordance with their chosen specific teaching model. As shown in Table 2, the TEL model (Hsu, 2008; Hsu, Wu, & Huang, 2008) is one of the built-in teaching models. As the pre-service teachers decide to design a lesson plan based upon the TEL model in TEACH, s/he shall acquire prompts from the system in different stages of design. After the design work, a real-time checklist pops up for pre-service teachers to examine whether her/his design fits in with the construct of the TEL model. In these sequenced procedures, pre-service teachers can not only get acquainted with instructional design but also obtain

opportunities for them to reflect the nexus between learning theory and instructional design. Further, they can also consult with teacher educators to discuss why these teaching models can contribute to their teaching competence. Second, the design and implementation of online courses provide a vision for pre-service teachers to deliberate the possibilities of carrying out teaching using Web-based technologies. As the online course is under way, the pre-service teachers will have a teacher identity that they can use to conduct the learning activities in the course and to recruit students to participate in the course through the student interface. Compared to conventional microteaching, online courses will increase the pre-service teachers' experience in conducting teaching with ICT and reduce the time loading of their peers (other pre-service teachers) and teacher educators. Being online, the virtual "students" might not be restricted only to their peers, so that pre-service teachers can, thus, get more useful comments from a broader audience. Third, an online review system is built into TEACH for teacher educators to provide comments and suggestions directly on the Web page-based artifacts of pre-service teachers. Conventionally, in paper-based lesson plans or course design, it is not easy to evaluate the suitability of the multi-media resources that are involved. Instead, the online review system provides a more precise manner of reviewing function, especially when the pre-service teachers conduct instruction design for teaching with ICT media. This function is also believed to strengthen the role of tutor played by teacher educators and contribute to cognitive apprenticeship in the community with teacher education more tightly since they meet in the classroom only once a week.

Table 2. Cognitive meaning, prompts, and self-evaluation of lesson plan design based on the TEL model

Stage	Cognitive meaning	Leading prompts	Self-evaluation (example)
Contextualization	Learners will confront an authentic and meaningful situation	What are the entry behaviors of students? Examples include their learned conceptions, experiences, and alternative conceptions.	● Can I list students' experiences, pre-conceptions, and alternative conceptions related to my teaching topic? ● Can I provide meaningful questions to incubate students' ideas?
Sense making	Learners will visualize and represent the dynamic mechanics of the complex situation and simplify it	How to represent the scientific concepts in a teaching topic with proper mechanisms or principles	● Can I list the scientific concepts in my teaching topic? ● Can I provide my students with opportunities to engage in discussion? ● Can I explain the main variables in the scientific concepts?
Exploration	Learners will plan and carry out their experiments or, given access to information on databases, explore scientific principles or relationships among variables	How to guide students to explore the hypothesis and related variables	● Can I list the model of the scientific concepts in my teaching topic? ● Can I promote students' manipulation of different factors or variables related to the scientific concepts? ● Can I guide students to form a hypothesis?
Modeling	Learners will form hypotheses or build models to explain their findings	How to help students establish a conceptual model	● Can I depict the model of the scientific concepts in my teaching topic? ● Can I guide students to organize the relationships among variables and factors? ● Can I guide students to confirm the correctness

			of their own model?
Application	Learners will get the opportunity to apply concepts to different situations and identify the limitations of their models	How to design a new problem or to provide a new context for students' utilization of their model	● Can I provide a new context for students' inspection of their own models? ● Can I guide students to select proper data or information to inspect the correctness of their model? ● Can I provide opportunities for student discussion of their model utilization?

Forming special interest groups online

Past research has indicated that the mutual interests of users on the Web will contribute to interactions among the members who participate in the online community (Hung, Tan, & Chen, 2005; Marra, Moore, & Klimczak, 2004; King, 2001). This idea also echoes the idea that goal-oriented forum discussion can enhance interaction in a Web-based learning environment (Guzdial & Turns, 2000; Barab, Makinster, Moore, Cunningham, & the ILF Design Team, 2001; Schrire, 2006; Linn, Clark, & Slotta, 2003). In addition to supporting collaborative learning, the online forum breaks through the limits of time and field and offers equal opportunity for all users in asserting their opinions. It is thus essential to enhance the in-depth interactions of the community comprising those who participated in the teacher education program. According to the suggestion of Guzdial and Turns (2000), effective discussions can sustain and focus on topics related to class learning goals. As a result, the forum must be able to invite discussion and is tied to the curriculum. This is believed to prevent perfunctory chat and hence form a "normal discussion," as proposed by Barab et al. (2001). With a mutual leaning goal, a special interest group can thus bear and consolidate the function of a learning community that was originally restricted in the classroom. This is why TEACH embodies a course-oriented discussion forum and invites all participants of the teacher education program, including teacher educators, pre-service teachers, and experienced teachers, as members of the learning community. In order to enhance the effective discussion of these members, the researchers also proposed several discussion topics and asked teacher educators to post on the forum. The sample topics included the following: "In microteaching, what difficulties do I meet when I prepare my teaching? How will I solve these problems? What assistance do I need?" "What problems will I meet when I teach with ICT, especially when there is enough or not enough equipment in my school? How do I overcome these problems?" "How do I grasp the attention of my students in a short time when I participate in microteaching, including their class climate and learning situations?" The discussion of these issues (comprising the issues initiated by pre-service teachers) both help pre-service teachers understand their peers' ideas about instruction and promote teacher educators' understanding of their students' needs. Such a forum is intended to complement the insufficient function of the community in the classroom and created a better interactive environment.

DATA COLLECTION AND ANALYSIS

In order to reveal how pre-service teachers conduct teaching practice online and depict their experience with TEACH, an online self-report survey was used to collect the participants' perceived usefulness of the innovation of the teacher education program. There were 18 items related to the three principles of innovation with a Likert scale. The scores, sorted from five to one, presented the opinions 'strongly agree', 'agree,' 'neutral', 'disagree', and 'strongly disagree'. The reliability of the survey was 0.80 and reached a satisfactory level. In addition, three open-ended questions in the survey were also included in order to understand these participants' suggestions or comments regarding TEACH. The survey was administrated near the end of the Science Teaching Practice course. This will ensure that all of the pre-service teachers had experienced the functions of TEACH and created their own artifacts. Further, the artifacts that the participants created were also calculated or analyzed.

RESULTS

The results of this study are presented in accordance with the order of the three mentioned principles individually. The results first show the perceived usefulness related to enhancing peripheral participation in TEACH. Then the data related to strengthening cognitive apprenticeship in TEACH follows. Finally, pre-service teachers' ideas regarding forming special interest groups online were presented.

Enhancing Peripheral Participation

According to the data shown in Table 3, the mean scores of the survey are higher than neutral except in the case of negatively stated items. The results indicate that the function of 'enhancing peripheral participation' in the teacher education course was perceived as quite useful. This also implies that a specifically designed Web-based environment can, possibly, contribute to teacher education to improve pre-service teachers' peripheral participation in professional practice.

Table 3. Perceived usefulness of 'enhancing peripheral participation'

	Mean	Max	Min
The operation of designing lesson plans is clear in TEACH.	3.7	5	1
I can correctly complete the lesson plan design in TEACH.	4.0	5	3
The function of TEACH can satisfy my needs when designing a lesson plan.	3.7	5	2
The procedure of designing lesson plans in TEACH is too complicated.	2.4*	4	1
I will think about how to integrate the WWW into my teaching design when I conduct design work in TEACH.	4.1	5	2
Designing teaching in a Web-based environment can help me to manage my teaching resources, especially multimedia files.	4.1	5	3
Creating a lesson plan design in TEACH stresses me.	1.8*	3	1
I don't have to know much programming language to create a multi-functional online course in TEACH.	4.4	5	3
I can get teaching resources from my peers in TEACH.	3.9	5	1
Sharing teaching resources is important to a community of teachers, especially to those who are pre-service.	4.2	5	3

*Negatively stated item

In the ten items of this dimension, item 5 and item 6 received the "strongly agree" opinion. The results show that the utilization of TEACH indeed improved the pre-service teachers' reflection on the practice of instructional design using Web-based technology. These trainees also tended to believe that a Web-based authoring system was useful in conducting teaching preparation with multimedia.

In the online courses created by the pre-service teachers, the most frequently utilized module was tutoring (178 times, 65.0%). However, the usage of other modules, including online notebooks, forums, assignments, tests, and concept maps, was comparatively lower. The concept maps module was utilized only one time. This evidence indicates that these pre-service teachers had limited competence or inclination to conduct teaching other than lecture tutoring. This also implies that the teacher educators need to consider how to manifest the advantage that online course can engender.

Further, the data for item 9 and item 10 indicate that sharing resources was rather useful to the pre-service teachers. Their artifacts further support their responses to the survey. These trainees created and shared 62 lesson plans (2.13/per person). In these lesson plans, the most popular ones were frequently collected and utilized by their peers six times. Further, the pre-service teachers shared 861 teaching resources, including figures (185, 21.5%), documents (273, 31.7%), PowerPoint files (203, 23.6%), and movie clips (15, 1.7%) during the course. This evidence highlights the pre-service teachers' focus on creating and sharing resources about teaching. It also implies that shared repertoire within a community has a degree of positive contribution to peripheral participation.

Strengthening Cognitive Apprenticeship

According to the survey data presented in Table 4, the pre-service teachers showed positive opinions toward the cognitive apprenticeship strengthened by TEACH in their teacher education program. The result for the first item shows the highest mean score (4.2) in this dimension. This indicates that the pre-service teachers perceived the importance of reflecting on the usage of ICT such that it would influence their teaching design. The results also imply that a Web-based environment that is well-integrated with a mentor's role can decrease teachers' workload when s/he perceives cognitive apprenticeship. In addition to conducting microteaching in a real classroom, these pre-service teachers also deemed online course design and virtual implementation to be a new experience that further improved their teaching competence.

Table 4. Perceived usefulness of "strengthening cognitive apprenticeship"

	Mean	Max	Min
Online courses offer me more opportunities to reflect on the usage of information technologies in instruction.	4.2	5	2
Comments and suggestions on instructional design from teacher educators in TEACH helped me greatly in teaching online.	4.1	5	2
I am confident in asking students to participate in my online teaching in TEACH.	3.4	5	2
I can effectively utilize the knowledge from teaching models provided by TEACH in implementing an online course.	3.4	4	2
Online course implementation has no significant difference from in-classroom microteaching.	2.4*	4	1

*Negatively stated item

Additionally, several of the comments and suggestions indicate that TEACH should offer more types of teaching models (methods) as references in guiding their instructional design. The results indicate that inexperienced pre-service teachers need more assistance in transferring their pedagogical knowledge into practice. This also implies that a Web-based environment has the potential to support the nurturing of pre-service teachers' design competence in teaching when there is enough guiding information needed by inexperienced teachers. This is a key point with respect to cognitive apprenticeship in teacher education that shall be strengthened.

Forming Special Interest Groups Online

The data shown in Table 5 indicate that the pre-service teacher perceived the function of "forming special interest groups online" to be useful at a level slightly over neutral. In the results of this dimension, a noticeable diversity appeared in the pre-service teachers' opinions (ranging from 5 to 1). The frequency of their responses in the forum within TEACH also indicate similar circumstances. Most of the discussions were gathered in the topics posted by the teacher educators (nine topics, 27 posts, 393 reading times). The topics posted by pre-service teachers were comparatively few (two topics, two posts, 97 reading times), even less than their reports of system problems. This indicates that some of the trainees believed that the forum in TEACH offered little help in improving their social interactions. In a Web-based forum that is related to their course, they would accept seminar discussion rather than actively initiate issues to elicit peers' opinions. It is also possible that the pre-service teachers got used to other formats of communication over ICT. It is notable, when confronting the issue, to form a special interest group online.

Table 5. Perceived usefulness of "forming special interest groups online"

	Mean	Max	Min
I will use the forum in TEACH to interact with other users.	3.2	5	1
I would like to share the teaching experiences with my peers in TEACH.	3.4	5	1
I don't think the forum is an effective means of communication in a course.	2.8*	5	1

*Negatively stated item

However, since the forum in TEACH did not engender great enthusiasm in pre-service teachers, but the use of the forum in online course design presented the second highest percentage (39 times, 14.2%). This evidence reveals that the pre-service teachers were under the impression that discussion forum was beneficial to their teaching, at least in a Web-based environment. This merits further investigation to reveal why pre-service teachers performed differently when they participated in the special interest group online with different identities.

DISCUSSION AND IMPLICATIONS

This study started this research arguing the advantages of involving the rationale of situated cognition in teacher education. Then the insufficiency of current teacher education and the derived challenges to be overcome were described as the research purpose. The authors then proposed three applicable principles to overcome the challenges. Intending to innovate in conventional teacher education, a Web-based platform called TEACH was established with the rationale of situated cognition to provide additional guidance in the teacher education program. The authors then inspected the research participants' perceive usefulness of TEACH to justify the argument of the situated cognition rationale in teacher education. The results of this study substantiate the principles to establish a Web-based environment to support a course of teacher education. Further, the Web-based environment indeed has the potential to make teacher education fit more with the rationale of situated cognition. Based on the results, this study explores three advanced implications in current discussion to address the research goal of our investigation.

Firstly, teacher education shall provide more opportunities to afford pre-service teachers' practice with respect to competence in instructional design. Our findings regarding pre-service teachers' perceived usefulness indicate that a Web-based environment needs to offer a goal-oriented context to support peripheral participation. This also echoes the idea that the professional development of teaching practice should be the aim in establishing a Web-based platform integrated into a teacher education program (Wedman & Diggs, 2001). In addition, the functionalities and interfaces of a Web-based environment enhanced pre-service teachers' competence through reducing the teaching load of teacher educators and offering opportunities for pre-service teachers' reflection on what they have observed, imitated, and practiced in the process of guided instructional design. Furthermore, pre-service teachers will be encouraged to design their lesson plans and course materials in a Web-based environment that can shape an extra social culture outside of the classroom to support their reflection and sharing in their teaching enterprise.

Secondly, an online implementation of Web-based teaching shall be emphasized as a supplement in teacher education. A Web-based course implementation through the Internet offers pre-service teachers more opportunities to experience authentic practice and peers' interactions with respect to instruction on the Web. One might argue that this "authentic" experience is actually undertaken in a "virtual" environment and not acquired in a real classroom with real students. However, the authors neither treat online course implementation as a full replacement nor neglect the benefits that conventional microteaching can offer. The results of the current research simply offer positive support to the idea that a Web-based teaching guidance environment offers unique advantages, such as helping pre-service teachers to manage a Web-based course and related multi-media resources. As shown in the results of previous research, pre-service teachers can, indeed, gain experience with multiple ICT applications through designing online courses (Koehler, Mishra, & Yahya, 2007; Williams, Coles, Wilson, Richardson, & Tuson, 2000). In such circumstances, this "virtual" teaching environment is the best supplement for conventional teacher education. As a result, this study suggests that the future teacher education program shall employ a combination of conventional and Web-based forms of teaching practice. This implementation can also serve as a necessity to improve pre-service teachers' core practice and further to

innovate in teacher education programs.

Finally, in-depth interaction shall be concentrated on and revealed in a new manner to determine the value of integration in teacher education. It is reasonable that the community of goal-oriented members will form its own cultural context. In such a cultural context, knowledge is constructed by the interactions among the members within it (Vosniadou, Ioannides, Dimitrakopoulou, & Papademetriou, 2001). Distributed intelligence is a good model for depicting the knowledge-sharing that takes place within a community of practice (Buysse, Sparkman, & Wesley, 2003). In most cases, the members of the community have different biographical backgrounds and offer different extents of participation. As expected, the members will also have different levels of the competence that is required to conduct their mutual practice. That is to say, the members of the community will be regarded as profitable subjects and will all have the opportunity to contribute their own expertise. Sharing of knowledge and collaboration will then emerge in the community of practice. Consequently, the community of practice can be considered a carrier that leads learners into a culture that encourages situated cognition. In teacher education, pre-service teachers, teacher educators, and mentors will be the main members that form a community of practice, i.e., a community of instructional issues. As for pre-service teachers, they enter the community to learn to teach and expect to become licensed teachers. Moreover, teacher educators and mentors play the roles of experts that guide the pre-service teachers to conduct their mutual practice of teaching and improve their competence. While the pre-service teachers may appreciate more the social context that the community provides, this will provide them with the opportunity to become better acquainted with the core values of the teaching practice. A Web-based learning environment such as the TEACH supports community of practice, and thus offers a juncture at which teacher educators can rethink the effects of social interactivities other than discussion forums or seminars in the classroom in a conventional program of teacher education. In addition to gaining teaching experience, pre-service teachers can also gain from the community experience and encouragement in developing their communication skills for interacting with experts and peers in their field. As a result, they will be able to create and share teaching resources with each other and to refine their cognition with regard to teaching practice. It seems that pre-service teachers are likely to dedicate a lot of effort to the community. In fact, they are in the process of acquiring a valuable intangible possession that will support their future teaching careers.

CONCLUSION

This paper discusses the rationale of situated cognition in teacher education. Some drawbacks that can occur when the ideas are applied in conventional teacher education are also suggested. These assertions illuminate the possible directions that might be followed in innovating within current teacher education programs. For a Web-based environment that encompasses situated cognition in teacher education, enhancing peripheral participation, strengthening cognitive apprenticeships, and forming special interest groups online were proposed as a means of confronting the challenges that teacher educators encounter in the modern educational milieu. In the future, researchers can employ the principles and implications proposed in this paper to engage in constructing a teaching guidance platform through the Internet and to manifest the value of situated cognition in teacher education. In addition, this study suggests that a larger population of pre-service teachers outside the field of science shall be invited in future research. Also, further tracking of pre-service teachers is suggested when they become teacher interns and in-service teachers. These approaches will accentuate a deeper understanding of pre-service teachers' perceptions of a Web-based environment within a teacher education program and provide a profitable direction for revision in preparing teacher prospects.

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